



# **Analysis of US Patent Referencing to IEEE Papers, Conferences, and Standards 1999-2018**

**Report prepared for:**

**IEEE**

445 Hoes Lane

P.O. Box 1331

Piscataway, NJ 08855-1331, USA

**Report prepared by:**

**1790 Analytics LLC**

130 Haddon Avenue

Haddonfield, NJ 08033

[www.1790analytics.com](http://www.1790analytics.com)

**June 18, 2019**

## Executive Summary

IEEE engaged 1790 Analytics in this project to assess the impact of IEEE publications on developments in various technologies. This impact is measured by examining the extent to which patented inventions build upon papers from IEEE journals, IEEE-sponsored conferences, and IEEE standards. This is an update of previous reports, and examines US patents issued from January 1, 1999 through December 31, 2018.

The main findings of this report are:

- New technology continues to build upon science, and the dependence is increasing. In this study, the top 50 firms (in 2018) were granted 92,564 patents, which made a total of 736,053 non-patent references (an average of 7.94 non-patent references per patent). Back in 2010 the top 30 firms had 58,179 patents which made a total of 239,789 non-patent references (an average of 4.13 non-patent references per patent). Thus, the number of patents is trending upward but the number of references from those patents is rising at a greater rate. Since a large number of these non-patent references are to scientific articles and conference papers, this suggests that today's technology developments are increasingly linked to developments in published science.
- A large portion of this science base comes from papers presented at IEEE sponsored conferences and published in IEEE journals. The top 50 patenting firms in 2018 have referenced over 1,968,763 articles in the last 20 years. About 27% (532,056) of those articles appeared in IEEE journals, IEEE sponsored conferences or IEEE Standards Documents.
- In this study, we also went beyond the top 50 patenting companies and analyzed all patents from the last 20 years in several technology categories of interest to IEEE members and customers. For example, 33.65% of all scientific references from Computer Hardware patents go to IEEE publications. The second most referenced publisher is ACM (Association for Computer Machinery) with 17.15% of the referenced publications. In other Information Technology areas, such as Information Storage, Semiconductor Manufacturing, and Computer Software, the results are similar.
- In Telecommunications technology, IEEE is particularly important. The 529,717 references to IEEE articles and conferences represents 42% of all science references from Telecommunications patents since 1999. To help put this in perspective consider: Telecommunications is a very technology driven industry and that technology is often built upon scientific discoveries published in journal and conference papers. If we consider this set of papers as the science base of telecommunications, than 42% of that science base is published in IEEE journals or presented at IEEE sponsored conferences. In addition, the 529,717 references to IEEE dwarf the combined total of the next 20 publishing organizations in this technology.

- This year for the first time we examined three new technology categories: Blockchain and Distributed Ledgers, Cybersecurity, and Virtual and Augmented Reality. In all three categories, IEEE enjoys a two-fold lead over second place ACM.
- We also kept the three categories added last year: Artificial Intelligence (AI), Autonomous Vehicles, and Internet-of-Things related patents. In AI, IEEE enjoys a 3-fold lead over second place ACM. In Autonomous Vehicles, IEEE has a dominant lead (10-fold lead) over the second place entry which is a conference sponsored jointly by IEEE and the Robotics Society of Japan, as well as a 10-fold lead over third place SPIE. And in the Internet-of-Things category IEEE has a 5-fold lead over second place ACM.
- IEEE is referenced a surprising amount in areas which are not central to its mission.
  - For example, 7.76% of the science references from patents in medical devices go to IEEE publications. This ranks IEEE third behind RELX and Lippincott-Williams (with 20.25% and 7.89% respectively). The latter publishers have hundreds of journals in the medical area, whereas IEEE has only a few, so the 7.76% figure is quite solid for a non-core area.
  - Optics is also somewhat surprising. IEEE publications receive the most references from Optics patents, and IEEE is referenced even more than the two large Optics Societies that would be expected to lead the area: OSA – The Optical Society of America, and SPIE – The International Society of Optical Engineering.
  - In Measuring, Testing, and Control, IEEE gets 19.71% of all references, which is just ahead of the 14.11% of RELX while, again, RELX has many more journal titles in the space.
  - In the Robotics and Intelligent Manufacturing category, 44.38% of the patent references are to articles published in IEEE journals or in proceedings of IEEE sponsored conferences. Second place RELX receives about one-fifth as many references in the category.
  - Patents related to Power Systems and Transmission also reference IEEE publications most frequently. The 45,380 references to IEEE journal and proceedings papers are more than the next two top referenced publishers (RELX and Electrochemical Society) combined. We also examined a specialized subset of the Power Transmission category related to smart meters and smart grids. In this category, 64.79% of the scientific references from patents go to IEEE journal or conference papers. The second most referenced publisher is RELX with only 5.15% of all references.
  - A few years back we started tracking some green energy categories: Solar and Photovoltaic energy and Wind energy. In the latter category IEEE science has a big advantage over the other publishers with more than 39% of the references. In solar energy, IEEE has a small lead over RELX. RELX has more than 50 journal titles

related to the area including several high impact journals such as *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, and *Solar Cells*. IEEE has only a few.

- In broadcasting technologies IEEE leads with 36% of the references, which is almost 5 times as many as second place International Telecommunication Union. The latter produces standards documents while the IEEE references are to standards documents as well as peer reviewed scientific papers from journals and conferences.
- It has been shown that high-quality, high-impact, and valuable patents tend to be cited more frequently by later patents. Citation impact is thus often used as a quantitative measure for evaluating patents (see [3]). In this study, we found that the patents that reference IEEE papers are cited more often than patents that do not. This was shown to be true for each of the twenty technology categories we examined. This suggests that, not only do IEEE publications frequently provide the science base for new inventions, but that inventions that build upon IEEE publications are more likely to be valuable in the future than inventions that do not build upon IEEE.
- Although this study concentrates on patents in specific technology areas, it should be noted that the importance of scientific and technical literature to patented technology is increasing in all areas. Our research shows that the average US patent had only 2.76 non-patent references (NPRs) back in 1997. That number jumped to 11.17 by 2018 – a 305% increase. These numbers are for all issued US patents and not just those in the twenty categories covered in this report.<sup>1</sup> This means that in the overall patent system, patented technologies are increasingly referencing scientific articles.
- Since we only look at specific categories of technology plus the top 50 firms, there is no way to know exactly how much referencing to IEEE has increased since 1997. However, we can make an estimate for the whole patent system by identifying any Non-Patent References that mention “IEEE” or “I.E.E.E.” (This will of course miss things like the *Journal of Lightwave Technology* or *Spectrum* which may not have IEEE in the reference, but it will be a reasonable estimate.) If we do a comparison as above we find that there were just 14,635 patent references with IEEE or I.E.E.E in 1997, but 137,799 in 2018 (an 842% increase). Thus science referencing and IEEE referencing have both increased greatly since 1997.

---

<sup>1</sup> Including science intensive areas like Biotechnology, Pharmaceuticals, Chemicals, and other areas where IEEE typically has little influence.

## Table of Contents

<b>Section</b>	<b>Page</b>
I. Introduction	2
II. Methodology	2
III. Results	5
IV. Conclusions	12
V. References	13
VI. Figures	14
Appendix A	A-1
Appendix B	B-1
Appendix C	C-1

## I. Introduction

In previous studies, it was found that patents reference papers from IEEE journals much more often than papers from other journal publishers. In this report, we update the previous results, and study US patents issued from January 1999 through December 2018. Although this report is an update of previous results, we have made our best efforts to make this report self-contained. The aim of this report, as in previous reports, is to analyze references from patents to journal articles, conferences and standards documents, in order to assess IEEE's impact upon technological developments.

This report covers twenty subcategories of Technology where IEEE members and readers are active. Many, but not all are related to Information Technology. The categories patent counts are shown below in Table 1.

Table 1: Number of Patents for Each Category Covered in this Study

Category	# Patents 1999-2018
AI/Artificial Intelligence	10666
Autonomous Vehicles	2170
Blockchain/Distributed Ledger	285
Broadcasting	158061
Computer Hardware	416195
Computer Software	241805
Cybersecurity	107702
Diagnosis/Surgery/Medical Instruments	210754
Information Storage	129692
IOT/Internet of Things	10671
Measuring, Testing and Control Devices	211386
Optics/Photography/Electrophotography	154461
Power Systems	114666
Robotics and Intelligent Manufacturing	31520
Semiconductors/Solid-State Devices/Electronics	283875
Smart Grid/Smart Meters/Energy Infrastructure	4085
Solar/Photovoltaic	13119
Telecom and Other Communications	598982
Virtual/Augmented Reality	10416
Wind Energy	6668

## II. Methodology

This study is based on referencing patterns from patents to prior art documents. When an inventor files a patent for a new invention, he/she will typically reference earlier documents to show that the new invention either builds upon, or improves upon, what came earlier. The inventor's patent attorney and/or the examiner may also add prior art references to either clarify or limit the claims of the new invention.

As an example, Figure 1 shows the front page of a patent owned by IBM. The prior art references on this patent come in two forms - references to earlier patents, and "other

references”. These other references are often to scientific publications, such as those produced by IEEE. In this report we are primarily concerned with these other references, which are also sometimes called “Non-Patent References”.

It has been suggested that patents with many non-patent references are likely to contain new leading-edge ideas, whereas patents that only reference earlier patents are likely to be incremental improvements on earlier patented technologies. For a comprehensive study on various hypotheses surrounding the motivations of inventors in citing other references, see [1].

### ***Patent Sets used in the Analysis***

This study is based on two patent sets. Our analysis is based on determining the number of references from these patent sets to publications from publishers such as IEEE, RELX (formerly Elsevier), the American Institute of Physics, and others.

The first set contains patents from the top 50 patenting companies in 2018. Analysis of this patent set provides an insight into how the top tier companies rely upon science from IEEE and other publishers. The second set contains all patents in twenty technology categories from all companies, universities, government agencies, and individuals. The twenty technology categories examined are shown in Table 1 above. Analysis of this patent set reveals the wider influence of IEEE science in these technologies.

### ***Identifying Relevant Non-Patent References***

Non-patent references can be to any published document, from comic strips and brochures, to scientific articles and standards documents. The main difficulty in identifying relevant non-patent references for a study such as this is that inventors do not use a standard form for listing references. As an example, Table 2 contains eight different variants for the IEEE Global Telecom Conference. Note that some inventors just use the GLOBECOM shorthand, while others list the entire name. Sometimes IEEE is mentioned and sometimes it is not. When abbreviation variations are included such as Telecom, Tele, Tcom, Proc., Proceed., the number of variants increases further. The same issue exists for variants in journal names and standards documents. For example there are more than 30 variant spellings of the journal title *Journal Of Thoracic And Cardiovascular Surgery* including numerous mis-spellings of thoracic and every conceivable way of abbreviating cardiovascular.

**Table 2 – Variants for IEEE Global Telecom Conference**

Proceedings of Globecom '96
IEEE Global Telecommunications Conference
GLOBECOM '90:IEEE
Proceedings of IEEE Globecom '94
Globecom '97
IEEE Globecom, Global Telecommunications Conference and Exhibiton
Proc of the Global Tele Conf, U.S. New York, IEEE

**Conference Identification** – to identify conference proceedings among the non-patent references, we first identified references containing keywords such as meeting, symposia, conference, etc. We then used parsing software to identify 2-word and 3-word phrases that appear frequently in this set of papers. The full string was identified for these string sub-sequences in order to identify frequently cited conferences. In this way, we identified the top conferences referenced in the patent sets, and standardized the names of these conferences (i.e. all of the different variants of a conference were collected under a single name). As an example, all of the variants shown in Table 2 are assigned to the name ‘<conf> IEEE Global Telecommunications Conference (GLOBECOM)’.

We then looked up each of these conferences on the web to determine who is listed as their primary sponsor. For example, many of the conferences are sponsored by organizations such as IEEE, ACM (Association for Computer Machinery) and ASME (American Society of Mechanical Engineers). Some conferences are jointly sponsored by multiple organizations and this is noted as well.

When we first started identifying conferences in the 2005 report, we looked up the top 100 most referenced conferences in order to identify the primary sponsors or hosts. In this current report we have identified the sponsors for the top 1,200+ most referenced conferences. These 1,200+ conferences are listed under more than 10,000 variant names.

**Standards Identification** – Standards documents are increasingly referenced, and in general they are easy to identify by looking for strings such as ‘standard’ or ‘std’. Once the records containing the standards were located, it is straightforward to identify the organization that produced each standard (ITU, IEEE, ISO, JEDEC, ANSI, etc.). Further, once the standards bodies are identified, we then identify references to other documents that do not specifically list the words ‘standard’ or ‘std.’ The latter step is necessary since some references look like this “ISO/TC97/SC21/N2066” or “IEEE802.3” without a specific mention of the word “standard.” As a consequence we also identify other non-standard documents released from these organizations including draft standards and “requests for comments” documents if they are cited by patents.

**Journal Identification** – identifying and standardizing journal names is a very difficult process because there are so many different journals, and their names can be abbreviated in many different ways. To make the problem more manageable, we base our analysis primarily to the 45,000+ journals covered by the combined databases of ISI/Thomson Reuters, Elsevier/SCOPUS, and 1790 Analytics, LLC. This is not a severe limitation, since these databases include more than 100 IEEE journals, 3,000+ RELX/Elsevier journals, and 1,200 Wiley journals. In addition, we also identify publishers of about 1,000 non-ISI, non-SCOPUS journals if they appear very frequently in the patent references, but do not appear in these databases.

Once restricted to these 45,000+ journals, we used software that transforms journal names into common abbreviations and then implements string matching. Care must be taken with string matching because, for example, searching for “Urology Journal” will also accidentally identify “Neurology Journal”. Similarly, a search for the journal “Science” would accidentally pick up



any reference with ‘science’ in the paper title as well as any of the 800+ journals with science in their titles such as “Game and Wildlife Science”. Our proprietary software for journal identification (along with some human intervention) deals with all of these problems, so that we generate an accurate match between the patent references and 45,000+ journals. After identifying all of the relevant journals, we then used the ISI and SCOPUS databases and web research to identify the publisher of each journal

### III. Results

#### *References from Top 50 Patenting Organizations*

Table 3 shows the 50 firms that were granted the largest number of US patents in 2018. It should be noted that many of these firms consist of multiple subsidiaries, and these firms patent under many names. (For example General Electric has patents filed under 316 names, of which only a fraction contain General Electric in the name.) We identified all of the subsidiary names for each company to ensure that our patent counts are accurate.

We identified the top 50 patenting firms because we want to understand the extent to which the current technology leaders use IEEE science. Figure 2 shows the 20 publishers of science whose publications are referenced most frequently by the 50 firms shown in Table 3. This figure shows that patents issued to the top 50 firms between 1999 and 2018 reference IEEE papers, conferences, and standards more than 532,000 times. This is more than three times as many references as the second placed publisher RELX (Elsevier).

IEEE receives 27% of the science references from the patents of the top 50 companies. The next closest publisher (RELX) has 8.20% of the total. About 1/3 of the 532,000+ patent references to IEEE are to IEEE sponsored conferences.

Table 4 illustrates the reference distribution of IBM, which is the top patent holder in 2018 (and for the past 15 years). This reference distribution is typical of the top 50 firms. The references from IBM to IEEE are actually to a number of different IEEE journals and conferences. In this table, IEEE journals are highlighted in yellow and IEEE conferences are highlighted in orange. The top overall reference is to IEEE is to the International Electron Device Meeting. The top IEEE journals are *IEEE Computer Magazine* and *IEEE Transactions on Electron Devices*.

Notice that 33 of the top 65 journals and conferences referenced by IBM patents are published or sponsored by IEEE. Seventeen of the top 65 journals and conferences are published or sponsored by ACM. As a software firm, IBM tends to reference ACM much more than most of the top 50 firms, but still IBM references IEEE almost twice as often as ACM as seen in Appendix A-11 (54,707 references to IEEE and 29,514 references to ACM.) The reader may notice the large number of references to ‘IEEE Unseparated’ or ‘Misc ACM’ in Table 4. These are articles that reference IEEE or ACM, but the inventor has not given a reference specific enough to identify the proper journal or conference. A few examples can be found in Table 5 below. These are relatively complete references; it is not clear why the inventors were not more careful about listing the full journal names.

**Table 3 – Top-Patenting Firms in 2018**

Rank	Full Parent Name	2018 Patent Count	1999-2018 Patent Count
1	International Business Machines Corp	9102	105441
2	Samsung Electronics Co Ltd	6190	73420
3	Canon Inc	3564	57673
4	Intel Corporation	3432	39832
5	LG Electronics Inc.	2493	24596
6	Taiwan Semiconductor Manufacturing Co.	2472	17739
7	Samsung SDI Co Ltd	2390	18036
8	Microsoft Corporation	2378	35932
9	Qualcomm Inc	2366	24101
10	Toyota Motor Corp	2345	20214
11	Google Inc.	2307	18491
12	United Technologies Corp	2276	15591
13	General Electric Company	2203	38624
14	Huawei Technologies Company Ltd.	2193	10821
15	Apple Inc	2187	16546
16	Sony Corp	2186	43372
17	Ford Motor Co.	2142	13931
18	Amazon.com Inc.	2116	9544
19	Dell Technologies Inc	2075	13993
20	Panasonic Corporation	1830	48539
21	BOE Technology Group Ltd	1644	4722
22	Siemens Aktiengesellschaft	1420	26022
23	Hyundai Motor Co.	1419	7539
24	Ericsson	1375	17453
25	Toshiba Corp	1326	37840
26	Bosch (Robert) GmbH	1300	19113
27	Medtronic Inc	1300	19052
28	Fujitsu Limited	1297	34042
29	Seiko Epson Corporation	1293	23309
30	Hitachi Ltd	1286	38008
31	Boeing Co. (The)	1248	12246
32	Fuji Film Holdings Corp	1242	27097
33	AT&T Inc	1223	18638
34	Mitsubishi Electric Corp	1192	18977
35	Hon Hai Precision Industry Co. Ltd.(Trades as Foxconn)	1179	37424
36	Denso Corp	1132	15406
37	General Motors Corp	1089	15917
38	Kyocera Corp.	1079	9030
39	DowDuPont	1072	22790
40	Honeywell International Inc.	1071	17897
41	Ricoh Co. Ltd.	1060	19297
42	Johnson & Johnson	1035	15104
43	Honda Motor Co. Ltd.(Honda Giken Kogyo KK)	971	17234
44	Micron Technology Inc.	930	26355
45	Koninklijke Philips N.V.	915	18900
46	TCL Corp	888	3847
47	Halliburton Co. (Holding)	884	6768
48	Infineon Technologies AG	879	15339
49	Semiconductor Energy Laboratory Co. Ltd.	877	12368
50	Cisco Systems Inc.	864	14666

**Table 4 – Reference Distribution from IBM Patents 1997-2017**

References	Journal/Conference/Standard
4980	Misc ACM
4162	IP.com
2958	IEEE Unseparated
2838	<conf> IEEE Int Electron Devices Meeting (IEDM)
2520	IBM JOURNAL OF RESEARCH AND DEVELOPMENT
2466	ACM SIGPLAN Notices
2242	APPLIED PHYSICS LETTERS
2081	IETF Network Working Group
2002	COMMUNICATIONS OF THE ACM
1693	<conf> Int Conf on Very Large Data Bases (VLDB)
1692	<std> IETF Document
1495	IEEE tr ELECTRON DEVICES
1354	JOURNAL OF APPLIED PHYSICS
1330	Computer (IEEE)
1311	<conf> USENIX Conference Proceedings
1309	<conf> IEEE/JPN Soc App Phys - symp on VLSI tech
1274	<conf> IEEE int conf on Data eng (ICDE)
1261	<conf> ACM/IEEE Design Automation conf
1247	<std> IETF Std
1233	IEEE JOURNAL OF SOLID-STATE CIRCUITS
1192	Proc SPIE
1186	IBM SYSTEMS JOURNAL
1180	<conf> ACM/IEEE int symp on comp Architecture (ISCA)
1114	<conf> Proceedings ACM SIGMOD Symp
1086	ACM SIGOPS
1077	<std> NIST Document
1069	IEEE ELECTRON DEVICE LETTERS
1047	IEEE tr COMPUTERS
1042	Proceedings of ACM SIGMOD
863	comp Architecture News
798	IEEE tr MAGNETICS
791	<conf> ACM Conference on Human Factors in Computing Systems (CHI)
757	J Vac Sci tech
750	JOURNAL OF THE ACM
707	<conf> IEEE Int Conf Acous, Speech, and Sig Proc (ICASSP)
698	IEEE tr Software eng
698	<conf> IEEE int conf on Distributed comp sys
684	SCIENCE
678	IEEE tr comp Aided Design of Integrated Circuits and sys
650	<conf> IEEE int symp On High Performance comp Architecture (HPCA)
641	<conf> IEEE int Symp on High Performance Distributed comp
640	<conf> Proceedings ACM SIGCOMM Symp
634	IEEE tr PARALLEL AND DISTRIBUTED SYSTEMS
598	IEEE tr KNOWLEDGE AND DATA ENGINEERING
592	<conf> proc IEEE int Solid State Circuits Conf (ISSCC)
586	<conf> IEEE Proceedings
579	<conf> IEEE/ACM Int Conf on Software eng (ICSE)
551	<conf> IEEE Hawaii Int Conf on Sys Sci (HICSS)
550	<conf> IEEE Electronic Components and tech conf
521	<conf> IEEE/ACM int conf on comp Aided Design (ICCAD)
520	<conf> IEEE Misc Conf
516	<conf> IEEE/ACM Proceedings on Supercomputing (SUPERCOMP)
504	IEEE tr INFORMATION THEORY
495	NATURE
488	<conf> IEEE International Parallel and Distributed Processing Symposium
485	IEEE MICRO
484	NANO LETTERS
483	Misc SPIE
475	<conf> ACSA/IEEE ann comp Security app conf (ACSAC)
462	<std> Network Working Group RFC
462	<conf> Proceedings ACM SIGPLAN Symp
454	ACM comp Surveys CSUR
443	<conf> IEEE/ACM International Symposium on Cluster, Cloud, and Grid Compu

Table 5 – Examples of References Mapped to “IEEE Unseparated”

Patent	NPR #	NPR Text
05692177	3	Lewis et al. "Hashing for dynamic and static internal tables." IEEE, pp. 45-56 Oct. 1988.
05699518	4	"The Design and Implementation of a Reliable Distributed Operating System--ROSE", Ng, IEEE, pp. 2-11, Apr. 1990.
05699518	5	"A service Platform for Distributed Applications", Popescu-Zeletin et al, IEEE, pp. 11-17, Jul. 1992.
05709219	5	Kotoku, Tetsuo et al., "Environment Modeling for the Interactive Display (EMID) Used in Telerobotic Systems," IEEE Nov. 3-5 1991, pp. 999-1004.
05709219	6	Kotoku, Tetsuo, "A Predictive Display with Force Feedback and Its Application to Remote Manipulation System with Transmission Time Delay," IEEE Jul. 7-10 1992, pp. 239-246.
05709219	8	Burdea, Grigore et al., "Distributed Virtual Force Feedback," IEEE May 2, 1993, Atlanta, GA, pp. 25-44.

### *References from Companies in Twenty Technology Categories*

In the previous section, we analyzed the use of IEEE science by the top patenting organizations. Out of all science publishers, IEEE was cited most often by these organizations by a wide margin. However, looking only at the top companies tells an incomplete story. IEEE publishes journals and runs conferences mainly in information technology, electronics and other areas. It is therefore useful to examine the extent to which IEEE science is referenced by all organizations that patent in specific technologies and not just the leading companies.

As mentioned in the methodology section, we identified all patents in the twenty technology categories shown above in Table 1. 1790 Analytics has developed a classification scheme that categorizes all patents into 50 broad technology areas based on International Patent Classes (IPCs) and Cooperative Patent Classes (CPCs) which are assigned to each patent as part of the examination process. This scheme was used to identify all relevant patents for the current analysis.

We examined each of the technology areas separately, and the results are summarized in Figures 3-19. The first category shown (in Figure 3) is Artificial Intelligence (AI). We identified all non-patent references on patents related to this technology issued between 1999 and 2018. We then determined the science publishers responsible for the largest number of these non-patent references. Figure 3 shows the result of this analysis, namely that IEEE science is referenced far more in AI related patents than science from any other publisher. Thirty-six percent of all science references from these patents go to IEEE journal papers or IEEE sponsored conference papers (the graphs also include standards documents, but the vast majority of the references are to journal or conference papers). In second place is the ACM with 11.79% of the references.

AI is currently a very hot area and often written about in the popular press. The same can be said for Autonomous Vehicles, which are shown in Figure 4. Here again IEEE dominates in references. In this case more than half (62.57%) of all references are to IEEE in this category.

Blockchain and Distributed Ledgers is a new category added this year. It has only a few hundred patents (as opposed to AI, which is a much more established category with 10,000+ patents). We see in Figure 5 though that nearly half (47.99%) of all science references from these patents go to IEEE.

Figure 6 covers Broadcasting patents, which is a category we first added in 2015. This category consists of US patents in the IPCs for Broadcast Communication and Pictorial Communication (Television). It would seem that this would be an area that is somewhat tangential to IEEE's core mission. However, over thirty-six percent of all science references from these patents go to IEEE journal papers or IEEE sponsored conference papers. The International Telecommunications Union is a distant second with 7.45% of all references.

Figures 7 and 8 show referencing patterns from Computer Hardware and Software patents. Here IEEE once again receives far more references than the other publishers. In both cases, ACM is the second most referenced publisher, but it receives about half of the references that papers published by IEEE receive.

Figure 9 shows another new area for this year – Cybersecurity. This is another hot area, and again IEEE leads by a wide margin (30.16% of all references compared to 14.83% for second place ACM).

Figure 10 examines the top referenced publishers in the Medical Device field, which covers devices as well as diagnostic tools and surgical instruments. Here, IEEE is a respectable third in an area that is somewhat outside its core competency. RELX who has more than 400 journals in the field, such as *Annals of Thoracic Surgery*, and the *Journal of the American College of Cardiology* has a substantial lead with 20.25% of all references. Lippincott has 7.89%, which is just ahead of IEEE with 7.76% of all references.

Figure 11 contains the results for the information storage category. In this area, IEEE is particularly dominant. 44.07% of all of the science references from patents in information storage are to papers in IEEE journals or conferences. IEEE's count of 80,437 references in this category is about six times as many as second place AIP (American Institute of Physics).

Another hot technology area consists of Internet-of-Things patents. As Figure 12 shows, IEEE science is very important to the development of this new and active area of patenting. More than 47% of all science references are to IEEE content. ACM is a distant second with 8.92% of all references.

Figure 13 contains the results of patents covering Measuring, Testing, and Control technology. Patents in this category are related to measuring or testing, force, pressure, weight, etc. as well as chemically measuring substances (e.g. measuring CO<sub>2</sub> levels). The category also contains control devices since these technologies are often combined. For example, a patent might be related to a valve that adjusts at a certain pressure or at a certain pollution level. Since this type of measuring can be done both mechanically, magnetically, electrically, or chemically, it is not too surprising to see both IEEE and RELX and the Optical and Chemical Societies all near the

top of Figure 13. IEEE receives the most references, but the lead is not as dominant as in the Information Technology related areas.

The results for the Optics category can be found in Figure 14. This is another area that is slightly outside the IEEE core. IEEE still has a lead over the second and third place publishers – the Optical Society of America (OSA) and the International Society of Optical Engineering (SPIE). Since these latter two societies are Optical societies, it would be reasonable to assume that one of these societies would lead in the category, but IEEE’s strong journals and conferences in the area receive more references from optics patents.

Figure 15 contains results for the patents related to power generation and transmission. Although this is a non-information technology category, IEEE leads in references in this category as well. 34.96% of science references from patents in this category go to IEEE publications. RELX is second with 20.18% of all US patent references in the category.

Intelligent Manufacturing and Robotics contains patents related to robotics, and robotics and control systems related to manufacturing. According to Markets and Markets, the Robotics market is about a \$20 billion dollar industry because of a population explosion in “service robots” that mow lawns, vacuum floors, and manufacture things.

As this industry grows, new innovations will be patented, and from Figure 16 it looks like those innovations will build upon ideas published in IEEE journal articles or presented at IEEE conferences. We see in that 44.38% of all science references from patents in this space refer to IEEE published articles. RELX is the second ranked publisher, but its papers receive only 7.76% of the science references. In this category, IEEE has more references than the next 15 publishers combined.

Figure 17 shows that IEEE is also very strong in the Semiconductor category. Here, the inclusion of conferences gives IEEE a substantial boost. Approximately one-third of the references to IEEE are to conference papers. With conferences excluded, IEEE would be about the same level as the American Institute of Physics in terms of science references from semiconductor patents.

The Smart Meter/Smart Grid category covers patents related to improving the power grid as well as for advanced residential electric meters. This is a relatively small category but as we see in Figure 18, IEEE provides the bulk of the science base with almost 65% of all patent references.

Solar and Photovoltaic energy results are contained in Figure 19. IEEE holds a small lead over RELX in this category in spite of having fewer journal titles. RELX has several strong journals in this category including *Solar Energy Materials and Solar Cells*, *Thin Solid Films*, *Solar Energy*, *Synthetic Metals*, *Journal of Crystal Growth*, *Solar Cells*, plus more than 50 smaller journal titles related to this technology. The references to IEEE science in this category mainly go to the *IEEE Photovoltaic Specialists conference*, the *IEEE World Conference on Photovoltaic Energy Conversion*, and *IEEE Transactions on Electronic Devices*.

The Telecommunications category is one of the strongest large categories for IEEE. There are about three times as many references to IEEE conference and journal papers as to second place

publisher 3GPP, which is a standards body. Standards are referenced more frequently in telecommunications, but still not nearly as often as journal and conference papers. About 55% of the nearly one million total references to all publishers are to journal articles; 25% of the references are to conference papers, and about 20% are to standards documents. In terms of standards documents, the 3GPP General Partnership Project, Internet Engineering Task Force and International Telecommunication Union received the most references in the category. New telecommunications patents are referencing scientific articles to a larger extent than in the past. In this category in 2008, there were just over 118,000 references to IEEE and last year there were 496,000 references to IEEE papers. Now as we see in Figure 20, there are more than 529,000 references to IEEE for telecommunications patents from 1999-2018. Thus, even though we removed a year of patents (last year's report covered 21 years 1997-2017) we added more than 33,000 references to IEEE documents.

Standards documents are referenced increasingly often in Telecommunications patents. Five of the top 11 (7 of the top 20) referenced publishers are standards bodies. Moreover, of the 529,000+ references to IEEE, over 20,000 are to various IEEE standards (mostly to the IEEE 802 family of standards).

Virtual and Augmented Reality patents were added for the first time this year. We see in this category that again IEEE leads by a wide margin with 41.82% of all science references from patents. ACM is in second place with 19.48% of references.

Wind Energy patents were tracked for the first time in the 2016 report. We see in Figure 22 that in this area 39.78% of all science references from Wind Energy patents go to IEEE journal and conference papers. This is almost four times as many references as second place RELX receives, in spite of having fewer journal titles in the area than RELX does.

Figures 3-22 show aggregate counts of references from all patents in each technology category. Readers who wish to see the firms that reference IEEE publications in each category can consult Appendix B. This appendix contains the 100 organizations that reference IEEE most frequently in each category. Appendix C is similar, except that it contains the organizations that reference IEEE most frequently in the twenty technology categories combined.

### ***Citation Index for Patents Referencing IEEE***

In an earlier study (see [2]), it was shown that patents that reference specific IEEE journals perform better on a number of quality metrics. Moreover, it was shown that the results were statistically significant. In this report, we update a key figure from the previous study showing the citation index of patents that reference IEEE papers versus peer patents that do not reference IEEE.

The citation index is a normalized citation metric that takes the number of citations received by a particular set of patents, and divides it by the expected number of citations for patents of the same age and technology class. A random set of patents therefore should have a citation index of 1.0. Research has shown that patents cited by many later patents tend to contain important ideas upon which the later patents are building (see [3] and [6]). Citation indicators are also the basis

for the patented financial models (see [4] and [7]) invented by the two 1790 founders Breitzman and Thomas.

Figure 23 contains the Citation Index for the patents in the twenty technology categories that reference IEEE papers and conferences. Also shown is the Citation Index for the set of the remaining patents in each category that do not reference IEEE. Note that the set of all patents in each category have an expected citation index of 1.0. Thus we see that the patents that reference IEEE are cited at least 30% more than expected, while the patents that do not reference IEEE are cited up to 30% less often than expected in some categories. This of course does not imply that all patents that reference IEEE are likely to be more valuable than patents that do not reference IEEE, but it does suggest that in general, patented technologies that build upon IEEE published or sponsored science are more likely to be valuable than patented technologies that do not reference IEEE science.

#### **IV. Conclusions**

When a patent is filed, it must reference the prior art upon which it builds, as well as any prior art that limits the claims of the new invention. This study and prior studies show that science published by IEEE forms a significant portion of this prior art for new patents.

In this study, we examined two separate patent sets. The first patent set consisted of patents granted between 1999 and 2018 to the 50 organizations with the largest number of US patents granted in 2018. The second patent set consisted of all US patents granted between 1999 and 2018 patents in twenty key technologies: Artificial Intelligence, Autonomous Vehicles, Cybersecurity, and several other categories. In both of these patent sets IEEE is the dominant source of non-patent prior art. In other words, IEEE journals and conferences are key outlets for scientific discoveries relevant to cutting-edge technology.

Finally, we conducted an analysis of citation indices for IEEE related patents and non-IEEE related patents. These types of metrics have been shown in validation studies to be good markers for the quality, impact, and potential value of patents [3]. In this study, it was shown that patents that build upon IEEE published science tend to have higher citation indices than patents that do not reference IEEE. This suggests but does not guarantee that patents that build upon IEEE science are more likely to become high-quality, high-impact, valuable inventions than patents that do not build upon IEEE.

Specific key results are identified in the Executive Summary.



## V. References

- [1] Branstetter, Lee. "Is Academic Science Driving a Surge in Industrial Innovation? Evidence from Patent Citations," Columbia Business School, Discussion Paper #28.
- [2] Breitzman, Anthony. "IEEE and Patents: An Analysis of Patent Referencing to IEEE Papers, Conferences and Standards", 1790 Analytics, LLC, May 23, 2005
- [3] Breitzman, Anthony and Moguee, Mary Ellen. "The Many Applications of Patent Analysis," *of Information Science*, 28, 3, 187-205, 2002.
- [4] Breitzman, Anthony., "Method and Apparatus for Choosing a Stock Portfolio, Based on Patent Indicators," US Patent #6,175,824, Jan. 16, 2001.
- [5] Fortune Magazine, "Ten Tech Trends," January 10, 2005.
- [6] Hall, Bronwyn H., Jaffe, Adam B. and Trajtenberg, Manuel., "The NBER Patent Citations Data File: Lessons, Insights and Methodological Tools" (December 2001). CEPR Discussion Paper No. 3094.
- [7] Thomas, Patrick., "System and Method for Producing Technology-Based Price Targets for a Company Stock," US Patent #6,832,211, Dec. 14, 2004.

# Figure 1: Sample Patent Front Page

United States Patent  
Bulzacchelli, et al.

7,822,114  
October 26, 2010

Decision feedback equalizer using soft decisions

## Abstract

A decision feedback equalizer (DFE) and method include at least two paths. Each path includes the following. An adder is configured to sum an input with a first feedback tap fed back from a different path. A latch is coupled to the adder to receive a summation signal as input. The latch includes a transparent state, and an output of the latch is employed as the first tap in a feedback path to an adder of a different path, wherein a partially resolved first tap in the feedback path is employed during the transparent state to provide a soft decision to supply correction information in advance of a hard decision of the latch.

**Inventors:** Bulzacchelli; John F. (Yonkers, NY), Friedman; Daniel J. (Sleepy Hollow, NY)  
**Assignee:** International Business Machines Corporation (Armonk, NY)  
**Appl. No.:** 11/761,586  
**Filed:** June 12, 2007

**Current U.S. Class:** 375/233; 375/229  
**Current CPC Class:** H04L 25/03057 (20130101); H04L 25/067 (20130101)  
**Current International Class:** H03H 7/30 (20060101)  
**Field of Search:** 375/233,229

## References Cited

### U.S. Patent Documents

7106099	September 2006	Nix
7539243	May 2009	Toifl et al.
2006/0188043	August 2006	Zerbe et al.

### Other References

Grozing, "Sampling Receive Equalizer with Bit-Rate Flexible Operation up to 10 Gbit/s," Proceedings of the 32nd European Solid-State Circuits Conference, 2006, ESSCIRC 2006, Sep. 2006 pp. 516-519. cited by examiner.

Kenney, "A parallel architecture for multilevel decision feedback equalization," **IEEE Transactions on Magnetics**, vol. 34, Issue 2, Part 2, Mar. 1998 pp. 588-595. cited by examiner.

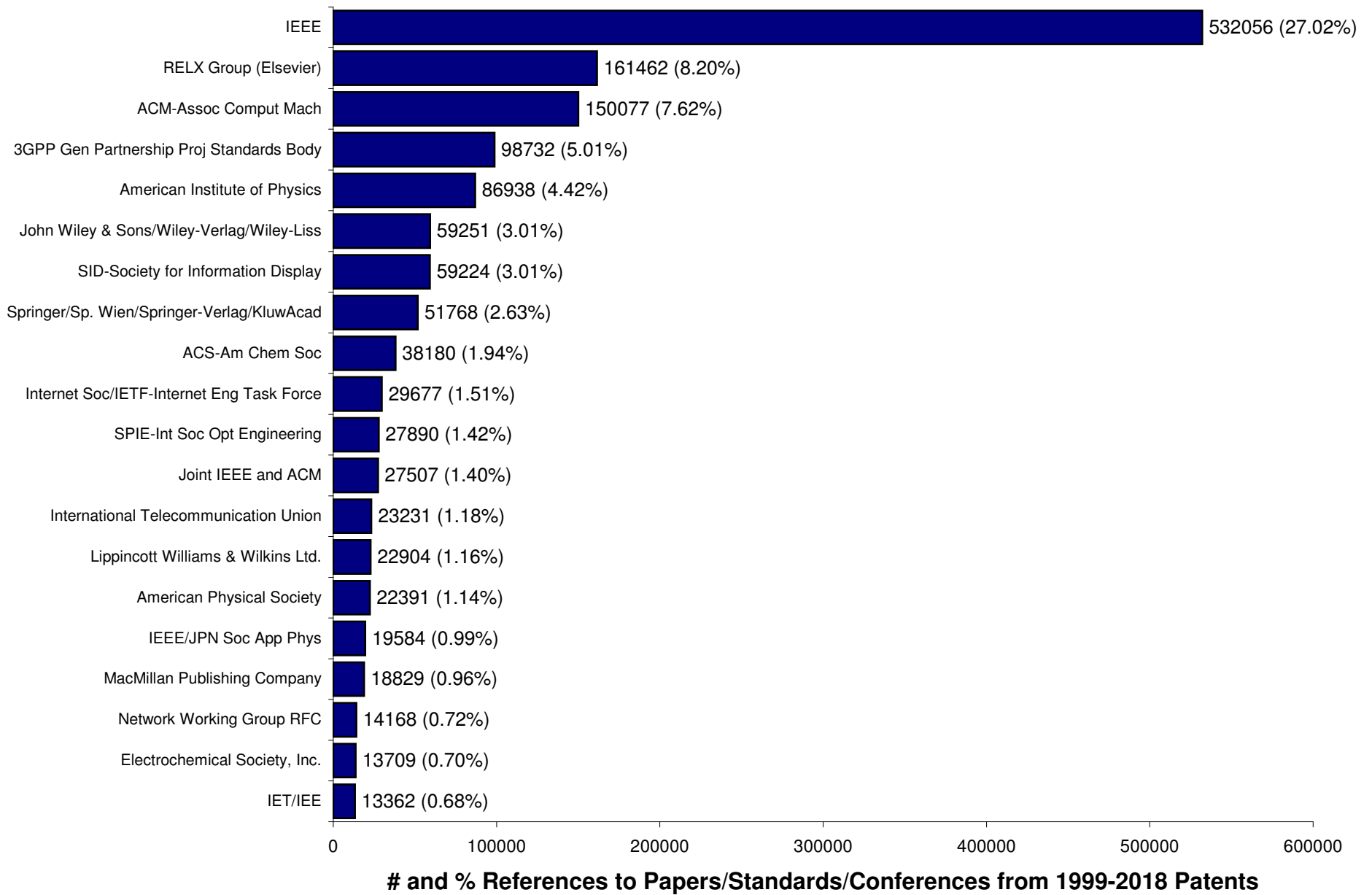
Kenney, "Pipelining for speed doubling in MDFE," 1996 **IEEE International Conference on Communications**, 1996, ICC 96, Conference Record, Converging Technologies for Tomorrow's Applications, vol. 1, Jun. 23-27, 1996 pp. 561-565 vol. 1. cited by examiner.

Varzaghani, "A 6-GSamples/s multi-level decision feedback equalizer embedded in a 4-bit time-interleaved pipeline A/D converter," **IEEE Journal of Solid-State Circuits**, on pp. 935-944, vol. 41, Issue: 4, Apr. 2006. cited by examiner.

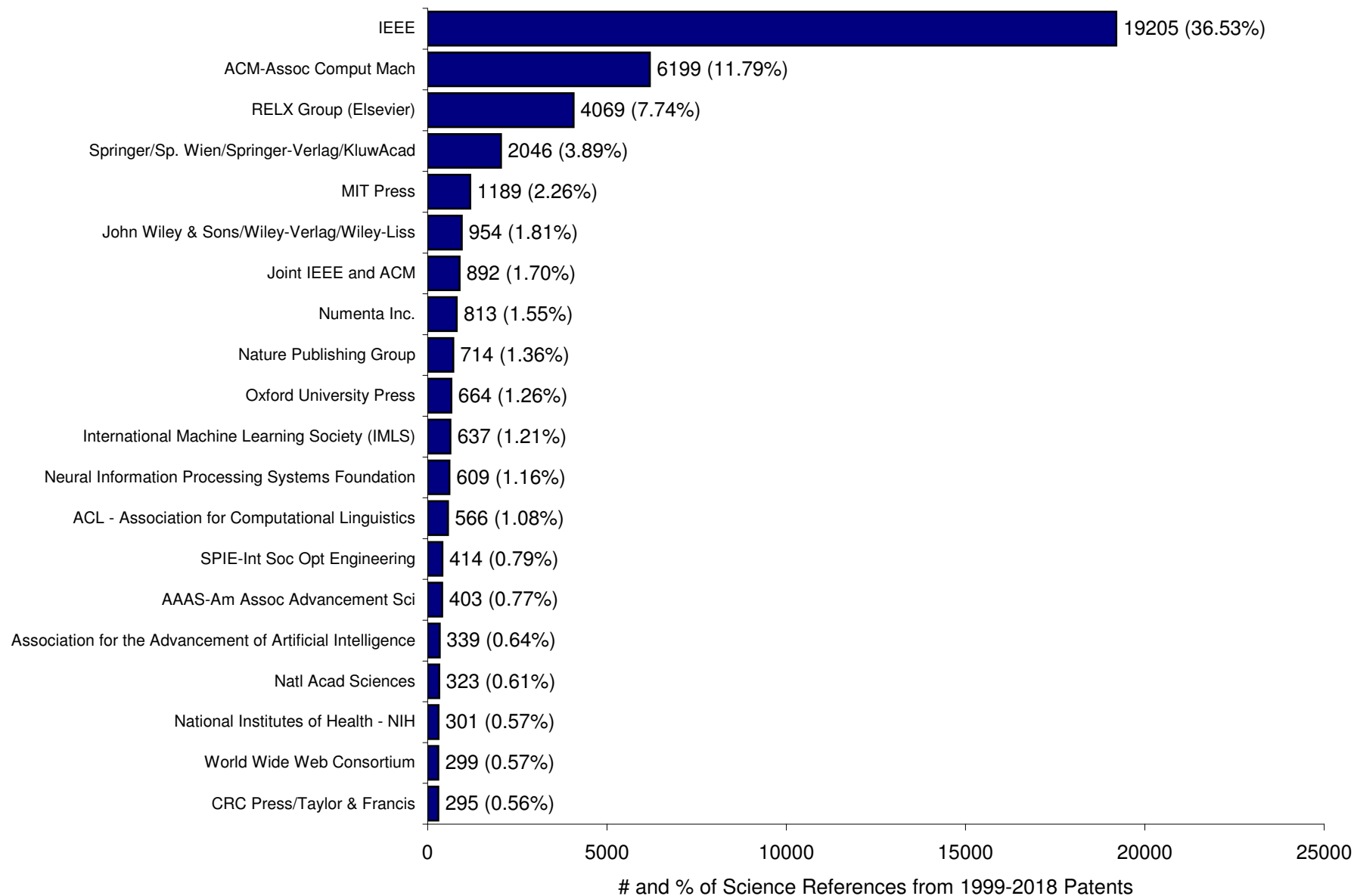
Krishna, "A multigigabit backplane transceiver core in 0.13-.mu.m CMOS with a power-efficient equalization architecture," **IEEE Journal of Solid-State Circuits**, pp. 2658-2666, vol. 40, Issue: 12, Dec. 2005. cited by examiner.

Ren, "Performance Analysis of Edge-based DFE", Electrical Performance of Electronic Packaging Oct. 2006 pp. 265-268. cited by examiner.

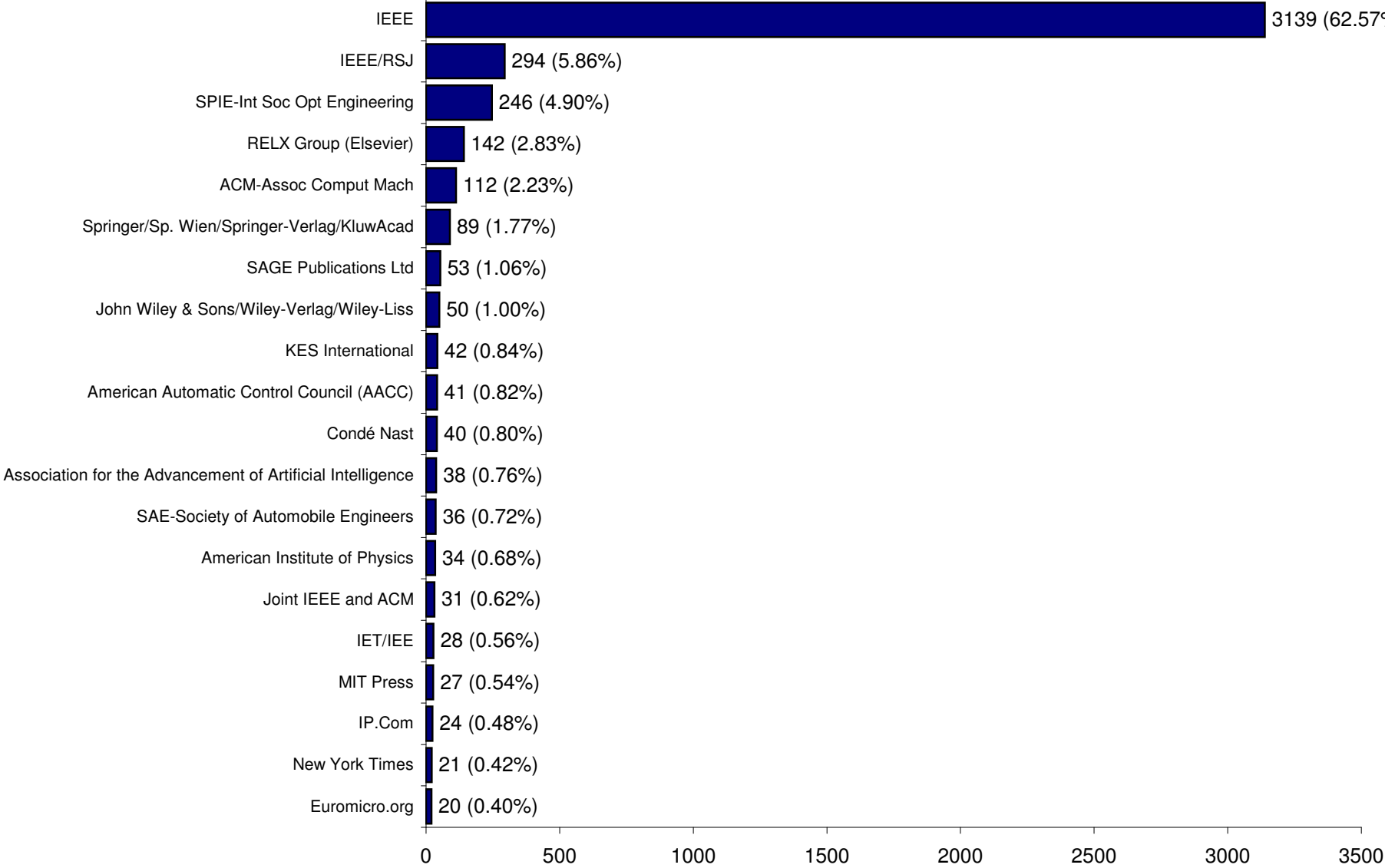
**Figure 2 - # and % of US Patent References from Top 50 Companies to Top 20 Journal Publishers**



### Figure 3 - # and % of Science References from 1999-2018 Artificial Intelligence US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

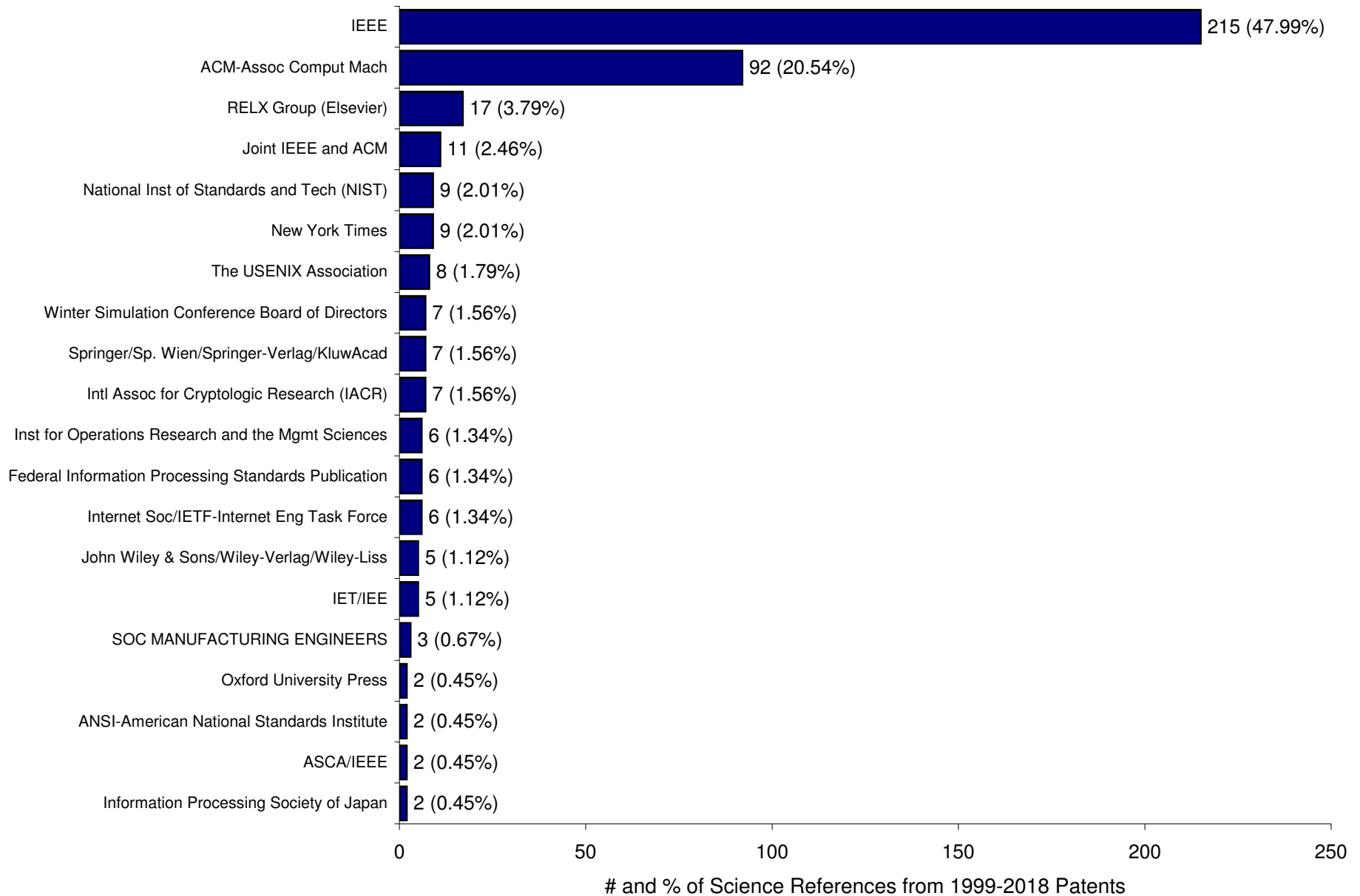


# Figure 4 - # and % of Science References from 1999-2018 Autonomous Vehicle US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

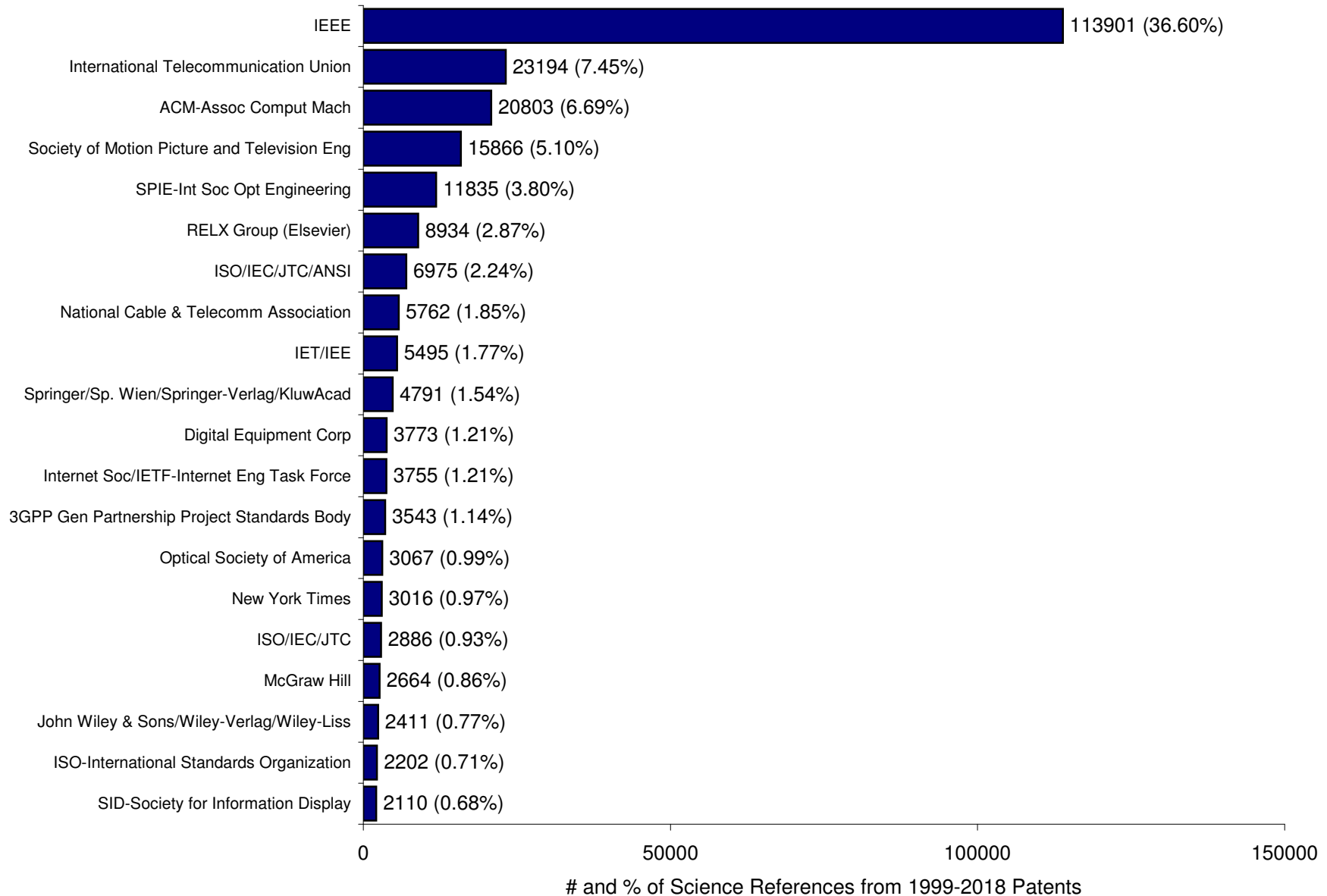


# and % of Science References from 1999-2018 Patents

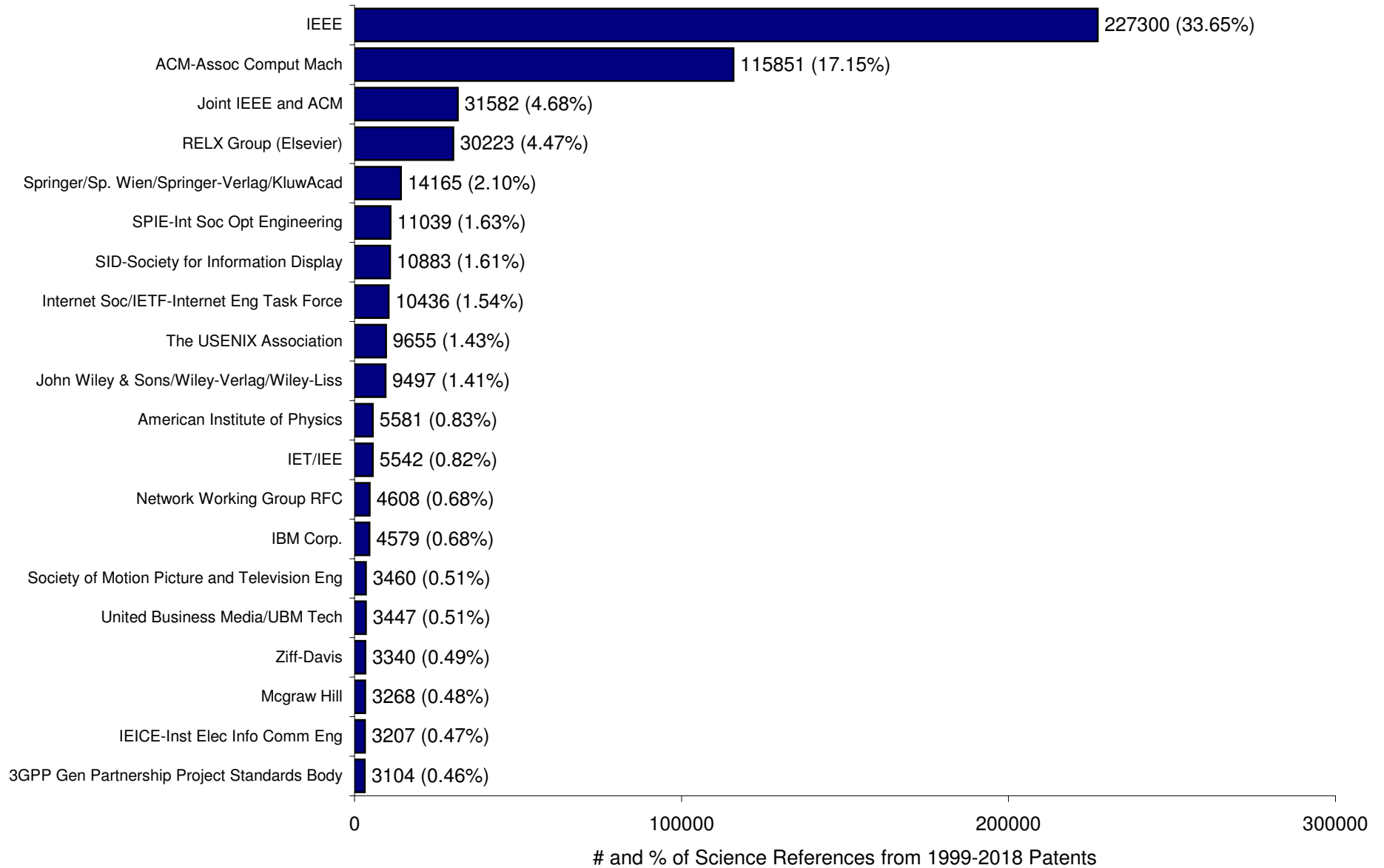
# Figure 5 - # and % of Science References from 1999-2018 Blockchain/Distributed Ledger US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



# Figure 6: # and % of Science References from 1999-2018 Broadcasting US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

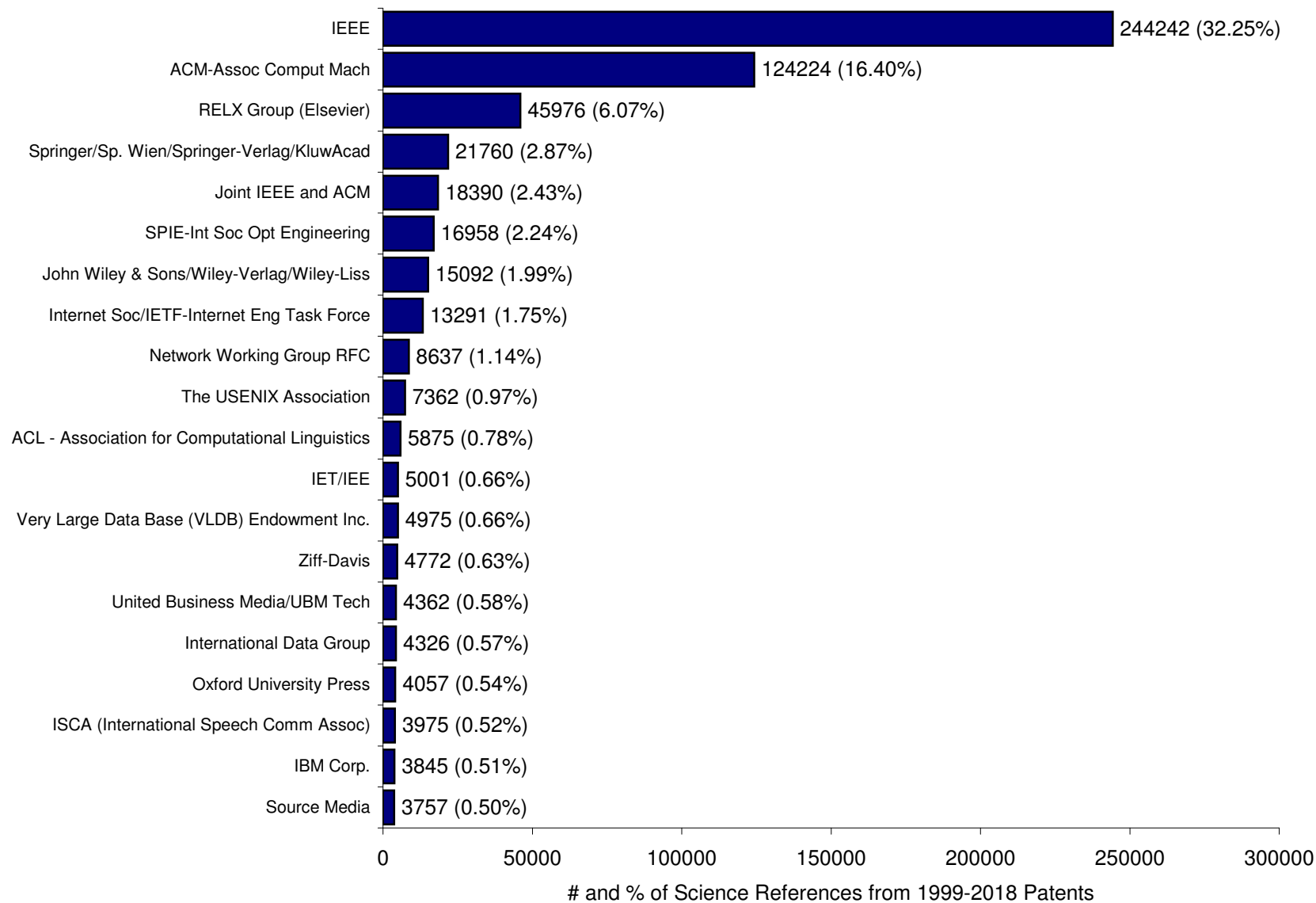


# Figure 7 - # and % of Science References from 1999-2018 Computer Hardware US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations

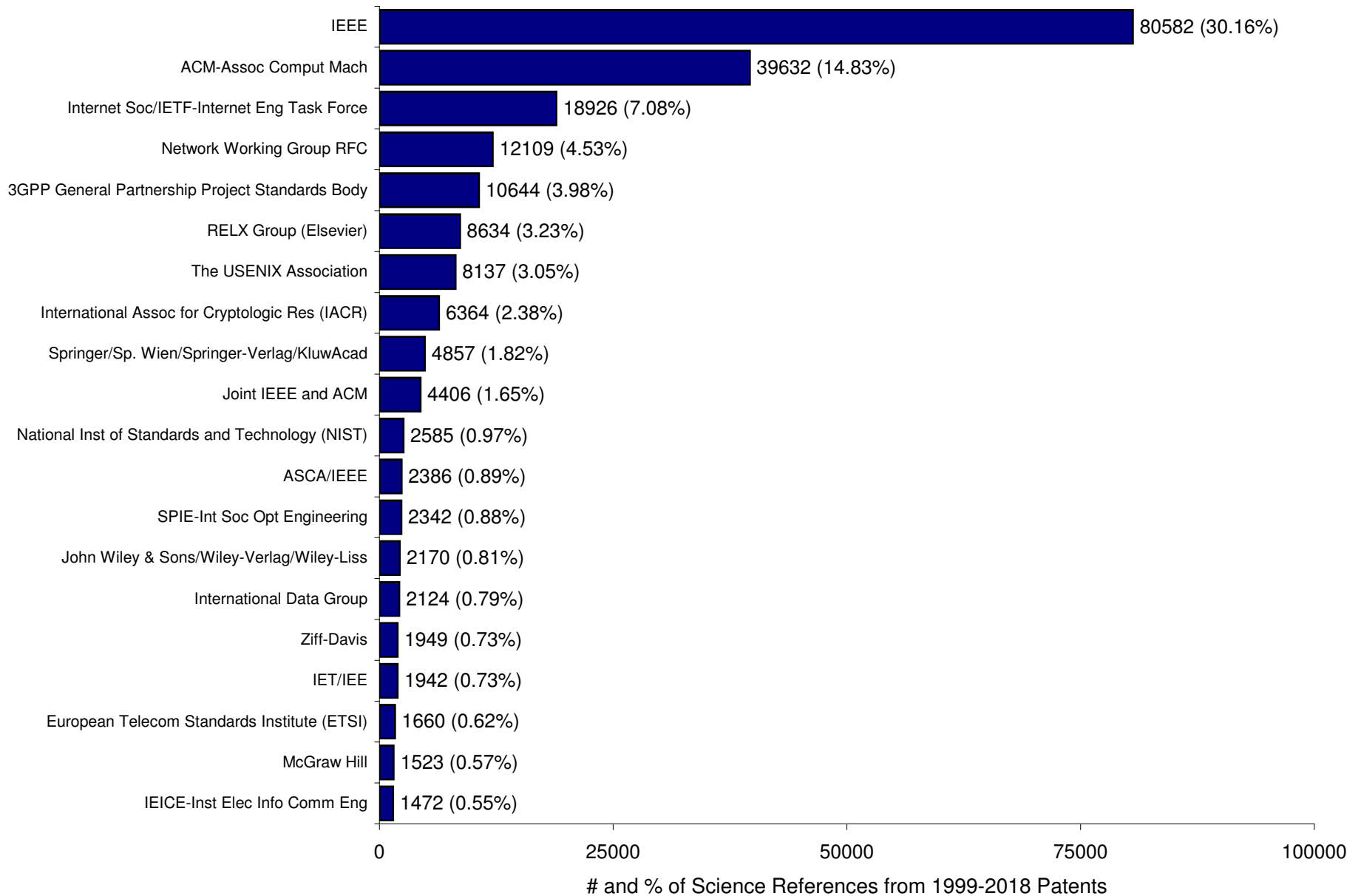




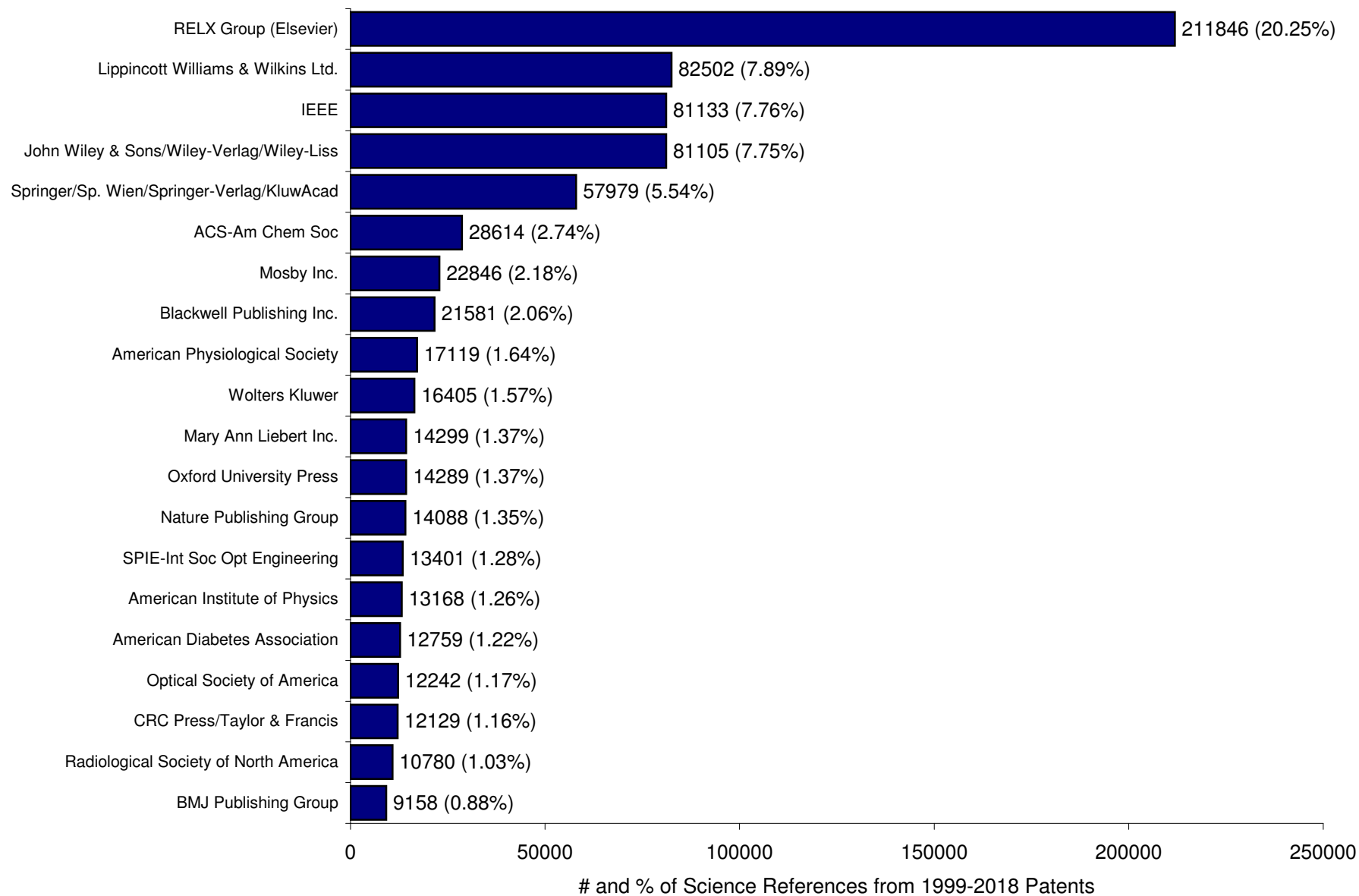
# Figure 8 - # and % of Science References from 1999-2018 Computer Software US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



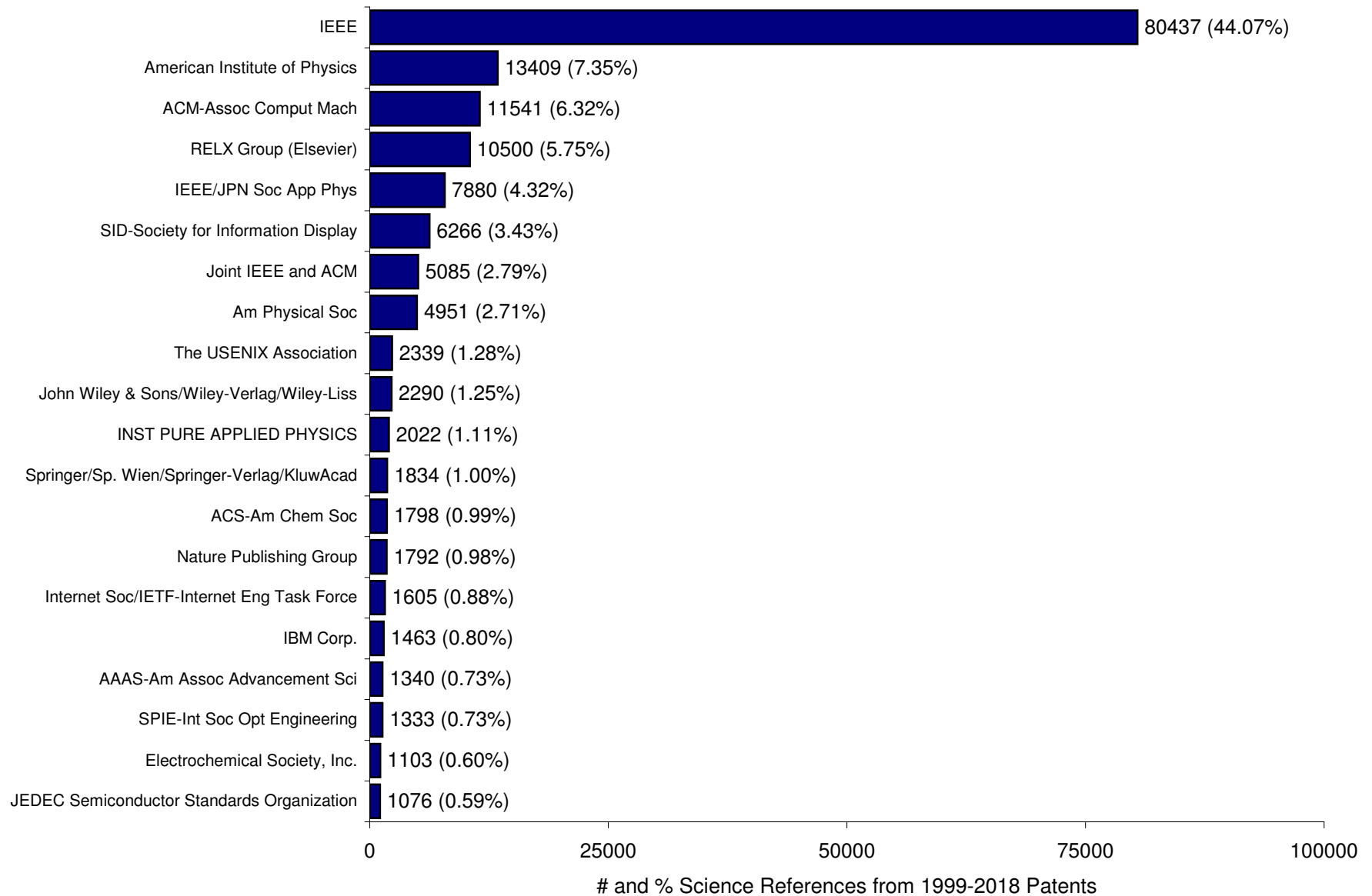
# Figure 9 - # and % of Science References from 1999-2018 Cybersecurity US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



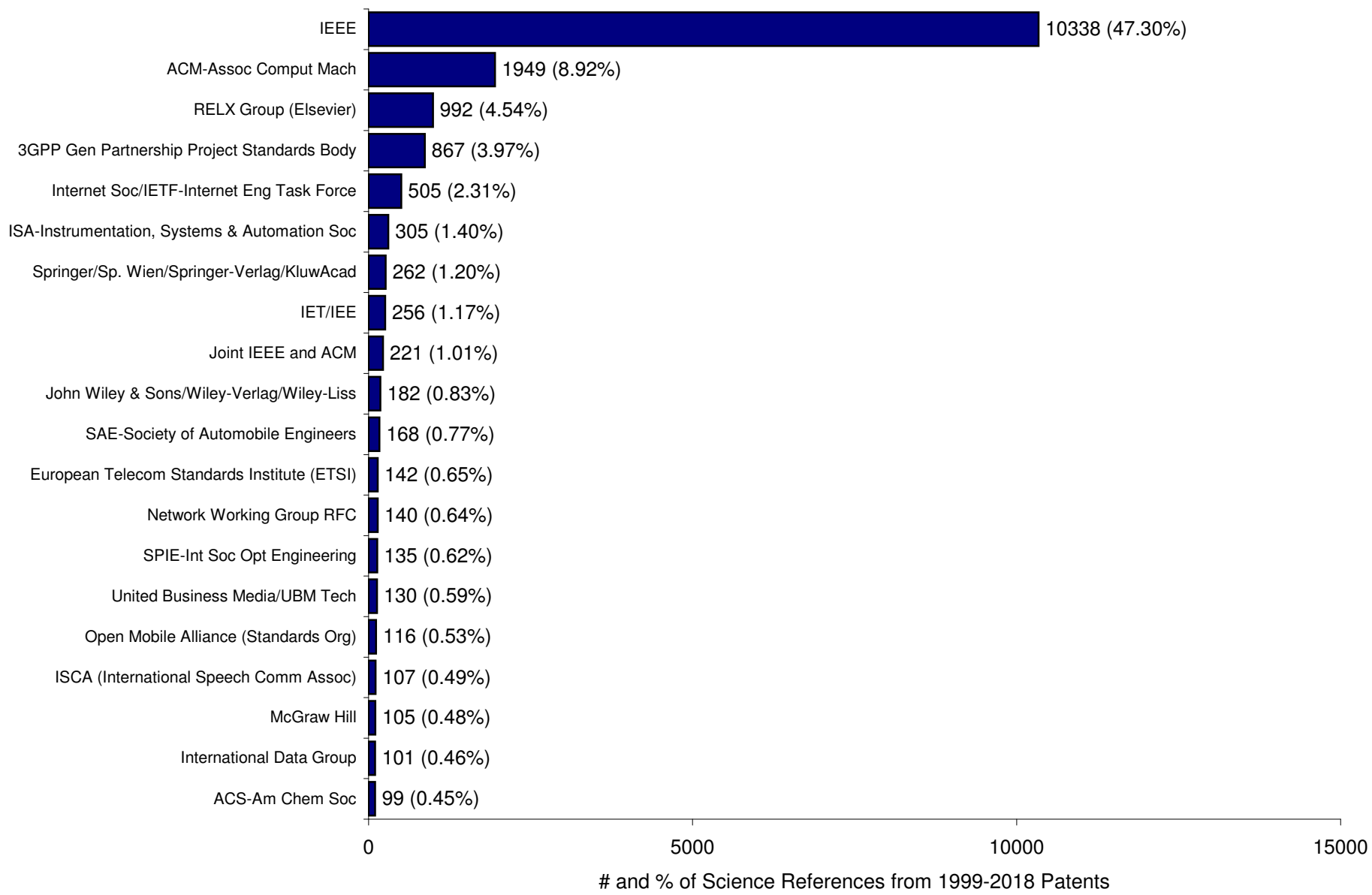
# Figure 10 - # and % of Science References from 1999-2018 Medical Device US Patents to Top 20 Publishers and Conference Organizers



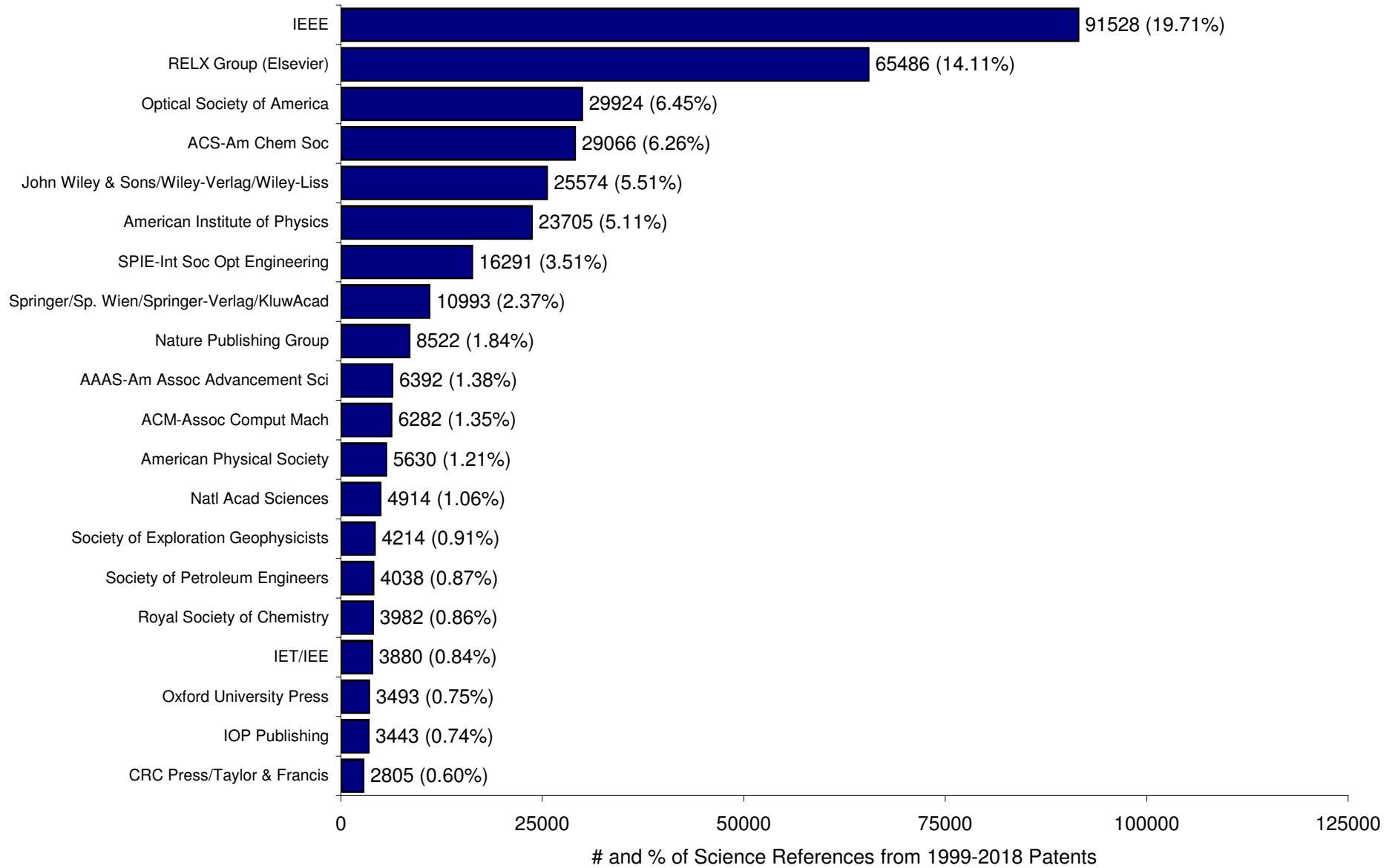
# Figure 11 - # and % of Science References from 1999-2018 Information Storage US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



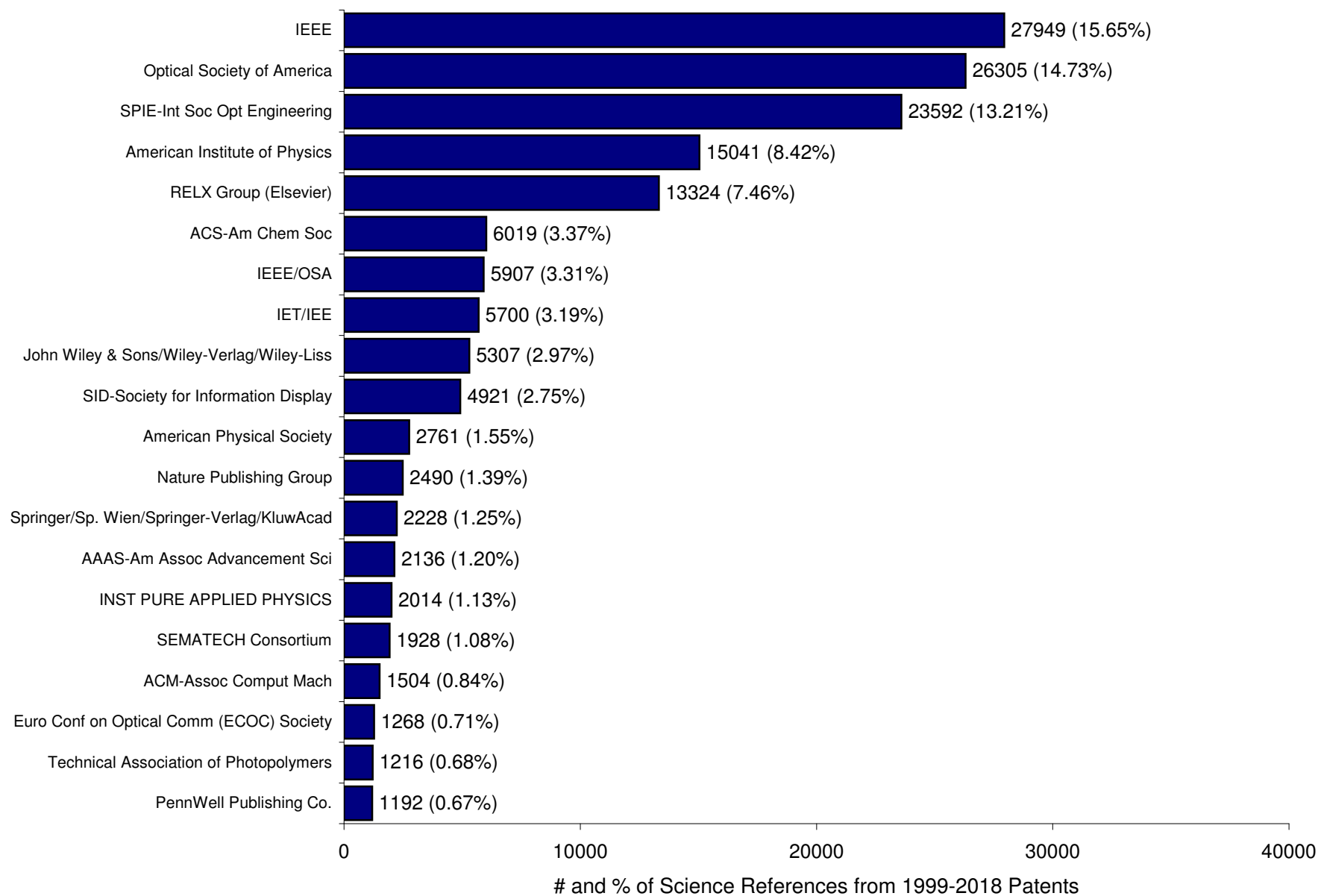
# Figure 12 - # and % of Science References from 1999-2018 Internet-Of-Things (IOT) US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



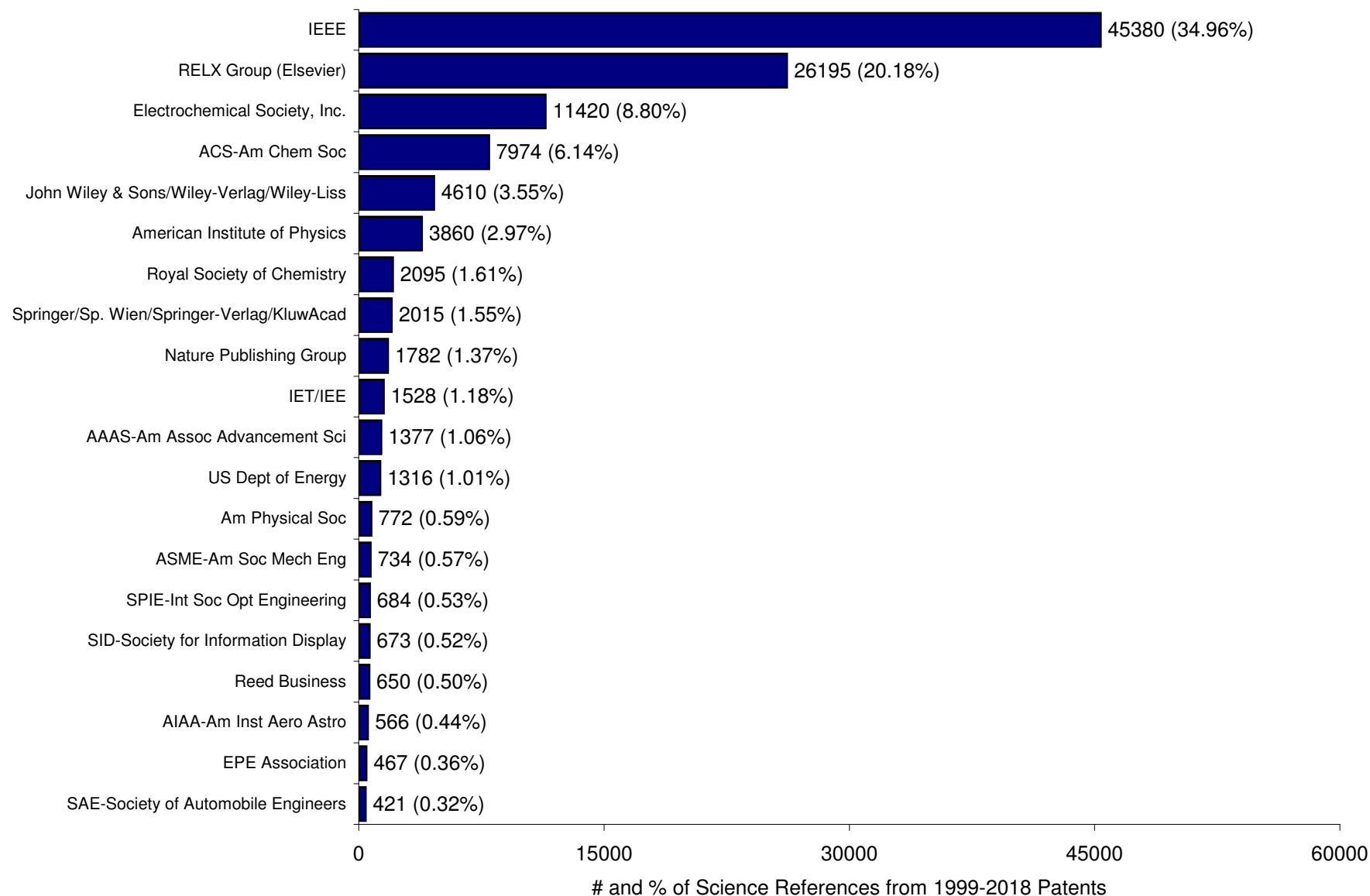
# Figure 13 - # and % of Science References from 1999-2018 Measuring/Testing/Control US Patents to Top 20 Publishers and Conference Organizers



# Figure 14 - # and % of Science References from 1999-2018 Optics US Patents to Top 20 Publishers and Conference Organizers

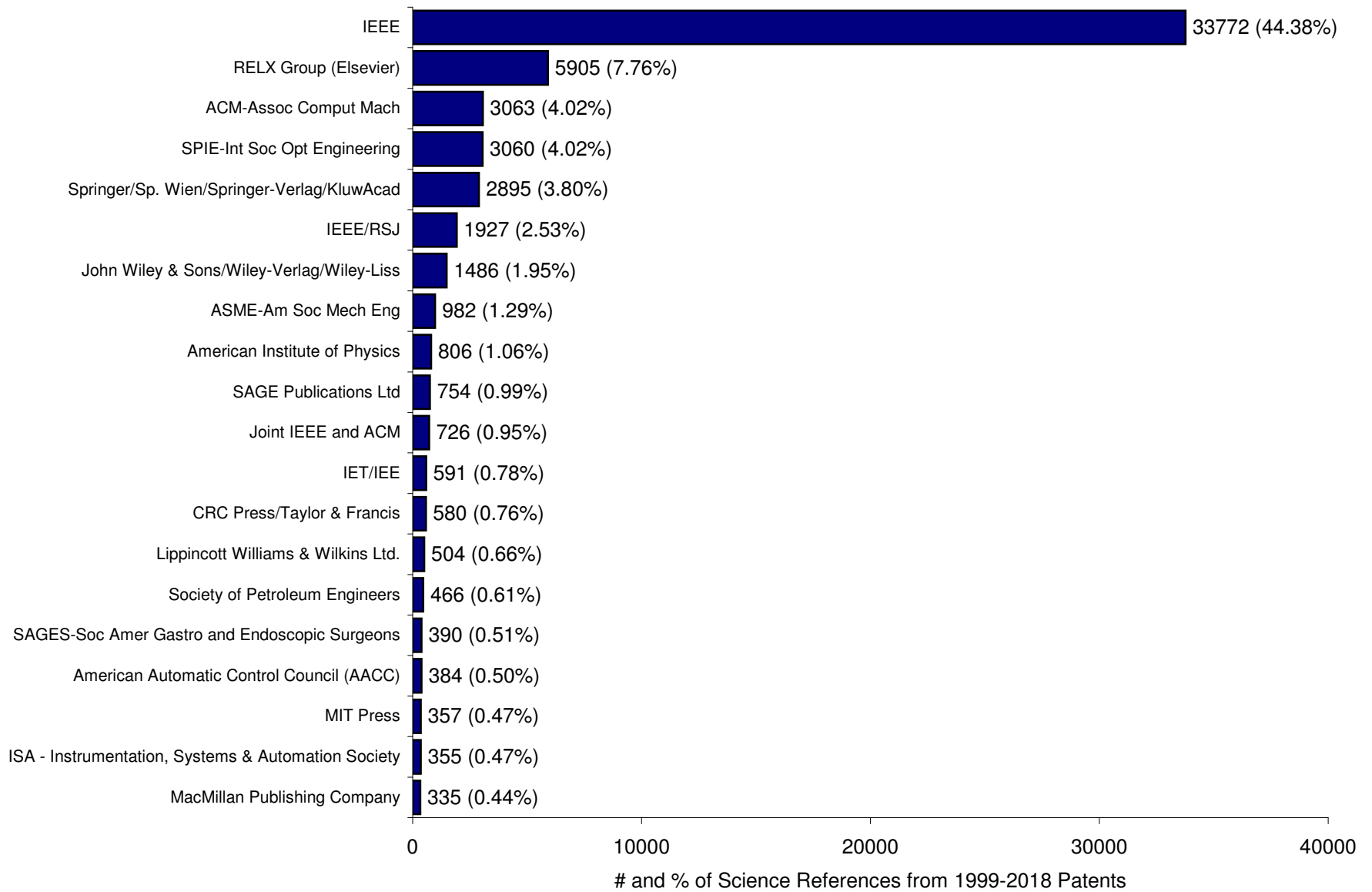


# Figure 15 - # and % of Science References from 1999-2018 Power Systems US Patents to Top 20 Publishers and Conference Organizers

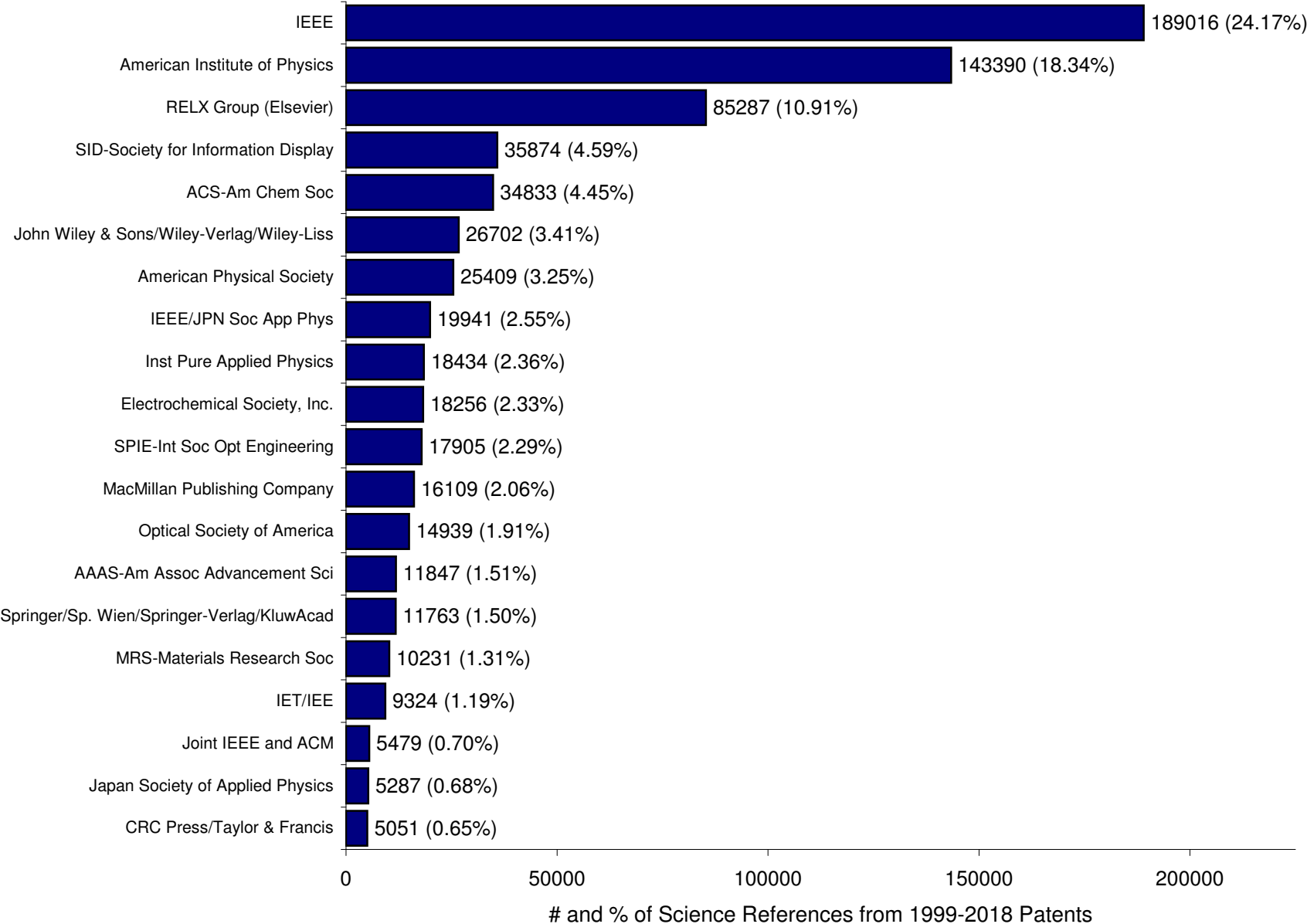




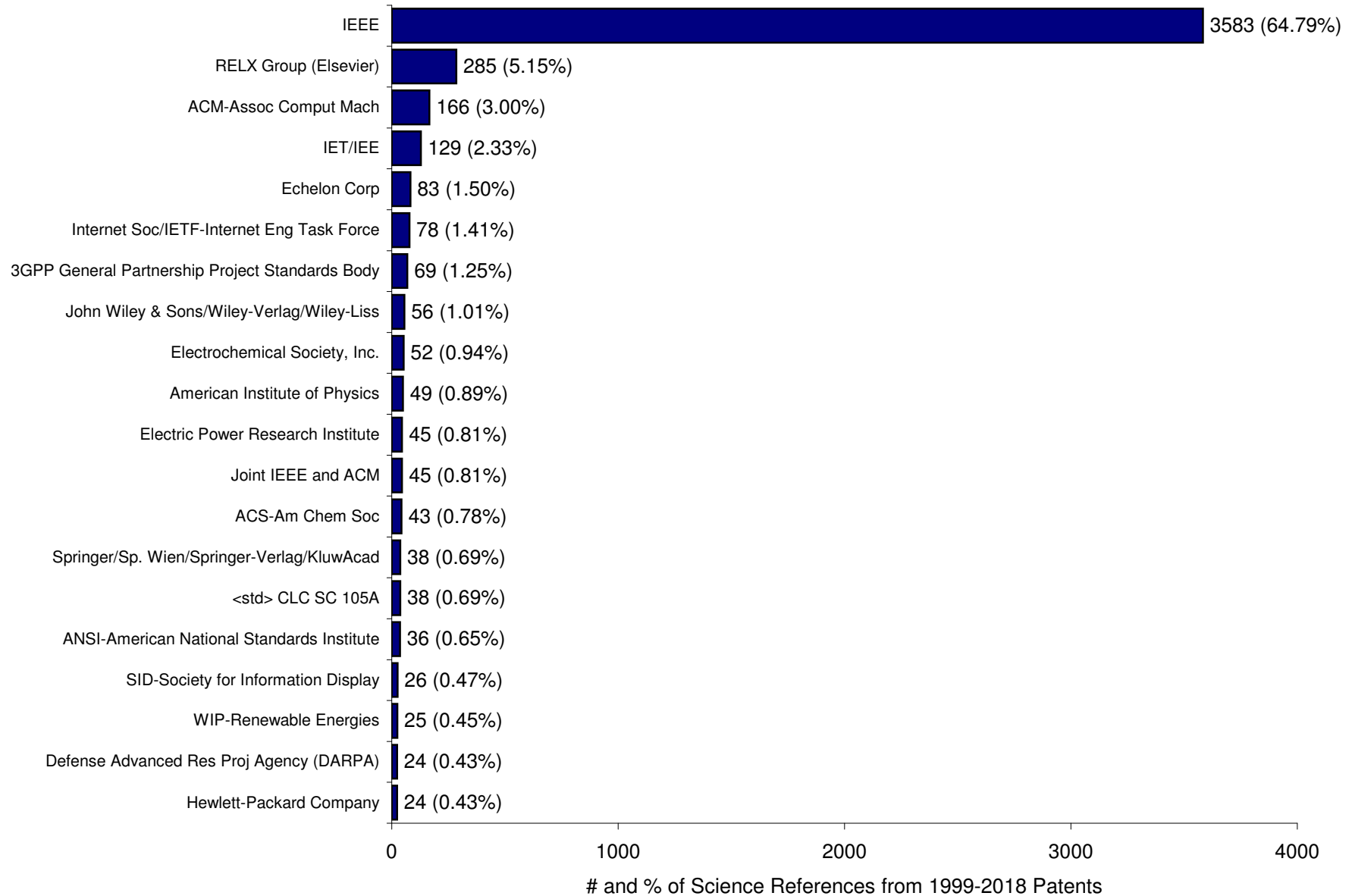
# Figure 16 - # and % of Science References from 1999-2018 Robotics and Intelligent Mfg US Patents to Top 20 Publishers and Conference Organizers



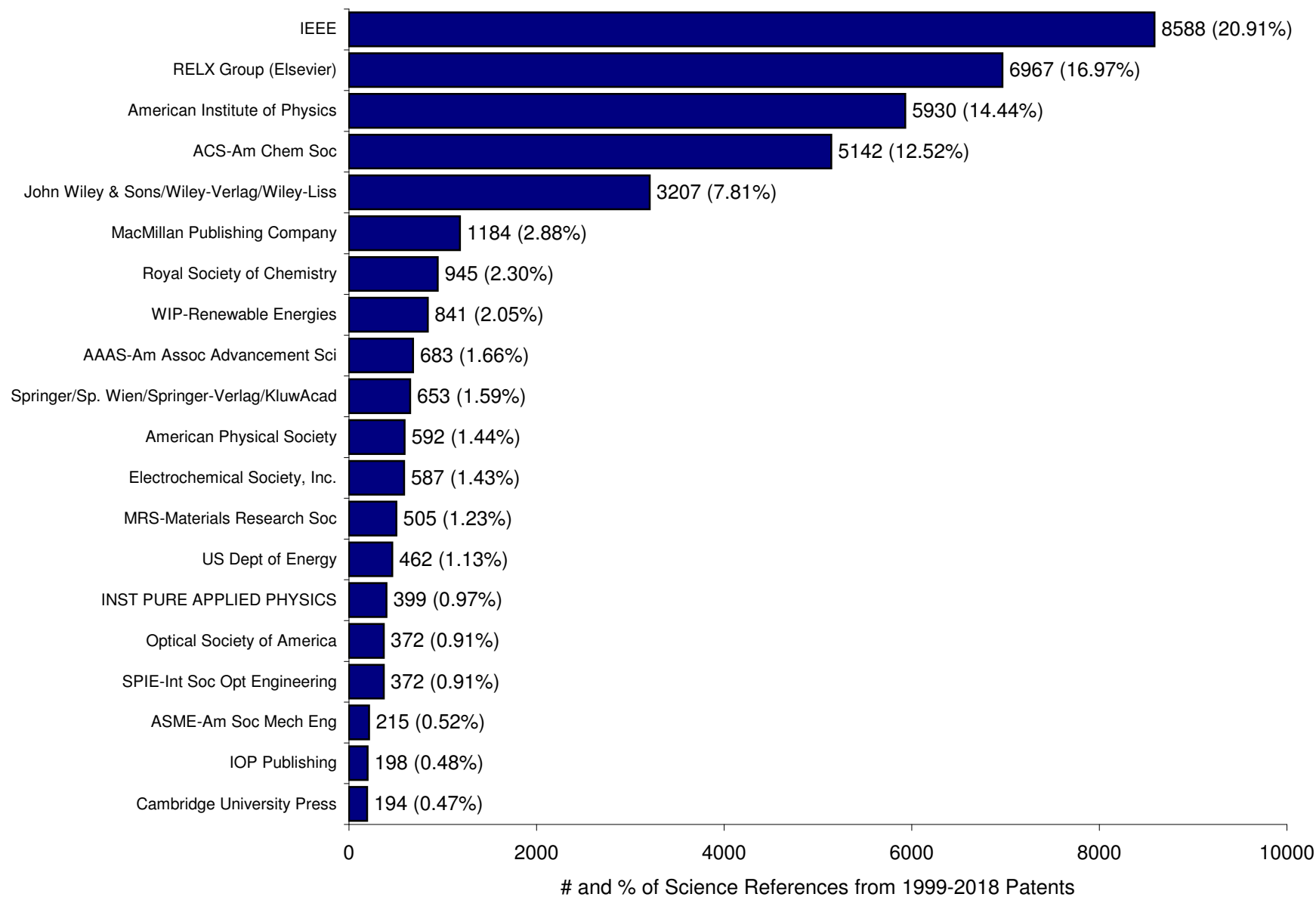
# Figure 17 - # and % of Science References from 1999-2018 Semiconductor US Patents to Top 20 Publishers and Conference Organizers



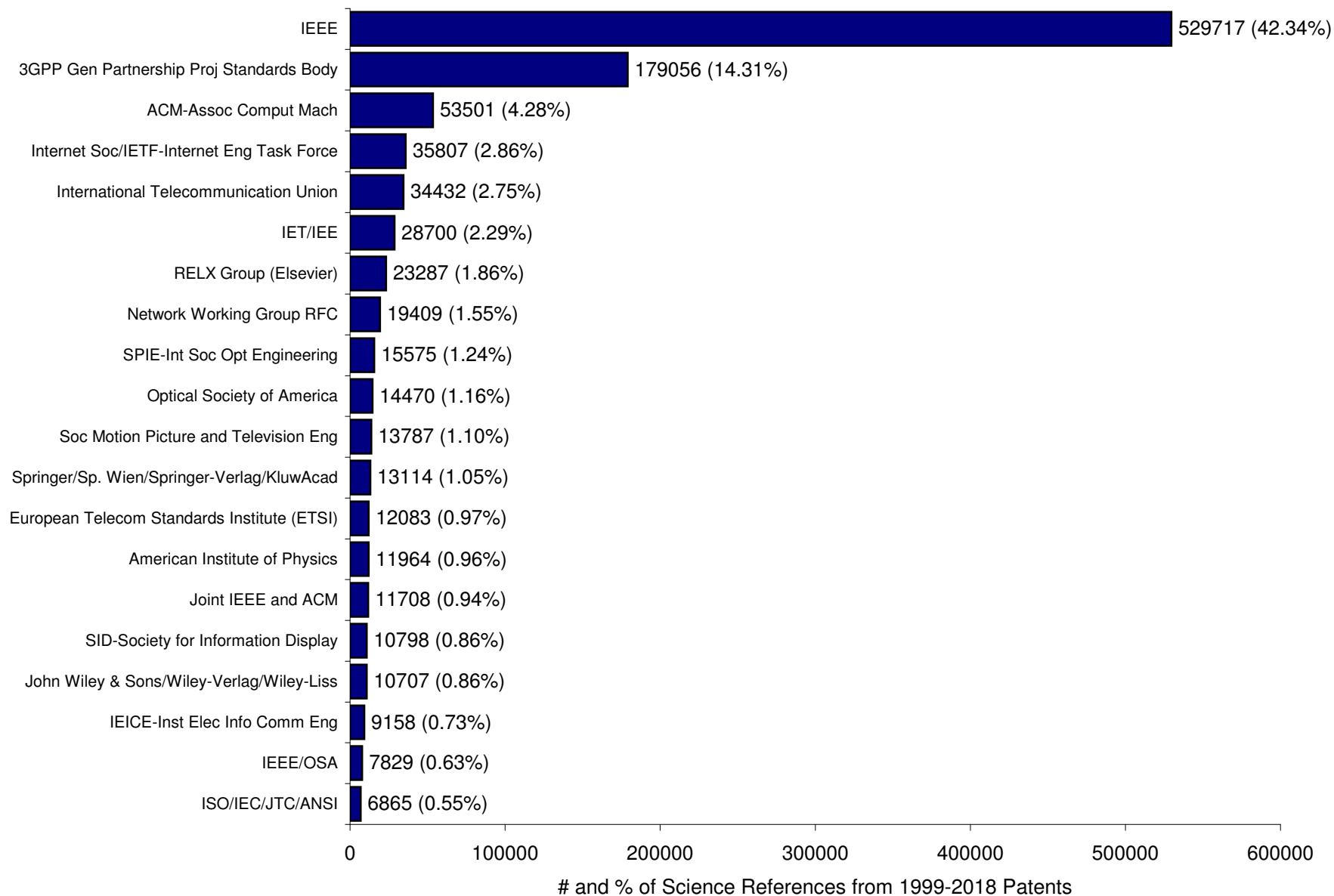
**Figure 18 - # and % of Science References from 1999-2018 Smart Meter/Smart Grid US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations**



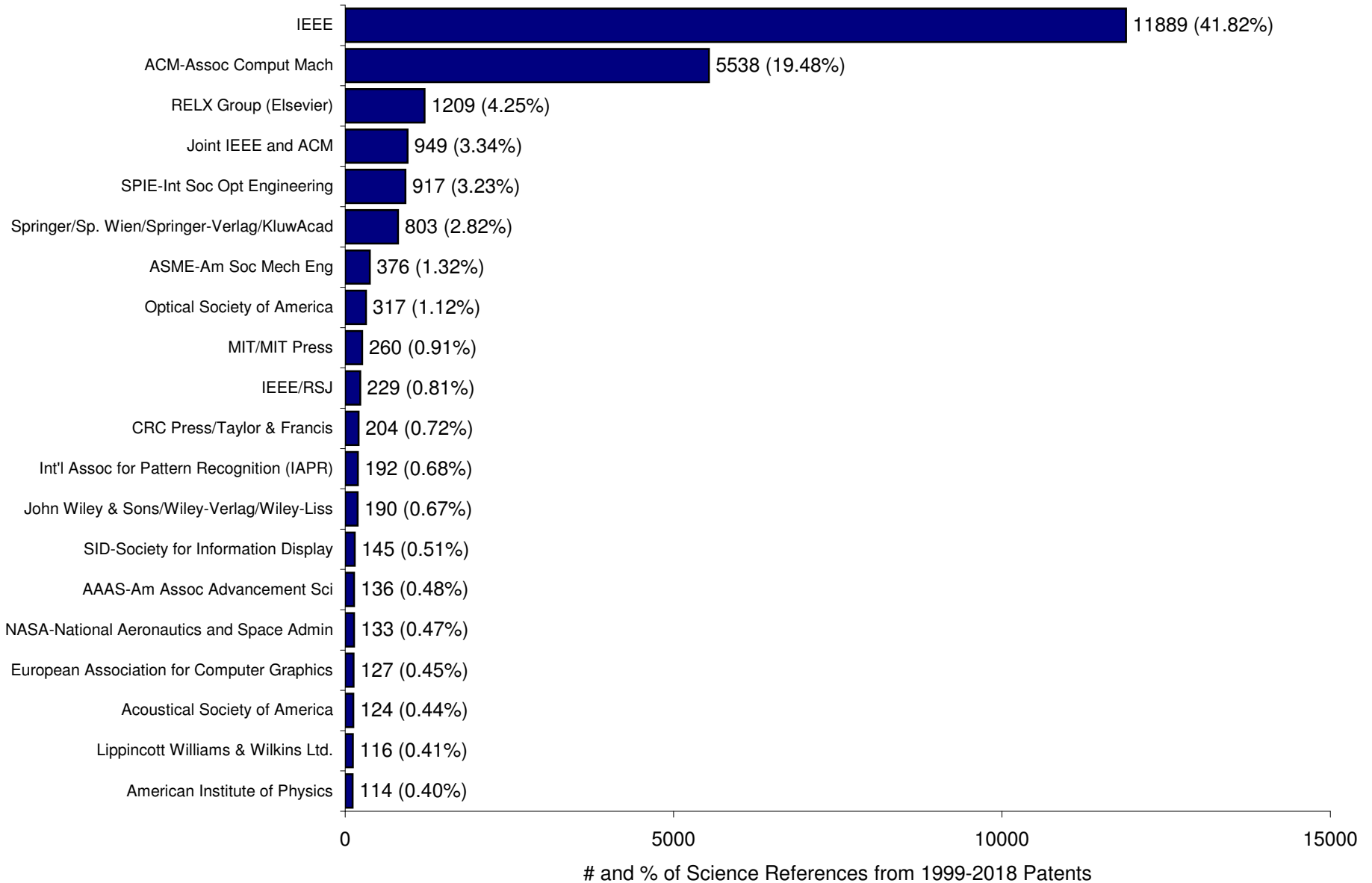
# Figure 19 - # and % of Science References from 1999-2018 Solar/Photovoltaic US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



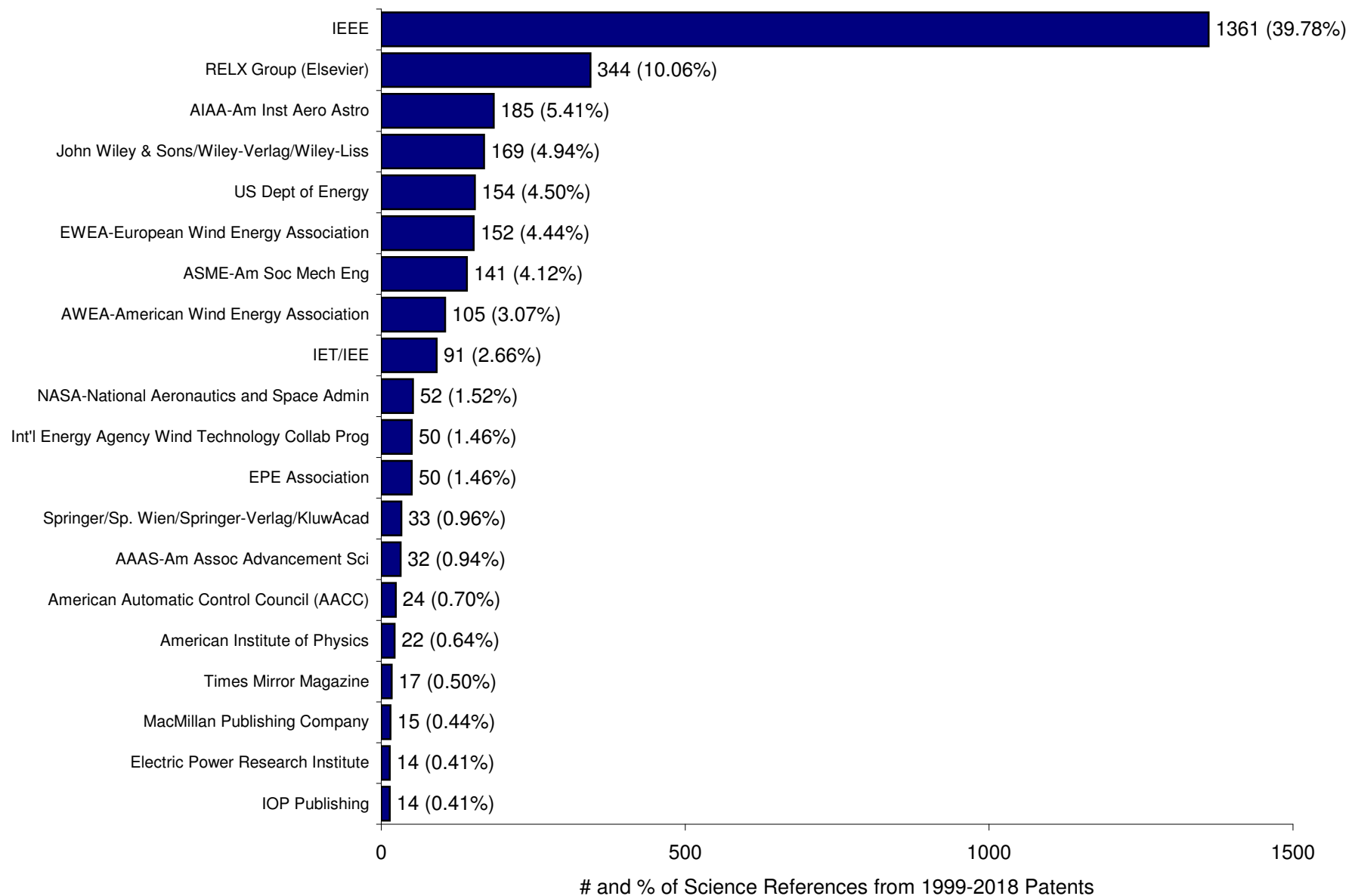
# Figure 20 - # and % of Science References from 1999-2018 Telecommunications US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



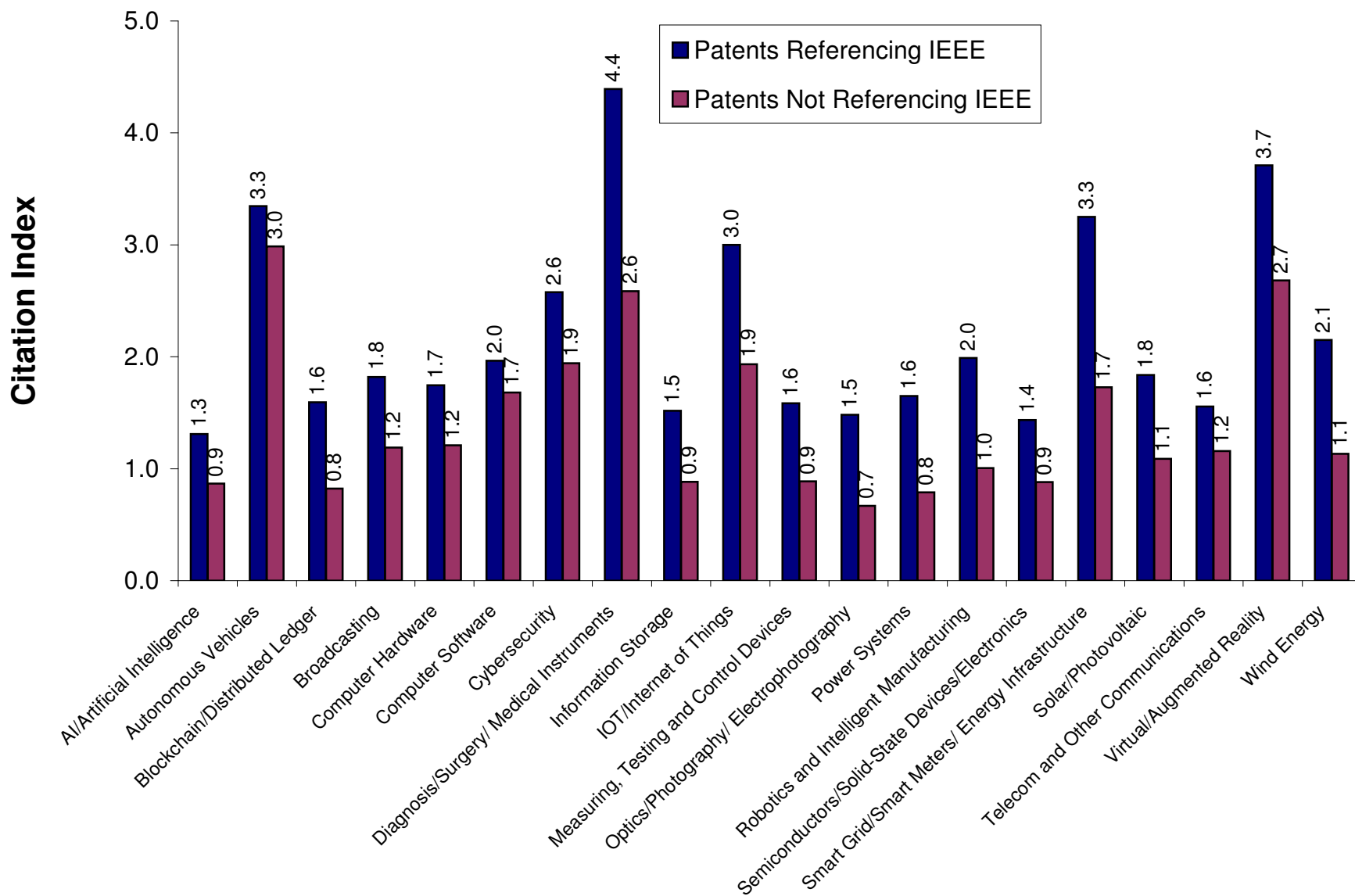
# Figure 21 - # and % of Science References from 1999-2018 Virtual/Augmented Reality US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



# Figure 22 - # and % of Science References from 1999-2018 Wind Energy US Patents to Top 20 Publishers, Conference Organizers, and Standards Organizations



**Figure 23 - 2000-2018 Citation Index of US Patents Referencing IEEE Papers and Conferences Versus US Patents not Referencing IEEE for 20 Categories**





## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>Amazon.com Inc.</b>		
ACM-Assoc Comput Mach	3357	28.2
IEEE	3138	26.4
Internet Soc/IETF-Internet Eng Task Force	594	5.0
RELX Group (Elsevier)	583	4.9
Joint IEEE and ACM	318	2.7
International Data Group	228	1.9
The USENIX Association	215	1.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	202	1.7
Information Processing Society of Japan	201	1.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	187	1.6
Ziff-Davis	181	1.5
New York Times	146	1.2
Network Working Group RFC	136	1.1
SPIE-Int Soc Opt Engineering	115	1.0
192 others with less than 1% each	2300	18.7
<b>Apple Inc</b>		
IEEE	31073	42.0
ACM-Assoc Comput Mach	16416	22.2
RELX Group (Elsevier)	2723	3.7
ISCA (International Speech Communication Association)	1212	1.6
3GPP General Partnership Project Standards Body	1095	1.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1137	1.5
Joint IEEE and ACM	954	1.3
Association for the Advancement of Artificial Intelligence	723	1.0
337 others with less than 1% each	18735	23.6
<b>AT&amp;T Inc</b>		
IEEE	22805	52.2
ACM-Assoc Comput Mach	3692	8.5
RELX Group (Elsevier)	1345	3.1
IET/IEE	1115	2.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	949	2.2
Internet Soc/IETF-Internet Eng Task Force	867	2.0
International Telecommunication Union	656	1.5
Optical Society of America	611	1.4
IEEE/OSA	566	1.3
3GPP General Partnership Project Standards Body	554	1.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	442	1.0
European Telecom Standards Institute (ETSI)	429	1.0
301 others with less than 1% each	9627	19.6

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>BOE Technology Group Ltd</b>		
ACS-Am Chem Soc	52	16.7
RELX Group (Elsevier)	40	12.9
American Institute of Physics	39	12.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	36	11.6
SID-Society for Information Display	24	7.7
IEEE	15	4.8
China Academic Journal Electronic Publishing House	11	3.5
MacMillan Publishing Company	9	2.9
Royal Society of Chemistry	9	2.9
Institute of Pure and Applied Physics	8	2.6
CRC Press/Taylor & Francis	7	2.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	7	2.3
Electrochemical Society, Inc.	5	1.6
Optical Society of America	5	1.6
SPIE-Int Soc Opt Engineering	4	1.3
Chinese Academy of Sciences	4	1.3
APS/OSA/IEEE	4	1.3
ISA - Instrumentation, Systems & Automation Society	3	1.0
Hindawi Publishing Corporation	3	1.0
MRS-Materials Research Soc	3	1.0
American Physical Society	3	1.0
16 others with less than 1% each	20	6.0
<b>Boeing Co. (The)</b>		
IEEE	3448	27.4
RELX Group (Elsevier)	1684	13.4
AIAA-Am Inst Aero Astro	1146	9.1
American Institute of Physics	492	3.9
SPIE-Int Soc Opt Engineering	468	3.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	418	3.3
ACM-Assoc Comput Mach	306	2.4
NASA-National Aeronautics and Space Admin	282	2.2
SAE-Society of Automobile Engineers	266	2.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	244	1.9
ACS-Am Chem Soc	238	1.9
SAGE Publications Ltd	182	1.4
ASME-Am Soc Mech Eng	161	1.3
Optical Society of America	159	1.3
American Physical Society	148	1.2
McGraw Hill	141	1.1
IET/IEE	124	1.0
320 others with less than 1% each	2677	18.1

**Appendix A - Publishers Receiving Most References from Top 50 Companies  
(Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)**

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>Bosch (Robert) GmbH</b>		
IEEE	2429	24.4
RELX Group (Elsevier)	880	8.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	702	7.0
American Diabetes Association	361	3.6
Amer Thoracic Soc	347	3.5
SAE-Society of Automobile Engineers	233	2.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	216	2.2
Electrochemical Society, Inc.	202	2.0
SAGE Publications Ltd	204	2.0
Georg Thieme Verlag	186	1.9
American Medical Informatics Association	193	1.9
Wichtig Publishing	175	1.8
Ziff-Davis	162	1.6
ACS-Am Chem Soc	154	1.5
SPIE-Int Soc Opt Engineering	144	1.4
Assoc Advancement Medical Instrumentation-AAMI	102	1.0
Multidisciplinary Digital Publishing Institute (MDPI)	102	1.0
IET/IEE	100	1.0
Am Diabetese Assoc	97	1.0
Schattauer GmbH	98	1.0
242 others with less than 1% each	2877	28.0
<b>Canon Inc</b>		
IEEE	6311	21.7
American Institute of Physics	3658	12.6
RELX Group (Elsevier)	3637	12.5
ACS-Am Chem Soc	1504	5.2
SPIE-Int Soc Opt Engineering	1519	5.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1489	5.1
ACM-Assoc Comput Mach	925	3.2
Optical Society of America	645	2.2
MacMillan Publishing Company	614	2.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	545	1.9
Institute of Pure and Applied Physics	496	1.7
AAAS-Am Assoc Advancement Sci	409	1.4
Electrochemical Society, Inc.	287	1.0
American Physical Society	295	1.0
International Telecommunication Union	287	1.0
433 others with less than 1% each	6420	18.5

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Cisco Systems Inc.</i></b>		
IEEE	12187	31.0
Internet Soc/IETF-Internet Eng Task Force	6457	16.4
Network Working Group RFC	4423	11.3
ACM-Assoc Comput Mach	4070	10.4
3GPP General Partnership Project Standards Body	2145	5.5
European Telecom Standards Institute (ETSI)	848	2.2
Joint IEEE and ACM	794	2.0
International Telecommunication Union	765	1.9
RELX Group (Elsevier)	611	1.6
259 others with less than 1% each	6970	16.2
<b><i>Dell Technologies Inc</i></b>		
ACM-Assoc Comput Mach	5155	37.3
IEEE	3490	25.3
The USENIX Association	1051	7.6
Internet Soc/IETF-Internet Eng Task Force	765	5.5
Joint IEEE and ACM	525	3.8
RELX Group (Elsevier)	256	1.9
Springer/Sp. Wien/Springer-Verlag/KluwAcad	200	1.4
International Association for Cryptologic Research (IACR)	164	1.2
Network Working Group RFC	136	1.0
199 others with less than 1% each	2073	13.5
<b><i>Denso Corp</i></b>		
IEEE	566	38.5
RELX Group (Elsevier)	161	10.9
American Institute of Physics	95	6.5
SAE-Society of Automobile Engineers	62	4.2
IET/IEE	50	3.4
Institute of Pure and Applied Physics	38	2.6
IEICE-Inst Elec Info Comm Eng	35	2.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	32	2.2
ACM-Assoc Comput Mach	29	2.0
ACS-Am Chem Soc	27	1.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	22	1.5
Trans Tech Publications Ltd.	18	1.2
Electrochemical Society, Inc.	18	1.2
Joint IEEE and ACM	15	1.0
SPIE-Int Soc Opt Engineering	15	1.0
PennWell Publishing Co.	15	1.0
109 others with less than 1% each	274	20.1

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>DowDuPont</i></b>		
RELX Group (Elsevier)	22737	19.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	11523	10.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	10960	9.5
ACS-Am Chem Soc	10578	9.1
American SocIETy for Microbiology	5394	4.7
Natl Acad Sciences	4179	3.6
MacMillan Publishing Company	3991	3.4
American Society of Plant Biologists	3971	3.4
Oxford University Press	3572	3.1
National Institutes of Health - NIH	3511	3.0
American Society for Biochemistry and Molecular Biology Inc.	2768	2.4
AAAS-Am Assoc Advancement Sci	2516	2.2
Crop Science Society of America	1896	1.6
US Dept. Agriculture USDA	1513	1.3
American Institute of Physics	1354	1.2
Blackwell Publishing Inc.	1386	1.2
578 others with less than 1% each	23918	17.3
<b><i>Ericsson</i></b>		
3GPP General Partnership Project Standards Body	14960	35.3
IEEE	13348	31.5
Network Working Group RFC	3290	7.8
Internet Soc/IETF-Internet Eng Task Force	2412	5.7
Optical Society of America	895	2.1
ACM-Assoc Comput Mach	866	2.0
European Telecom Standards Institute (ETSI)	751	1.8
International Telecommunication Union	724	1.7
IET/IEE	592	1.4
261 others with less than 1% each	4489	8.7
<b><i>Ford Motor Co.</i></b>		
SAE-Society of Automobile Engineers	2233	34.4
IEEE	1381	21.2
RELX Group (Elsevier)	712	11.0
IP.Com	322	5.0
American Automatic Control Council (AACC)	171	2.6
ACS-Am Chem Soc	135	2.1
ACM-Assoc Comput Mach	113	1.7
Society of Automotive Engineers of Japan, Inc. (JSAE)	93	1.4
IEEE/RSJ	92	1.4
ASME-Am Soc Mech Eng	83	1.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	73	1.1
IET/IEE	62	1.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	62	1.0
171 others with less than 1% each	967	12.9

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Fuji Film Holdings Corp</i></b>		
IEEE	2013	14.5
RELX Group (Elsevier)	1685	12.1
ACM-Assoc Comput Mach	1281	9.2
ACS-Am Chem Soc	1053	7.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	791	5.7
SPIE-Int Soc Opt Engineering	686	4.9
American Institute of Physics	658	4.7
MacMillan Publishing Company	533	3.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	347	2.5
Optical Society of America	237	1.7
AAAS-Am Assoc Advancement Sci	230	1.7
Cell Press	178	1.3
Natl Acad Sciences	187	1.3
Oxford University Press	156	1.1
Institute of Pure and Applied Physics	151	1.1
IEICE-Inst Elec Info Comm Eng	145	1.0
405 others with less than 1% each	3583	22.0
<b><i>Fujitsu Limited</i></b>		
IEEE	10030	38.3
3GPP General Partnership Project Standards Body	2694	10.3
Joint IEEE and ACM	1071	4.1
ACM-Assoc Comput Mach	1041	4.0
Optical Society of America	1026	3.9
IEICE-Inst Elec Info Comm Eng	1008	3.8
American Institute of Physics	994	3.8
RELX Group (Elsevier)	839	3.2
IET/IEE	589	2.2
IEEE/OSA	559	2.1
European Conference on Optical Communication (ECOC) Society	487	1.9
Internet Soc/IETF-Internet Eng Task Force	384	1.5
IEEE/JPN Soc App Phys	403	1.5
International Telecommunication Union	367	1.4
ATM Forum Standards Body	309	1.2
SPIE-Int Soc Opt Engineering	258	1.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	275	1.0
345 others with less than 1% each	3874	11.5

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>General Electric Company</b>		
US Dept of Energy	10577	17.7
IEEE	8148	13.6
RELX Group (Elsevier)	8053	13.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3966	6.6
Society of Petroleum Engineers	3793	6.3
General Electric Co.	3428	5.7
ACS-Am Chem Soc	2547	4.3
American Institute of Physics	1548	2.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1390	2.3
MacMillan Publishing Company	694	1.2
SPIE-Int Soc Opt Engineering	723	1.2
Lippincott Williams & Wilkins Ltd.	662	1.1
ASME-Am Soc Mech Eng	619	1.0
American Physical Society	591	1.0
736 others with less than 1% each	13093	17.5
<b>General Motors Corp</b>		
IEEE	1464	22.0
RELX Group (Elsevier)	1328	20.0
SAE-Society of Automobile Engineers	801	12.0
ACS-Am Chem Soc	476	7.2
Electrochemical Society, Inc.	415	6.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	270	4.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	176	2.6
Royal Society of Chemistry	147	2.2
ASME-Am Soc Mech Eng	141	2.1
American Institute of Physics	119	1.8
Optical Society of America	97	1.5
MacMillan Publishing Company	74	1.1
American Automatic Control Council (AACC)	66	1.0
177 others with less than 1% each	1078	14.0
<b>Google Inc.</b>		
IEEE	16581	34.3
ACM-Assoc Comput Mach	11119	23.0
RELX Group (Elsevier)	2206	4.6
SPIE-Int Soc Opt Engineering	1359	2.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1317	2.7
International Telecommunication Union	1208	2.5
3GPP General Partnership Project Standards Body	1017	2.1
World Wide Web Consortium	794	1.6
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	710	1.5
ACL - Association for Computational Linguistics	688	1.4
Joint IEEE and ACM	618	1.3
Internet Soc/IETF-Internet Eng Task Force	513	1.1
360 others with less than 1% each	10162	19.2

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Halliburton Co. (Holding)</i></b>		
Society of Petroleum Engineers	2991	35.6
SPWLA-Society of Petrophysicists and Well Log Analysts	662	7.9
RELX Group (Elsevier)	645	7.7
IEEE	540	6.4
Society of Exploration Geophysicists	321	3.8
ACS-Am Chem Soc	264	3.1
SPIE-Int Soc Opt Engineering	228	2.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	164	2.0
Optical Society of America	161	1.9
soc of Exploration Geophysicists	149	1.8
American Institute of Mining and Metallurgical Engineers	154	1.8
ACM-Assoc Comput Mach	153	1.8
Society of Petroleum Engineers, Inc.	148	1.8
SAGE Publications Ltd	139	1.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	139	1.7
American Institute of Physics	130	1.5
Gulf Publishing Co.	101	1.2
Oilfield Reviews Services	100	1.2
Pennwell Pub	94	1.1
138 others with less than 1% each	1121	12.1
<b><i>Hitachi Ltd</i></b>		
IEEE	5631	25.2
RELX Group (Elsevier)	1569	7.0
ACM-Assoc Comput Mach	1471	6.6
American Institute of Physics	1360	6.1
IEICE-Inst Elec Info Comm Eng	816	3.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	644	2.9
Internet Soc/IETF-Internet Eng Task Force	618	2.8
ACS-Am Chem Soc	529	2.4
The USENIX Association	416	1.9
Network Working Group RFC	369	1.7
Institute of Pure and Applied Physics	386	1.7
International Telecommunication Union	362	1.6
SPIE-Int Soc Opt Engineering	302	1.4
Nikkei Business Publications, Inc.	318	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	282	1.3
MacMillan Publishing Company	288	1.3
SID-Society for Information Display	269	1.2
IEEE/JPN Soc App Phys	239	1.1
IET/IEE	240	1.1
3GPP General Partnership Project Standards Body	255	1.1
IBM Corp.	235	1.1
Joint IEEE and ACM	239	1.1
Optical Society of America	221	1.0
American Physical Society	227	1.0
451 others with less than 1% each	5053	18.5



**Appendix A - Publishers Receiving Most References from Top 50 Companies  
(Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)**

*Publisher*

*# Pat Refs to: Percent of Total*

**Hon Hai Precision Industry Co. Ltd.(also known as Foxconn)**

3GPP General Partnership Project Standards Body	4721	21.0
IEEE	4507	20.1
American Institute of Physics	1518	6.8
SID-Society for Information Display	1399	6.2
RELX Group (Elsevier)	1077	4.8
ACM-Assoc Comput Mach	1004	4.5
ACS-Am Chem Soc	818	3.6
International Telecommunication Union	645	2.9
SPIE-Int Soc Opt Engineering	523	2.3
ISO/IEC/JTC	501	2.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	471	2.1
AAAS-Am Assoc Advancement Sci	469	2.1
MacMillan Publishing Company	364	1.6
Institute of Pure and Applied Physics	338	1.5
American Physical Society	307	1.4
IEICE-Inst Elec Info Comm Eng	285	1.3
Internet Soc/IETF-Internet Eng Task Force	276	1.2
274 others with less than 1% each	3213	11.5

**Honda Motor Co. Ltd.(Honda Giken Kogyo KK)**

IEEE	1864	41.7
RELX Group (Elsevier)	626	14.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	212	4.7
ACM-Assoc Comput Mach	165	3.7
IEEE/RSJ	165	3.7
ASME-Am Soc Mech Eng	136	3.0
ACS-Am Chem Soc	135	3.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	61	1.4
AAAS-Am Assoc Advancement Sci	57	1.3
SAGE Publications Ltd	47	1.1
MacMillan Publishing Company	48	1.1
CRC Press/Taylor & Francis	45	1.0
American Institute of Physics	43	1.0
181 others with less than 1% each	870	16.8

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Honeywell International Inc.</i></b>		
IEEE	7942	30.3
RELX Group (Elsevier)	3885	14.8
ACS-Am Chem Soc	1974	7.5
SPIE-Int Soc Opt Engineering	1331	5.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	927	3.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	828	3.2
American Institute of Physics	735	2.8
Optical Society of America	473	1.8
ACM-Assoc Comput Mach	424	1.6
Royal Society of Chemistry	367	1.4
SAE-Society of Automobile Engineers	324	1.2
IET/IEEE	268	1.0
436 others with less than 1% each	6697	21.8
<b><i>Huawei Technologies Company Ltd.</i></b>		
3GPP General Partnership Project Standards Body	10827	39.2
IEEE	7347	26.6
International Telecommunication Union	2292	8.3
Internet Soc/IETF-Internet Eng Task Force	2039	7.4
Network Working Group RFC	1386	5.0
ACM-Assoc Comput Mach	460	1.7
Open Mobile Alliance (Standards Org)	394	1.4
European Telecom Standards Institute (ETSI)	370	1.3
190 others with less than 1% each	2505	7.7
<b><i>Hyundai Motor Co.</i></b>		
RELX Group (Elsevier)	128	29.7
IEEE	119	27.6
ACS-Am Chem Soc	32	7.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	20	4.6
SAE-Society of Automobile Engineers	16	3.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	14	3.2
ACM-Assoc Comput Mach	12	2.8
American Automatic Control Council (AACC)	10	2.3
Electrochemical Society, Inc.	9	2.1
Royal Society of Chemistry	9	2.1
American Institute of Physics	8	1.9
IET/IEEE	5	1.2
35 others with less than 1% each	49	10.6

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Infineon Technologies AG</i></b>		
IEEE	5805	56.9
American Institute of Physics	878	8.6
RELX Group (Elsevier)	543	5.3
IEEE/JPN Soc App Phys	383	3.8
IET/IEE	179	1.8
SPIE-Int Soc Opt Engineering	186	1.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	139	1.4
Joint IEEE and ACM	118	1.2
Institute of Pure and Applied Physics	120	1.2
ACS-Am Chem Soc	125	1.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	112	1.1
Electrochemical Society, Inc.	104	1.0
186 others with less than 1% each	1515	12.5
<b><i>Intel Corporation</i></b>		
IEEE	31308	47.2
3GPP General Partnership Project Standards Body	6386	9.6
ACM-Assoc Comput Mach	4887	7.4
Joint IEEE and ACM	3827	5.8
RELX Group (Elsevier)	1601	2.4
American Institute of Physics	1520	2.3
IET/IEE	1106	1.7
IEEE/JPN Soc App Phys	780	1.2
Internet Soc/IETF-Internet Eng Task Force	734	1.1
SPIE-Int Soc Opt Engineering	661	1.0
424 others with less than 1% each	13468	17.3
<b><i>International Business Machines Corp</i></b>		
IEEE	54707	33.0
ACM-Assoc Comput Mach	29514	17.8
Joint IEEE and ACM	8879	5.4
RELX Group (Elsevier)	7109	4.3
Internet Soc/IETF-Internet Eng Task Force	5436	3.3
American Institute of Physics	4944	3.0
IP.Com	4623	2.8
IBM Corp.	3706	2.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	2987	1.8
ACS-Am Chem Soc	2775	1.7
The USENIX Association	2568	1.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2160	1.3
SPIE-Int Soc Opt Engineering	2015	1.2
Very Large Data Base Endowment Inc. (VLDB Endowment)	1779	1.1
778 others with less than 1% each	32537	15.9

**Appendix A - Publishers Receiving Most References from Top 50 Companies  
(Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)**

*Publisher*

*# Pat Refs to: Percent of Total*

**Johnson & Johnson**

RELX Group (Elsevier)	8277	19.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3920	9.4
Lippincott Williams & Wilkins Ltd.	3534	8.5
Springer/Sp. Wien/Springer-Verlag/KluwAcad	3019	7.2
IEEE	2105	5.0
Mosby Inc.	1384	3.3
ACS-Am Chem Soc	898	2.1
Association for Research in Vision and Ophthalmology	852	2.0
Optical Society of America	803	1.9
MacMillan Publishing Company	703	1.7
Journal Bone Joint Surgery Inc.	714	1.7
Blackwell Publishing Inc.	642	1.5
SPIE-Int Soc Opt Engineering	607	1.5
ASTM International	559	1.3
SAGE Publications Ltd	442	1.1
Wolters Kluwer	418	1.0
CRC Press/Taylor & Francis	414	1.0
Mary Ann Liebert Inc.	399	1.0
American Institute of Physics	429	1.0
432 others with less than 1% each	11686	25.8

**Koninklijke Philips N.V.**

IEEE	6860	27.0
RELX Group (Elsevier)	2638	10.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1879	7.4
Lippincott Williams & Wilkins Ltd.	1564	6.1
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1348	5.3
SPIE-Int Soc Opt Engineering	1156	4.5
American Institute of Physics	776	3.0
ACM-Assoc Comput Mach	522	2.1
Society of Magnetic Resonance in Medicine (SMRM)	510	2.0
Optical Society of America	435	1.7
American Medical Informatics Association	308	1.2
SAGE Publications Ltd	283	1.1
3GPP General Partnership Project Standards Body	292	1.1
IOP Publishing	244	1.0
Radiological Society of North America	250	1.0
American Physiological Society	248	1.0
468 others with less than 1% each	6137	21.3

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Kyocera Corp.</i></b>		
IEEE	1202	34.6
3GPP General Partnership Project Standards Body	1145	33.0
RELX Group (Elsevier)	188	5.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	111	3.2
Electrochemical Society, Inc.	101	2.9
American Institute of Physics	61	1.8
IET/IEE	52	1.5
ACS-Am Chem Soc	49	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	47	1.4
ACM-Assoc Comput Mach	41	1.2
European Microwave Association	37	1.1
IEICE-Inst Elec Info Comm Eng	39	1.1
Penton Media	36	1.0
104 others with less than 1% each	365	9.7
<b><i>LG Electronics Inc.</i></b>		
3GPP General Partnership Project Standards Body	20590	51.7
IEEE	8681	21.8
ISO/IEC/JTC/ANSI	1546	3.9
International Telecommunication Union	1174	2.9
ATSC Std	1160	2.9
European Telecom Standards Institute (ETSI)	1039	2.6
Audio Eng Soc	817	2.1
ISO-International Standards Organization	453	1.1
170 others with less than 1% each	4379	10.1
<b><i>Medtronic Inc</i></b>		
RELX Group (Elsevier)	24188	17.3
Lippincott Williams & Wilkins Ltd.	16265	11.6
IEEE	11220	8.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	10098	7.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	9285	6.6
American Physiological Society	3513	2.5
American Association of Neurological Surgeons	3240	2.3
Blackwell Publishing Inc.	3016	2.2
Oxford University Press	3024	2.2
Radiological Society of North America	2448	1.8
ACS-Am Chem Soc	2524	1.8
Mosby Inc.	2132	1.5
SPIE-Int Soc Opt Engineering	1865	1.3
Wolters Kluwer	1816	1.3
International Federation of Gynecology and Obstetrics (FIGO)	1664	1.2
S. Karger AG	1509	1.1
569 others with less than 1% each	42034	27.1

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Micron Technology Inc.</i></b>		
IEEE	43042	33.4
RELX Group (Elsevier)	20937	16.2
American Institute of Physics	14960	11.6
IEEE/JPN Soc App Phys	5631	4.4
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5158	4.0
ACS-Am Chem Soc	3416	2.6
Electrochemical Society, Inc.	3263	2.5
Institute of Pure and Applied Physics	3007	2.3
American Physical Society	2796	2.2
MRS-Materials Research Soc	2051	1.6
SPIE-Int Soc Opt Engineering	2107	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1627	1.3
CRC Press/Taylor & Francis	1389	1.1
IOP Publishing	1266	1.0
263 others with less than 1% each	18281	13.5
<b><i>Microsoft Corporation</i></b>		
IEEE	62466	34.5
ACM-Assoc Comput Mach	50648	28.0
RELX Group (Elsevier)	5794	3.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	4077	2.3
Joint IEEE and ACM	4007	2.2
The USENIX Association	3920	2.2
Internet Soc/IETF-Internet Eng Task Force	3013	1.7
International Telecommunication Union	2476	1.4
SPIE-Int Soc Opt Engineering	2324	1.3
621 others with less than 1% each	42140	19.5
<b><i>Mitsubishi Electric Corp</i></b>		
IEEE	5580	45.3
3GPP General Partnership Project Standards Body	1079	8.8
ACM-Assoc Comput Mach	859	7.0
IEICE-Inst Elec Info Comm Eng	456	3.7
RELX Group (Elsevier)	419	3.4
IET/IEE	317	2.6
American Institute of Physics	302	2.4
SPIE-Int Soc Opt Engineering	204	1.7
International Association for Cryptologic Research (IACR)	204	1.7
International Telecommunication Union	213	1.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	184	1.5
IEEE/JPN Soc App Phys	175	1.4
Institute of Pure and Applied Physics	120	1.0
243 others with less than 1% each	2216	15.7

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>Panasonic Corporation</b>		
IEEE	10062	31.7
3GPP General Partnership Project Standards Body	4485	14.1
RELX Group (Elsevier)	1944	6.1
IEICE-Inst Elec Info Comm Eng	1567	4.9
International Telecommunication Union	1505	4.7
American Institute of Physics	1314	4.1
Institute of Pure and Applied Physics	929	2.9
Internet Soc/IETF-Internet Eng Task Force	575	1.8
Electrochemical Society, Inc.	479	1.5
ACM-Assoc Comput Mach	491	1.5
ACS-Am Chem Soc	447	1.4
SPIE-Int Soc Opt Engineering	416	1.3
IET/IEE	370	1.2
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	356	1.1
ISO/IEC/JTC/ANSI	348	1.1
Japan Society of Applied Physics	310	1.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	310	1.0
389 others with less than 1% each	5796	15.8
<b>Qualcomm Inc</b>		
IEEE	37863	43.0
3GPP General Partnership Project Standards Body	15977	18.1
International Telecommunication Union	6695	7.6
ISO/IEC/JTC/ANSI	2244	2.5
SID-Society for Information Display	1807	2.1
ACM-Assoc Comput Mach	1794	2.0
Internet Soc/IETF-Internet Eng Task Force	1766	2.0
RELX Group (Elsevier)	1694	1.9
SPIE-Int Soc Opt Engineering	1328	1.5
American Institute of Physics	1028	1.2
IET/IEE	1029	1.2
European Telecom Standards Institute (ETSI)	1068	1.2
Network Working Group RFC	907	1.0
Springer/Sp. Wien/Springer-Verlag/KluwAcad	858	1.0
360 others with less than 1% each	11997	11.1

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Ricoh Co. Ltd.</i></b>		
IEEE	5197	43.9
ACM-Assoc Comput Mach	1801	15.2
SPIE-Int Soc Opt Engineering	870	7.4
RELX Group (Elsevier)	626	5.3
International Association for Pattern Recognition (IAPR)	514	4.3
Springer/Sp. Wien/Springer-Verlag/KluwAcad	333	2.8
American Institute of Physics	200	1.7
IEICE-Inst Elec Info Comm Eng	137	1.2
ISO-International Standards Organization	144	1.2
Optical Society of America	118	1.0
182 others with less than 1% each	1888	15.2
<b><i>Samsung Electronics Co Ltd</i></b>		
IEEE	14557	30.2
3GPP General Partnership Project Standards Body	8401	17.4
RELX Group (Elsevier)	2753	5.7
ACS-Am Chem Soc	2403	5.0
American Institute of Physics	2244	4.7
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1588	3.3
International Telecommunication Union	1257	2.6
ACM-Assoc Comput Mach	1264	2.6
SID-Society for Information Display	977	2.0
SPIE-Int Soc Opt Engineering	711	1.5
MacMillan Publishing Company	712	1.5
Audio Eng Soc	564	1.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	582	1.2
American Physical Society	483	1.0
502 others with less than 1% each	9718	16.8
<b><i>Samsung SDI Co Ltd</i></b>		
American Institute of Physics	1715	21.4
RELX Group (Elsevier)	1658	20.7
ACS-Am Chem Soc	1036	12.9
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	694	8.6
SID-Society for Information Display	461	5.7
IEEE	314	3.9
Royal Society of Chemistry	213	2.7
Electrochemical Society, Inc.	204	2.5
Institute of Pure and Applied Physics	158	2.0
MacMillan Publishing Company	150	1.9
IEC-International Electrotechnical Commission	152	1.9
American Physical Society	132	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	124	1.5
J. Van Voorst	104	1.3
129 others with less than 1% each	913	9.4



**Appendix A - Publishers Receiving Most References from Top 50 Companies  
(Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)**

*Publisher*

*# Pat Refs to: Percent of Total*

**Seiko Epson Corporation**

IEEE	2968	33.9
ACM-Assoc Comput Mach	677	7.7
Joint IEEE and ACM	640	7.3
American Institute of Physics	609	7.0
RELX Group (Elsevier)	605	6.9
SID-Society for Information Display	460	5.3
ACS-Am Chem Soc	267	3.1
IEEE/JPN Soc App Phys	181	2.1
Institute of Pure and Applied Physics	154	1.8
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	155	1.8
IBM Corp.	148	1.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	137	1.6
SPIE-Int Soc Opt Engineering	122	1.4
American Physical Society	96	1.1
IEICE-Inst Elec Info Comm Eng	100	1.1
Optical Society of America	90	1.0
196 others with less than 1% each	1336	13.0

**Semiconductor Energy Laboratory Co. Ltd.**

SID-Society for Information Display	50635	30.6
American Institute of Physics	30641	18.5
IEEE	16164	9.8
American Physical Society	13151	7.9
RELX Group (Elsevier)	11684	7.1
IEEE/JPN Soc App Phys	7319	4.4
MacMillan Publishing Company	4357	2.6
Electrochemical Society, Inc.	4151	2.5
CRC Press/Taylor & Francis	3818	2.3
Institute of Pure and Applied Physics	3460	2.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2885	1.7
Japan Society of Applied Physics	2830	1.7
Korean Information Display Society (KIDS)	2080	1.3
AAAS-Am Assoc Advancement Sci	2000	1.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	1979	1.2
Nirim.org	1845	1.1
North-Holland Publ Co	1857	1.1
Oldenbourg Verlag	1841	1.1
91 others with less than 1% each	2807	1.3

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b>Siemens Aktiengesellschaft</b>		
IEEE	12738	35.9
RELX Group (Elsevier)	3723	10.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2567	7.2
SPIE-Int Soc Opt Engineering	1541	4.3
Joint IEEE and ACM	1125	3.2
Springer/Sp. Wien/Springer-Verlag/KluwAcad	877	2.5
ACM-Assoc Comput Mach	862	2.4
American Institute of Physics	815	2.3
ACS-Am Chem Soc	436	1.2
Society of Magnetic Resonance in Medicine (SMRM)	414	1.2
Radiological Society of North America	390	1.1
Lippincott Williams & Wilkins Ltd.	359	1.0
615 others with less than 1% each	9636	22.9
<b>Sony Corp</b>		
IEEE	12490	42.5
ACM-Assoc Comput Mach	2479	8.4
3GPP General Partnership Project Standards Body	1558	5.3
RELX Group (Elsevier)	1335	4.5
International Telecommunication Union	934	3.2
SPIE-Int Soc Opt Engineering	770	2.6
American Institute of Physics	607	2.1
Internet Soc/IETF-Internet Eng Task Force	431	1.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	404	1.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	397	1.4
IEICE-Inst Elec Info Comm Eng	393	1.3
Joint IEEE and ACM	368	1.3
European Telecom Standards Institute (ETSI)	365	1.2
ACS-Am Chem Soc	354	1.2
IET/IEE	310	1.1
408 others with less than 1% each	6160	17.7
<b>Taiwan Semiconductor Manufacturing Co.</b>		
IEEE	8987	36.8
American Institute of Physics	6937	28.4
RELX Group (Elsevier)	2193	9.0
Electrochemical Society, Inc.	838	3.4
IEEE/JPN Soc App Phys	800	3.3
Institute of Pure and Applied Physics	598	2.5
SPIE-Int Soc Opt Engineering	555	2.3
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	433	1.8
Springer/Sp. Wien/Springer-Verlag/KluwAcad	330	1.4
IET/IEE	272	1.1
MRS-Materials Research Soc	252	1.0
145 others with less than 1% each	2208	7.8

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>TCL Corp</i></b>		
IEEE	130	23.7
ACM-Assoc Comput Mach	59	10.7
3GPP General Partnership Project Standards Body	58	10.6
Miller Freeman	34	6.2
Ziff-Davis	30	5.5
Time Inc.	21	3.8
Joint IEEE and ACM	20	3.6
RELX Group (Elsevier)	17	3.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	17	3.1
Open Mobile Alliance (Standards Org)	16	2.9
International Data Group	14	2.6
Linley Group	12	2.2
Penton Media, Inc.	12	2.2
SPIE-Int Soc Opt Engineering	10	1.8
ACS-Am Chem Soc	9	1.6
SID-Society for Information Display	8	1.5
Internet Soc/IETF-Internet Eng Task Force	7	1.3
United Business Media/UBM Tech	6	1.1
GSM Association (standards org)	6	1.1
33 others with less than 1% each	63	11.8
<b><i>Toshiba Corp</i></b>		
IEEE	8620	39.4
American Institute of Physics	1722	7.9
RELX Group (Elsevier)	1332	6.1
IEEE/JPN Soc App Phys	876	4.0
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	694	3.2
American Physical Society	604	2.8
IEICE-Inst Elec Info Comm Eng	584	2.7
SPIE-Int Soc Opt Engineering	502	2.3
ACM-Assoc Comput Mach	513	2.3
Institute of Pure and Applied Physics	426	1.9
Internet Soc/IETF-Internet Eng Task Force	354	1.6
International Telecommunication Union	339	1.6
Springer/Sp. Wien/Springer-Verlag/KluwAcad	325	1.5
AACS-Advanced Access Content System	299	1.4
ACS-Am Chem Soc	295	1.3
IET/IEE	231	1.1
Joint IEEE and ACM	239	1.1
Japan Society of Applied Physics	219	1.0
373 others with less than 1% each	3685	13.8

## *Appendix A - Publishers Receiving Most References from Top 50 Companies (Top 50 Companies in terms of 2018 Patent Activity; References from 1999-2018 Patents)*

<i>Publisher</i>	<i># Pat Refs to:</i>	<i>Percent of Total</i>
<b><i>Toyota Motor Corp</i></b>		
RELX Group (Elsevier)	1597	19.2
IEEE	1523	18.3
ACS-Am Chem Soc	506	6.1
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	484	5.8
American Society of Plant Biologists	367	4.4
Springer/Sp. Wien/Springer-Verlag/KluwAcad	335	4.0
American Institute of Physics	276	3.3
SAE-Society of Automobile Engineers	246	3.0
AAAS-Am Assoc Advancement Sci	212	2.6
MacMillan Publishing Company	208	2.5
Natl Acad Sciences	207	2.5
Optical Society of America	156	1.9
ACM-Assoc Comput Mach	157	1.9
Electrochemical Society, Inc.	150	1.8
Oxford Univ Press	113	1.4
Royal Society of Chemistry	105	1.3
American SocIETy for Microbiology	107	1.3
American Society for Biochemistry and Molecular Biology Inc.	98	1.2
National Institutes of Health - NIH	101	1.2
241 others with less than 1% each	1361	13.1
<b><i>United Technologies Corp</i></b>		
IEEE	1562	17.8
NASA-National Aeronautics and Space Admin	858	9.8
RELX Group (Elsevier)	745	8.5
ASME-Am Soc Mech Eng	676	7.7
AIAA-Am Inst Aero Astro	491	5.6
IHS Markit	401	4.6
SAE-Society of Automobile Engineers	392	4.5
John Wiley & Sons/Wiley-Verlag/Wiley-Liss	342	3.9
American Institute of Physics	237	2.7
Springer/Sp. Wien/Springer-Verlag/KluwAcad	241	2.7
SPIE-Int Soc Opt Engineering	163	1.9
Optical Society of America	163	1.9
McGraw Hill	148	1.7
ACS-Am Chem Soc	143	1.6
Cambridge University Press	137	1.6
American Society of Mechanical Engineers	128	1.5
IOP Publishing	123	1.4
SAGE Publications Ltd	127	1.4
International Society or Air Breathing Engines (ISABE)	117	1.3
IET/IEE	94	1.1
Federal Aviation Administration	86	1.0
236 others with less than 1% each	1403	13.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>AI/Artificial Intelligence</i>										
1	Microsoft Corporation	2027	5123	39.6	IEEE	2027	39.6	ACM-Assoc Comput Mach	1439	28.1
2	International Business Machi	1537	4325	35.5	IEEE	1537	35.5	ACM-Assoc Comput Mach	633	14.6
3	Google Inc.	1198	2723	44.0	IEEE	1198	44.0	ACM-Assoc Comput Mach	379	13.9
4	Brain Corporation	937	2264	41.4	IEEE	937	41.4	MIT Press	401	17.7
5	HRL Laboratories LLC	648	1342	48.3	IEEE	648	48.3	RELX Group (Elsevier)	118	8.8
6	NUMENTA INC	570	2247	25.4	Numenta Inc.	809	36.0	IEEE	570	25.4
7	Apple Inc	457	925	49.4	IEEE	457	49.4	ACM-Assoc Comput Mach	231	25.0
8	Qualcomm Inc	424	1108	38.3	IEEE	424	38.3	MIT Press	86	7.8
9	Columbia University	237	605	39.2	IEEE	237	39.2	ACM-Assoc Comput Mach	59	9.8
10	Xerox Corp	229	725	31.6	IEEE	229	31.6	ACM-Assoc Comput Mach	111	15.3
11	Siemens Aktiengesellschaft	199	488	40.8	IEEE	199	40.8	RELX Group (Elsevier)	46	9.4
12	Cortica Ltd	186	258	72.1	IEEE	186	72.1	ACM-Assoc Comput Mach	23	8.9
13	Fujitsu Limited	161	366	44.0	IEEE	161	44.0	Joint IEEE and ACM	79	21.6
14	University of Tennessee	155	245	63.3	IEEE	155	63.3	RELX Group (Elsevier)	18	7.3
15	Cisco Systems Inc.	135	207	65.2	IEEE	135	65.2	ACM-Assoc Comput Mach	35	16.9
16	Giant Grey Inc (formerly BR	133	155	85.8	IEEE	133	85.8	International Association for Pattern Recognition (IAPR)	17	11.0
17	Sony Corp	132	290	45.5	IEEE	132	45.5	ACM-Assoc Comput Mach	31	10.7
18	NEC Corp	127	321	39.6	IEEE	127	39.6	ACM-Assoc Comput Mach	34	10.6
19	ICOSYSTEM CORP	125	172	72.7	IEEE	125	72.7	RELX Group (Elsevier)	9	5.2
20	Adobe Systems Inc.	124	227	54.6	IEEE	124	54.6	ACM-Assoc Comput Mach	57	25.1
21	Amazon.com Inc.	117	265	44.2	IEEE	117	44.2	ACM-Assoc Comput Mach	59	22.3
22	eBay Inc	114	135	84.4	IEEE	114	84.4	ACM-Assoc Comput Mach	7	5.2
23	Samsung Electronics Co Ltd	107	219	48.9	IEEE	107	48.9	ACM-Assoc Comput Mach	28	12.8
24	General Electric Company	106	223	47.5	IEEE	106	47.5	RELX Group (Elsevier)	35	15.7
25	United States Navy	103	191	53.9	IEEE	103	53.9	RELX Group (Elsevier)	30	15.7
26	AT&T Inc	95	283	33.6	IEEE	95	33.6	ACM-Assoc Comput Mach	83	29.3
27	SAS Institute	94	294	32.0	IEEE	94	32.0	RELX Group (Elsevier)	47	16.0
28	Intel Corporation	93	186	50.0	IEEE	93	50.0	Joint IEEE and ACM	24	12.9
29	Massachusetts Institute of Te	90	319	28.2	IEEE	90	28.2	RELX Group (Elsevier)	29	9.1
30	Raytheon Co.	88	198	44.4	IEEE	88	44.4	SPIE-Int Soc Opt Engineering	19	9.6
31	FireEye Inc	87	235	37.0	IEEE	87	37.0	The USENIX Association	41	17.4
32	Verizon Communications Inc	87	432	20.1	ACM-Assoc Comput Mach	174	40.3	IEEE	87	20.1
33	Boeing Co. (The)	86	243	35.4	IEEE	86	35.4	RELX Group (Elsevier)	41	16.9
34	Nuance Communications Inc	82	183	44.8	IEEE	82	44.8	ACM-Assoc Comput Mach	28	15.3
35	Oracle Corporation	82	331	24.8	ACM-Assoc Comput Mach	83	25.1	IEEE	82	24.8
36	Lockheed Martin Corp.	81	118	68.6	IEEE	81	68.6	RELX Group (Elsevier)	11	9.3
37	Zebra Technologies Corp.	80	102	78.4	IEEE	80	78.4	RFID Journal/YGS Group	12	11.8
38	ALOFT MEDIA LLC	79	147	53.7	IEEE	79	53.7	Institute for Operations Research and the Management Science	24	16.3
39	HP Inc	77	273	28.2	IEEE	77	28.2	ACM-Assoc Comput Mach	62	22.7

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	University of Alabama	77	97	79.4	IEEE	77	79.4	RELX Group (Elsevier)	9	9.3
41	Accenture Ltd.	75	349	21.5	IEEE	75	21.5	ACM-Assoc Comput Mach	66	18.9
42	BLANDING HOVENWEEP	75	216	34.7	IEEE	75	34.7	SPIE-Int Soc Opt Engineering	41	19.0
43	PRIMAL FUSION INC	75	150	50.0	IEEE	75	50.0	ACM-Assoc Comput Mach	29	19.3
44	EXEGY INC	73	145	50.3	IEEE	73	50.3	ACM-Assoc Comput Mach	26	17.9
45	University of California	72	909	7.9	RELX Group (Elsevier)	135	14.9	Oxford University Press	115	12.7
46	IP RESERVOIR LLC	71	122	58.2	IEEE	71	58.2	ACM-Assoc Comput Mach	19	15.6
47	Marvell Technology Group Lt	71	122	58.2	IEEE	71	58.2	ACM-Assoc Comput Mach	36	29.5
48	WORLD ASSETS CONSUL	71	146	48.6	IEEE	71	48.6	ACM-Assoc Comput Mach	18	12.3
49	INDIVIDUAL PATENTER	67	150	44.7	IEEE	67	44.7	ACM-Assoc Comput Mach	28	18.7
50	California Institute of Techno	66	199	33.2	IEEE	66	33.2	ACM-Assoc Comput Mach	16	8.0
51	ConvergeOne Inc	64	145	44.1	IEEE	64	44.1	ACM-Assoc Comput Mach	29	20.0
52	FACENSE LTD	64	72	88.9	IEEE	64	88.9	ACM-Assoc Comput Mach	8	11.1
53	Sap SE	63	202	31.2	IEEE	63	31.2	ACM-Assoc Comput Mach	43	21.3
54	KNOWMTECH LLC	61	229	26.6	IEEE	61	26.6	American Institute of Physics	58	25.3
55	University of Illinois	61	194	31.4	IEEE	61	31.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	23	11.9
56	Causam Energy Inc	59	66	89.4	IEEE	59	89.4	RELX Group (Elsevier)	3	4.5
57	Honda Motor Co. Ltd.(Honda	58	147	39.5	IEEE	58	39.5	RELX Group (Elsevier)	17	11.6
58	Cornell University	57	416	13.7	RELX Group (Elsevier)	63	15.1	IEEE	57	13.7
59	Micron Technology Inc.	53	78	67.9	IEEE	53	67.9	Plenum Publishers	4	5.1
60	ZOOX INC	53	66	80.3	IEEE	53	80.3	IEEE/RSJ	5	7.6
61	Toyota Motor Corp	52	78	66.7	IEEE	52	66.7	RELX Group (Elsevier)	6	7.7
62	Arizona State University	51	78	65.4	IEEE	51	65.4	ACM-Assoc Comput Mach	8	10.3
63	Rethink Robotics Inc	51	80	63.8	IEEE	51	63.8	RELX Group (Elsevier)	12	15.0
64	Rockwell Automation Inc	51	105	48.6	IEEE	51	48.6	RELX Group (Elsevier)	17	16.2
65	SOCIETE DE COMMERCIA	51	135	37.8	IEEE	51	37.8	RELX Group (Elsevier)	20	14.8
66	Commissariat A L'Energie At	50	65	76.9	IEEE	50	76.9	RELX Group (Elsevier)	5	7.7
67	Nokia Corp	50	126	39.7	IEEE	50	39.7	ACM-Assoc Comput Mach	30	23.8
68	Toshiba Corp	49	71	69.0	IEEE	49	69.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	5	7.0
69	Knowles Corp	48	66	72.7	IEEE	48	72.7	RELX Group (Elsevier)	4	6.1
70	United States of America De	48	120	40.0	IEEE	48	40.0	ACL - Association for Computational Linguistics	15	12.5
71	Mitsubishi Electric Corp	47	95	49.5	IEEE	47	49.5	International Speech Communication Association (ISCA)	5	5.3
72	Symantec Corp.	47	176	26.7	IEEE	47	26.7	ACM-Assoc Comput Mach	43	24.4
73	Aerospace Corp.	45	185	24.3	RELX Group (Elsevier)	78	42.2	IEEE	45	24.3
74	University of Texas	45	75	60.0	IEEE	45	60.0	RELX Group (Elsevier)	17	22.7
75	Avigilon Corp	44	48	91.7	IEEE	44	91.7	International Association for Pattern Recognition (IAPR)	4	8.3
76	Emerson Electric Co.	44	86	51.2	IEEE	44	51.2	RELX Group (Elsevier)	9	10.5
77	Nevada System of Higher Ed	43	75	57.3	IEEE	43	57.3	RELX Group (Elsevier)	12	16.0
78	Dell Technologies Inc	42	111	37.8	IEEE	42	37.8	ACM-Assoc Comput Mach	26	23.4
79	Walt Disney Co.	42	67	62.7	IEEE	42	62.7	ACM-Assoc Comput Mach	4	6.0
80	Xperi Corporation (Formerly	41	65	63.1	IEEE	41	63.1	ACM-Assoc Comput Mach	4	6.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	NEURALA INC	40	59	67.8	IEEE	40	67.8	MIT Press	10	16.9
82	PEGASYSYSTEMS INC	40	82	48.8	IEEE	40	48.8	ACM-Assoc Comput Mach	15	18.3
83	CONDUENT BUSINESS SE	38	48	79.2	IEEE	38	79.2	INRIA Grenoble - Rhône-Alpes	2	4.2
84	Purdue University	38	63	60.3	IEEE	38	60.3	ACM-Assoc Comput Mach	8	12.7
85	Boston Scientific Corp.	37	173	21.4	RELX Group (Elsevier)	38	22.0	IEEE	37	21.4
86	FTI Consulting Inc	37	166	22.3	ACM-Assoc Comput Mach	55	33.1	IEEE	37	22.3
87	Halliburton Co. (Holding)	37	144	25.7	Society of Petroleum Engineers	55	38.2	IEEE	37	25.7
88	GOOGLE LCC	36	38	94.7	IEEE	36	94.7	MIT Press	2	5.3
89	Canon Inc	35	91	38.5	IEEE	35	38.5	RELX Group (Elsevier)	11	12.1
90	EDGE 3 TECHNOLOGIES I	35	52	67.3	IEEE	35	67.3	International Association for Pattern Recognition (IAPR)	4	7.7
91	University of Notre Dame Du	35	40	87.5	IEEE	35	87.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	5.0
92	Analog Devices Inc.	34	49	69.4	IEEE	34	69.4	Neural Information Processing Systems Foundation	4	8.2
93	Health Discovery Corp	34	158	21.5	IEEE	34	21.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	13	8.2
94	Honeywell International Inc.	33	100	33.0	IEEE	33	33.0	RELX Group (Elsevier)	33	33.0
95	Nielsen Holdings Plc	33	215	15.3	IEEE	33	15.3	RELX Group (Elsevier)	32	14.9
96	Drexel University	32	67	47.8	IEEE	32	47.8	ASME-Am Soc Mech Eng	10	14.9
97	Electronics and Telecommuni	32	49	65.3	IEEE	32	65.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	4	8.2
98	SENTIENT TECHNOLOGIE	32	80	40.0	IEEE	32	40.0	RELX Group (Elsevier)	9	11.3
99	University of Southern Califo	32	168	19.0	ACL - Association for Computational Linguist	68	40.5	IEEE	32	19.0
100	BAE Systems Plc.	31	62	50.0	IEEE	31	50.0	ACM-Assoc Comput Mach	5	8.1

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Autonomous Vehicles</i>										
1	Irobot Corp	1498	2321	64.5	IEEE	1498	64.5	SPIE-Int Soc Opt Engineering	221	9.5
2	ZOOX INC	266	331	80.4	IEEE	266	80.4	IEEE/RSJ	22	6.6
3	Brain Corporation	113	224	50.4	IEEE	113	50.4	MIT Press	22	9.8
4	WAYMO LLC	59	86	68.6	IEEE	59	68.6	IEEE/RSJ	7	8.1
5	California Institute of Techno	58	109	53.2	IEEE	58	53.2	IOP Publishing	6	5.5
6	NUTONOMY INC	53	73	72.6	IEEE	53	72.6	RELX Group (Elsevier)	4	5.5
7	International Business Machi	51	166	30.7	IEEE	51	30.7	IP.Com	24	14.5
8	Google Inc.	50	107	46.7	IEEE	50	46.7	ACM-Assoc Comput Mach	11	10.3
9	Uber Technologies Inc	50	63	79.4	IEEE	50	79.4	Joint IEEE and ACM	9	14.3
10	Toyota Motor Corp	48	69	69.6	IEEE	48	69.6	IEEE/RSJ	10	14.5
11	University of Pennsylvania	44	55	80.0	IEEE	44	80.0	IEEE/RSJ	6	10.9
12	SZ DJI Technology Co Ltd	41	70	58.6	IEEE	41	58.6	ISIF/IEEE	5	7.1
13	WALMART APOLLO LLC	37	43	86.0	IEEE	37	86.0	IEEE/RSJ	6	14.0
14	Intel Corporation	32	40	80.0	IEEE	32	80.0	JOURNAL OF CENTRAL SOUTH UNIV TECHNOLOGY, E	2	5.0
15	INTOUCH HEALTH INC	32	81	39.5	IEEE	32	39.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	6	7.4
16	SPHERO INC	32	34	94.1	IEEE	32	94.1	American Automatic Control Council (AACC)	2	5.9
17	Walmart Stores Inc	32	46	69.6	IEEE	32	69.6	IEEE/RSJ	6	13.0
18	Ford Motor Co.	31	52	59.6	IEEE	31	59.6	IEEE/RSJ	3	5.8
19	Digimarc Corp.	30	56	53.6	IEEE	30	53.6	ACM-Assoc Comput Mach	11	19.6
20	Deere & Co.	24	44	54.5	IEEE	24	54.5	International Association for Pattern Recognition (IAPR)	3	6.8
21	Oshkosh Corporation	23	30	76.7	IEEE	23	76.7	SAE-Society of Automobile Engineers	2	6.7
22	Amazon.com Inc.	21	21	100.0	IEEE	21	100.0			
23	TUSIMPLE	21	24	87.5	IEEE	21	87.5	ACM-Assoc Comput Mach	3	12.5
24	HRL Laboratories LLC	20	25	80.0	IEEE	20	80.0	IEEE/RSJ	4	16.0
25	NONEND INVENTIONS N	20	21	95.2	IEEE	20	95.2	The International Association for Computers and Communicat	1	4.8
26	Toshiba Corp	19	20	95.0	IEEE	19	95.0	ACM-Assoc Comput Mach	1	5.0
27	Battelle Memorial Institute	18	24	75.0	IEEE	18	75.0	IEEE/RSJ	4	16.7
28	FedEx Corp	18	18	100.0	IEEE	18	100.0			
29	State Farm Mutual Automobi	17	50	34.0	IEEE	17	34.0	IEEE/RSJ	11	22.0
30	Boeing Co. (The)	16	30	53.3	IEEE	16	53.3	AIAA-Am Inst Aero Astro	4	13.3
31	CYBERNET SYSTEMS CO	15	17	88.2	IEEE	15	88.2	Joint IEEE and ACM	1	5.9
32	NIO USA INC	15	22	68.2	IEEE	15	68.2	ACM-Assoc Comput Mach	7	31.8
33	PELTON TECHNOLOGY I	15	27	55.6	IEEE	15	55.6	American Automatic Control Council (AACC)	5	18.5
34	BRIAN CORP	14	17	82.4	IEEE	14	82.4	MIT Press	3	17.6
35	Walt Disney Co.	13	13	100.0	IEEE	13	100.0			
36	Lockheed Martin Corp.	12	45	26.7	American Institute of Physics	29	64.4	IEEE	12	26.7
37	ZYTEK COMMUNICATIO	12	44	27.3	IEEE	12	27.3	COMPANY OF BIOLOGISTS LTD	6	13.6
38	Honda Motor Co. Ltd.(Honda	11	19	57.9	IEEE	11	57.9	RELX Group (Elsevier)	3	15.8
39	AUTONOMOUS SOLUTIO	10	19	52.6	IEEE	10	52.6	American Automatic Control Council (AACC)	6	31.6



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	EPISYS SCIENCE INC	10	14	71.4	IEEE	10	71.4	MIT Press	2	14.3
41	General Motors Corp	8	16	50.0	IEEE	8	50.0	SAE-Society of Automobile Engineers	2	12.5
42	Leidos Holdings Inc	8	10	80.0	IEEE	8	80.0	ISIF/IEEE	2	20.0
43	PERRONE ROBOTICS INC	8	12	66.7	IEEE	8	66.7	IEEE/RSJ	2	16.7
44	King Fahd University of Petr	7	9	77.8	IEEE	7	77.8	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1	11.1
45	Raytheon Co.	7	19	36.8	IEEE	7	36.8	RELX Group (Elsevier)	3	15.8
46	Baidu Inc	6	10	60.0	IEEE	6	60.0	SAE-Society of Automobile Engineers	2	20.0
47	CRINKLAW FARM SERVI	6	6	100.0	IEEE	6	100.0			
48	Nissan Motor Co. Ltd.	6	12	50.0	IEEE	6	50.0	University of Zagreb	2	16.7
49	Porsche Automobil Holding	6	7	85.7	IEEE	6	85.7	ASME-Am Soc Mech Eng	1	14.3
50	Qualcomm Inc	6	6	100.0	IEEE	6	100.0			
51	Bosch (Robert) GmbH	5	8	62.5	IEEE	5	62.5	SAGE Publications Ltd	1	12.5
52	Commonwealth Scientific an	5	9	55.6	IEEE	5	55.6	American Society of Civil Engineers	1	11.1
53	Hon Hai Precision Industry C	5	7	71.4	IEEE	5	71.4	RELX Group (Elsevier)	2	28.6
54	Omron Corp.	5	14	35.7	IEEE	5	35.7	RELX Group (Elsevier)	4	28.6
55	Siemens Aktiengesellschaft	5	7	71.4	IEEE	5	71.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1	14.3
56	ACTIVE KNOWLEDGE LT	4	4	100.0	IEEE	4	100.0			
57	Casio Computer	4	4	100.0	IEEE	4	100.0			
58	Crown Equipment Corporatio	4	9	44.4	IEEE	4	44.4	IEICE-Inst Elec Info Comm Eng	3	33.3
59	Denso Corp	4	7	57.1	IEEE	4	57.1	RELX Group (Elsevier)	2	28.6
60	OPTIMAL RANGING INC	4	6	66.7	IEEE	4	66.7	RELX Group (Elsevier)	2	33.3
61	PERCEPTIN INC	4	4	100.0	IEEE	4	100.0			
62	Samsung Electronics Co Ltd	4	4	100.0	IEEE	4	100.0			
63	BYTELIGHT INC	3	4	75.0	IEEE	3	75.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1	25.0
64	Carnegie Mellon University	3	3	100.0	IEEE	3	100.0			
65	Delphi Automotive PLC	3	4	75.0	IEEE	3	75.0	IEEE/RSJ	1	25.0
66	FTS ComputerTechnik	3	4	75.0	IEEE	3	75.0	ACM-Assoc Comput Mach	1	25.0
67	Fuji Film Holdings Corp	3	3	100.0	IEEE	3	100.0			
68	Fujitsu Limited	3	3	100.0	IEEE	3	100.0			
69	International Electronic Mach	3	5	60.0	IEEE	3	60.0	SPIE-Int Soc Opt Engineering	1	20.0
70	Lenovo Group Ltd	3	5	60.0	IEEE	3	60.0	ACM-Assoc Comput Mach	1	20.0
71	Mitsubishi Electric Corp	3	4	75.0	IEEE	3	75.0	American Automatic Control Council (AACC)	1	25.0
72	Northrop Grumman Corp	3	3	100.0	IEEE	3	100.0			
73	SZ DJ TECHNOLOGY CO L	3	7	42.9	IEEE	3	42.9	ISIF/IEEE	1	14.3
74	United States Navy	3	9	33.3	IEEE	3	33.3	US GOVERNMENT PRINTING OFFICE, SUPERINTENDE	1	11.1
75	VECNA TECHNOLOGIES I	3	3	100.0	IEEE	3	100.0			
76	X Development Llc	3	4	75.0	IEEE	3	75.0	SAGE Publications Ltd	1	25.0
77	XOLLAI INC	3	7	42.9	IEEE	3	42.9	Society of Instrument and Control Engineers	2	28.6
78	Agency for Defense Develop	2	4	50.0	IEEE	2	50.0	CRC Press/Taylor & Francis	1	25.0
79	Allstate Corp	2	12	16.7	ACM-Assoc Comput Mach	6	50.0	IEEE	2	16.7
80	ANKI INC	2	2	100.0	IEEE	2	100.0			

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Aviation Industry Corporatio	2	2	100.0	IEEE	2	100.0			
82	BAE Systems Plc.	2	5	40.0	IEEE/RSJ	2	40.0	IEEE	2	40.0
83	DELTA SUBSEA LLC	2	2	100.0	IEEE	2	100.0			
84	DRONOMY LTD	2	2	100.0	IEEE	2	100.0			
85	Electronics and Telecommuni	2	2	100.0	IEEE	2	100.0			
86	GoPro Inc	2	5	40.0	IEEE	2	40.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1	20.0
87	Here Global BV	2	3	66.7	IEEE	2	66.7	Science X Network	1	33.3
88	Koninklijke Philips N.V.	2	2	100.0	IEEE	2	100.0			
89	Kyushu Institute of Technolo	2	4	50.0	IEEE	2	50.0	IEEE/RSJ	2	50.0
90	LOVELAND INNOVATION	2	2	100.0	IEEE	2	100.0			
91	Massachusetts Institute of Te	2	2	100.0	IEEE	2	100.0			
92	MASSIVE ANALYTIC LTD	2	2	100.0	IEEE	2	100.0			
93	MegaChips Corp	2	4	50.0	IEEE	2	50.0	IEEE/RSJ	2	50.0
94	Microsoft Corporation	2	4	50.0	IEEE	2	50.0	IET/IEE	1	25.0
95	Murata Machinery Ltd.	2	6	33.3	IEEE	2	33.3	RELX Group (Elsevier)	1	16.7
96	National Chiao Tung Univers	2	2	100.0	IEEE	2	100.0			
97	NEAR EARTH AUTONOM	2	2	100.0	IEEE	2	100.0			
98	Renault SA	2	3	66.7	IEEE	2	66.7	Cambridge University Press	1	33.3
99	ROBART GMBH	2	2	100.0	IEEE	2	100.0			
100	THE FLORIDA INTERNATI	2	2	100.0	IEEE	2	100.0			

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Blockchain/Distributed Ledger</i>										
1	IP RESERVOIR LLC	82	152	53.9	IEEE	82	53.9	ACM-Assoc Comput Mach	26	17.1
2	Juniper Networks Inc.	35	38	92.1	IEEE	35	92.1	IEEE/Eurasip	1	2.6
3	Marvell Technology Group Lt	28	28	100.0	IEEE	28	100.0			
4	Via Technologies Inc.	9	16	56.3	IEEE	9	56.3	RELX Group (Elsevier)	2	12.5
5	LG Electronics Inc.	8	9	88.9	IEEE	8	88.9	World Academy of Science Engineering and Technology	1	11.1
6	ANTHURIUM SOLUTIONS	7	42	16.7	ACM-Assoc Comput Mach	15	35.7	IEEE	7	16.7
7	Accenture Ltd.	6	28	21.4	ACM-Assoc Comput Mach	16	57.1	IEEE	6	21.4
8	Dell Technologies Inc	4	20	20.0	ACM-Assoc Comput Mach	16	80.0	IEEE	4	20.0
9	Raytheon Co.	3	3	100.0	IEEE	3	100.0			
10	Sap SE	3	10	30.0	IEEE	3	30.0	ACM-Assoc Comput Mach	2	20.0
11	Cisco Systems Inc.	2	2	100.0	IEEE	2	100.0			
12	Global Foundries Inc	2	4	50.0	IEEE	2	50.0	RELX Group (Elsevier)	1	25.0
13	HOVERKEY LTD	2	2	100.0	IEEE	2	100.0			
14	OBOPAY INC	2	4	50.0	IEEE	2	50.0	I B C BUSINESS PUBL LTD, MORTIMER HOUSE, 37-41	1	25.0
15	TiVo Corp	2	2	100.0	IEEE	2	100.0			
16	ALTR SOLUTIONS INC	1	2	50.0	ACM-Assoc Comput Mach	1	50.0	IEEE	1	50.0
17	Bank of America Corp.	1	10	10.0	New York Times	9	90.0	IEEE	1	10.0
18	ENT TECHNOLOGIES INC	1	1	100.0	IEEE	1	100.0			
19	Intel Corporation	1	4	25.0	Federal Information Processing Standards Pub	2	50.0	IEEE	1	25.0
20	International Business Machi	1	8	12.5	International Association for Cryptologic Rese	2	25.0	ACM-Assoc Comput Mach	1	12.5
21	McKesson Corporation	1	4	25.0	ACM-Assoc Comput Mach	2	50.0	Joint IEEE and ACM	1	25.0
22	PANJIVA INC	1	1	100.0	IEEE	1	100.0			
23	Samsung Electronics Co Ltd	1	1	100.0	IEEE	1	100.0			
24	SKUCHAIN INC	1	2	50.0	Internet Soc/IETF-Internet Eng Task Force	1	50.0	IEEE	1	50.0
25	SS8 NETWORKS INC	1	3	33.3	Internet Soc/IETF-Internet Eng Task Force	2	66.7	IEEE	1	33.3
26	Texas Instruments Inc	1	1	100.0	IEEE	1	100.0			
27	THE BANK OF NEW YORK	1	1	100.0	IEEE	1	100.0			

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Broadcasting</i>										
1	Microsoft Corporation	9403	19311	48.7	IEEE	9403	48.7	ACM-Assoc Comput Mach	2370	12.3
2	Personalized Media Commun	7679	47994	16.0	Society of Motion Picture and Television Engi	14146	29.5	IEEE	7679	16.0
3	Qualcomm Inc	4393	16926	26.0	International Telecommunication Union	6245	36.9	IEEE	4393	26.0
4	Xperi Corporation (Formerly	4281	7246	59.1	IEEE	4281	59.1	SPIE-Int Soc Opt Engineering	599	8.3
5	Google Inc.	3398	8929	38.1	IEEE	3398	38.1	ACM-Assoc Comput Mach	1193	13.4
6	Sony Corp	3299	7337	45.0	IEEE	3299	45.0	International Telecommunication Union	840	11.4
7	Magna International Inc.	2602	4044	64.3	IEEE	2602	64.3	SAE-Society of Automobile Engineers	227	5.6
8	Pelican Imaging Corporation	2428	5027	48.3	IEEE	2428	48.3	SPIE-Int Soc Opt Engineering	804	16.0
9	Apple Inc	2257	5525	40.9	IEEE	2257	40.9	ACM-Assoc Comput Mach	564	10.2
10	TiVo Corp	2170	8013	27.1	IEEE	2170	27.1	ACM-Assoc Comput Mach	616	7.7
11	Technicolor SA	1959	4166	47.0	IEEE	1959	47.0	ISO/IEC/JTC/ANSI	278	6.7
12	Samsung Electronics Co Ltd	1847	5160	35.8	IEEE	1847	35.8	International Telecommunication Union	1144	22.2
13	Cisco Systems Inc.	1833	4533	40.4	IEEE	1833	40.4	ACM-Assoc Comput Mach	332	7.3
14	Broadcom Ltd	1801	2811	64.1	IEEE	1801	64.1	ACM-Assoc Comput Mach	168	6.0
15	LG Electronics Inc.	1720	6994	24.6	IEEE	1720	24.6	ISO/IEC/JTC/ANSI	1198	17.1
16	Panasonic Corporation	1532	4798	31.9	IEEE	1532	31.9	International Telecommunication Union	1233	25.7
17	Dolby Laboratories Inc	1359	3971	34.2	IEEE	1359	34.2	International Telecommunication Union	816	20.5
18	Hon Hai Precision Industry C	1247	3577	34.9	IEEE	1247	34.9	International Telecommunication Union	625	17.5
19	Fraunhofer Gesellschaft	1138	2357	48.3	IEEE	1138	48.3	MPEG.org	234	9.9
20	Adobe Systems Inc.	1114	2342	47.6	IEEE	1114	47.6	ACM-Assoc Comput Mach	512	21.9
21	AT&T Inc	1066	2680	39.8	IEEE	1066	39.8	ACM-Assoc Comput Mach	293	10.9
22	Massachusetts Institute of Te	1038	1626	63.8	IEEE	1038	63.8	ACM-Assoc Comput Mach	188	11.6
23	Nokia Corp	1033	2412	42.8	IEEE	1033	42.8	International Telecommunication Union	218	9.0
24	Intel Corporation	1003	2355	42.6	IEEE	1003	42.6	3GPP General Partnership Project Standards Body	535	22.7
25	Canon Inc	917	2316	39.6	IEEE	917	39.6	International Telecommunication Union	243	10.5
26	International Business Machi	876	2286	38.3	IEEE	876	38.3	ACM-Assoc Comput Mach	349	15.3
27	InterDigital Inc	776	1541	50.4	IEEE	776	50.4	3GPP General Partnership Project Standards Body	436	28.3
28	DIRECTV Group Inc. (The)	761	1453	52.4	IEEE	761	52.4	Elettronica e Telecomunicazioni	161	11.1
29	STMicroelectronics	698	1045	66.8	IEEE	698	66.8	RELX Group (Elsevier)	50	4.8
30	California Institute of Techno	695	1201	57.9	IEEE	695	57.9	SPIE-Int Soc Opt Engineering	111	9.2
31	HP Inc	687	1467	46.8	IEEE	687	46.8	ACM-Assoc Comput Mach	175	11.9
32	NETWORK-1 TECHNOLO	678	1581	42.9	IEEE	678	42.9	ACM-Assoc Comput Mach	451	28.5
33	Ricoh Co. Ltd.	624	1334	46.8	IEEE	624	46.8	ACM-Assoc Comput Mach	172	12.9
34	Sonos Inc	615	1351	45.5	IEEE	615	45.5	SPIE-Int Soc Opt Engineering	181	13.4
35	Huawei Technologies Compa	589	1956	30.1	International Telecommunication Union	644	32.9	IEEE	589	30.1
36	INTOUCH HEALTH INC	522	1068	48.9	IEEE	522	48.9	IEEE/RSJ	58	5.4
37	Digimarc Corp.	516	1162	44.4	IEEE	516	44.4	SPIE-Int Soc Opt Engineering	166	14.3
38	Mitsubishi Electric Corp	488	1088	44.9	IEEE	488	44.9	ACM-Assoc Comput Mach	99	9.1
39	Columbia University	484	862	56.1	IEEE	484	56.1	ACM-Assoc Comput Mach	129	15.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Honeywell International Inc.	473	858	55.1	IEEE	473	55.1	SPIE-Int Soc Opt Engineering	82	9.6
41	Xerox Corp	473	1114	42.5	IEEE	473	42.5	SPIE-Int Soc Opt Engineering	163	14.6
42	ARRIS Group Inc	472	1128	41.8	IEEE	472	41.8	International Telecommunication Union	66	5.9
43	Koninklijke Philips N.V.	471	979	48.1	IEEE	471	48.1	SPIE-Int Soc Opt Engineering	87	8.9
44	Wisteria Trading Inc	466	901	51.7	IEEE	466	51.7	SPIE-Int Soc Opt Engineering	98	10.9
45	Blackberry Ltd.	463	960	48.2	IEEE	463	48.2	3GPP General Partnership Project Standards Body	143	14.9
46	PixelWorks Inc	455	678	67.1	IEEE	455	67.1	SPIE-Int Soc Opt Engineering	61	9.0
47	Toshiba Corp	432	1118	38.6	IEEE	432	38.6	International Telecommunication Union	233	20.8
48	Verance Corp	420	807	52.0	IEEE	420	52.0	SPIE-Int Soc Opt Engineering	102	12.6
49	ACACIA MEDIA TECHNO	406	736	55.2	IEEE	406	55.2	ACM-Assoc Comput Mach	66	9.0
50	GoPro Inc	404	584	69.2	IEEE	404	69.2	ACM-Assoc Comput Mach	61	10.4
51	Nippon Telegraph & Telepho	398	1054	37.8	IEEE	398	37.8	International Telecommunication Union	189	17.9
52	Nant Holdings IP Llc	394	1218	32.3	IEEE	394	32.3	ACM-Assoc Comput Mach	337	27.7
53	Fuji Film Holdings Corp	377	1103	34.2	IEEE	377	34.2	ACM-Assoc Comput Mach	250	22.7
54	EchoStar Corp	349	666	52.4	IEEE	349	52.4	RELX Group (Elsevier)	56	8.4
55	Marvell Technology Group Lt	342	415	82.4	IEEE	342	82.4	ACM-Assoc Comput Mach	8	1.9
56	Industrial Technology Researc	336	504	66.7	IEEE	336	66.7	SPIE-Int Soc Opt Engineering	34	6.7
57	Ericsson	325	1152	28.2	IEEE	325	28.2	International Telecommunication Union	156	13.5
58	On Semiconductor Corporati	305	433	70.4	IEEE	305	70.4	SPIE-Int Soc Opt Engineering	43	9.9
59	NEC Corp	303	656	46.2	IEEE	303	46.2	International Telecommunication Union	47	7.2
60	Semiconductor Energy Labor	303	2592	11.7	SID-Society for Information Display	797	30.7	American Institute of Physics	485	18.7
61	General Electric Company	297	711	41.8	IEEE	297	41.8	International Telecommunication Union	115	16.2
62	Walt Disney Co.	294	803	36.6	ACM-Assoc Comput Mach	296	36.9	IEEE	294	36.6
63	Electronics and Telecommuni	283	889	31.8	International Telecommunication Union	292	32.8	IEEE	283	31.8
64	Nielsen Holdings Plc	282	1483	19.0	IEEE	282	19.0	RELX Group (Elsevier)	185	12.5
65	Raytheon Co.	280	490	57.1	IEEE	280	57.1	SPIE-Int Soc Opt Engineering	55	11.2
66	Texas Instruments Inc	275	898	30.6	International Telecommunication Union	441	49.1	IEEE	275	30.6
67	EUCLID DISCOVERIES LL	255	468	54.5	IEEE	255	54.5	RELX Group (Elsevier)	96	20.5
68	Eastman Kodak Company	250	745	33.6	IEEE	250	33.6	SPIE-Int Soc Opt Engineering	89	11.9
69	BLACK HILLS MEDIA LLC	249	1040	23.9	Open Connectivity Foundation	513	49.3	IEEE	249	23.9
70	Cortica Ltd	249	330	75.5	IEEE	249	75.5	ACM-Assoc Comput Mach	31	9.4
71	BT Group PLC	247	446	55.4	IEEE	247	55.4	RELX Group (Elsevier)	37	8.3
72	Micron Technology Inc.	246	422	58.3	IEEE	246	58.3	SPIE-Int Soc Opt Engineering	55	13.0
73	ECOLE DE TECHBOLOGIE	245	375	65.3	IEEE	245	65.3	3GPP General Partnership Project Standards Body	40	10.7
74	NVIDIA Corp.	241	553	43.6	IEEE	241	43.6	ACM-Assoc Comput Mach	103	18.6
75	ARC DEVICES LTD	240	819	29.3	ACM-Assoc Comput Mach	390	47.6	IEEE	240	29.3
76	CONVERGENT MEDIA SO	240	954	25.2	ACM-Assoc Comput Mach	257	26.9	IEEE	240	25.2
77	University of Minnesota (The	237	294	80.6	IEEE	237	80.6	SPIE-Int Soc Opt Engineering	10	3.4
78	Sigma Corp	235	295	79.7	IEEE	235	79.7	SPIE-Int Soc Opt Engineering	40	13.6
79	Amazon.com Inc.	234	514	45.5	IEEE	234	45.5	ACM-Assoc Comput Mach	119	23.2
80	Avid Technology Inc.	234	517	45.3	IEEE	234	45.3	ACM-Assoc Comput Mach	155	30.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Omnivision Technologies Inc	234	403	58.1	IEEE	234	58.1	SPIE-Int Soc Opt Engineering	64	15.9
82	University of California	233	440	53.0	IEEE	233	53.0	ACM-Assoc Comput Mach	33	7.5
83	INTERVAL RESEARCH CO	224	437	51.3	IEEE	224	51.3	ACM-Assoc Comput Mach	29	6.6
84	Seiko Epson Corporation	221	425	52.0	IEEE	221	52.0	ACM-Assoc Comput Mach	35	8.2
85	United States Navy	216	439	49.2	IEEE	216	49.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	58	13.2
86	Avigilon Corp	212	307	69.1	IEEE	212	69.1	International Association for Pattern Recognition (IAPR)	24	7.8
87	Hitachi Ltd	208	751	27.7	IEEE	208	27.7	IEICE-Inst Elec Info Comm Eng	67	8.9
88	Stanford University	207	534	38.8	IEEE	207	38.8	ACM-Assoc Comput Mach	106	19.9
89	IMAX Corp	202	396	51.0	IEEE	202	51.0	SPIE-Int Soc Opt Engineering	83	21.0
90	Siemens Aktiengesellschaft	201	439	45.8	IEEE	201	45.8	International Telecommunication Union	33	7.5
91	Comcast Corp	200	683	29.3	IEEE	200	29.3	ACM-Assoc Comput Mach	169	24.7
92	Kofax Inc	196	498	39.4	IEEE	196	39.4	ACM-Assoc Comput Mach	78	15.7
93	Intellectual Ventures Manage	192	463	41.5	IEEE	192	41.5	ACM-Assoc Comput Mach	95	20.5
94	SUN PATENT TRUST	192	1559	12.3	International Telecommunication Union	1016	65.2	IEEE	192	12.3
95	REALTIME DATA LLC	182	644	28.3	IEEE	182	28.3	Network Working Group RFC	79	12.3
96	SRI International	182	287	63.4	IEEE	182	63.4	RELX Group (Elsevier)	20	7.0
97	Mediatek Inc.	181	360	50.3	IEEE	181	50.3	International Telecommunication Union	99	27.5
98	Ford Motor Co.	178	292	61.0	IEEE	178	61.0	IEEE/RSJ	22	7.5
99	Fujitsu Limited	178	594	30.0	IEEE	178	30.0	International Telecommunication Union	110	18.5
100	BE HERE CORP	173	526	32.9	IEEE	173	32.9	ACM-Assoc Comput Mach	59	11.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Hardware</i>										
1	International Business Machi	15683	51154	30.7	IEEE	15683	30.7	ACM-Assoc Comput Mach	12808	25.0
2	Microsoft Corporation	13951	51508	27.1	ACM-Assoc Comput Mach	18993	36.9	IEEE	13951	27.1
3	Intel Corporation	8772	18202	48.2	IEEE	8772	48.2	ACM-Assoc Comput Mach	2368	13.0
4	Apple Inc	8761	25997	33.7	IEEE	8761	33.7	ACM-Assoc Comput Mach	8670	33.4
5	Oracle Corporation	4710	17141	27.5	ACM-Assoc Comput Mach	6122	35.7	IEEE	4710	27.5
6	Immersion Corp.	3921	10463	37.5	IEEE	3921	37.5	ACM-Assoc Comput Mach	1220	11.7
7	Broadcom Ltd	3750	6226	60.2	IEEE	3750	60.2	ACM-Assoc Comput Mach	424	6.8
8	Cadence Design Systems Inc	3585	8940	40.1	IEEE	3585	40.1	Joint IEEE and ACM	3175	35.5
9	Google Inc.	3274	11489	28.5	ACM-Assoc Comput Mach	3586	31.2	IEEE	3274	28.5
10	Qualcomm Inc	3186	7519	42.4	IEEE	3186	42.4	ACM-Assoc Comput Mach	530	7.0
11	Sony Corp	3125	7120	43.9	IEEE	3125	43.9	ACM-Assoc Comput Mach	1050	14.7
12	Samsung Electronics Co Ltd	2869	7374	38.9	IEEE	2869	38.9	SID-Society for Information Display	736	10.0
13	HP Inc	2467	8144	30.3	IEEE	2467	30.3	ACM-Assoc Comput Mach	1673	20.5
14	Ricoh Co. Ltd.	2432	5086	47.8	IEEE	2432	47.8	ACM-Assoc Comput Mach	884	17.4
15	Canon Inc	2275	5769	39.4	IEEE	2275	39.4	RELX Group (Elsevier)	522	9.0
16	Nokia Corp	2248	5402	41.6	IEEE	2248	41.6	ACM-Assoc Comput Mach	776	14.4
17	Fujitsu Limited	1951	4965	39.3	IEEE	1951	39.3	ACM-Assoc Comput Mach	583	11.7
18	Siemens Aktiengesellschaft	1946	4033	48.3	IEEE	1946	48.3	Joint IEEE and ACM	534	13.2
19	MicroUnity Systems Enginee	1853	3044	60.9	IEEE	1853	60.9	Joint IEEE and ACM	267	8.8
20	Panasonic Corporation	1669	4034	41.4	IEEE	1669	41.4	International Telecommunication Union	296	7.3
21	Rambus Inc.	1587	2212	71.7	IEEE	1587	71.7	JEDEC Semiconductor Standards Organization	94	4.2
22	AT&T Inc	1576	4067	38.8	IEEE	1576	38.8	ACM-Assoc Comput Mach	834	20.5
23	Cisco Systems Inc.	1544	4718	32.7	IEEE	1544	32.7	Internet Soc/IETF-Internet Eng Task Force	783	16.6
24	Personalized Media Commun	1518	10064	15.1	Society of Motion Picture and Television Engi	2934	29.2	IEEE	1518	15.1
25	Micron Technology Inc.	1479	2654	55.7	IEEE	1479	55.7	ACM-Assoc Comput Mach	220	8.3
26	Xilinx Inc.	1391	2159	64.4	IEEE	1391	64.4	Joint IEEE and ACM	271	12.6
27	Synopsys Inc.	1365	3461	39.4	IEEE	1365	39.4	Joint IEEE and ACM	791	22.9
28	NEC Corp	1361	3230	42.1	IEEE	1361	42.1	ACM-Assoc Comput Mach	407	12.6
29	Honeywell International Inc.	1353	3613	37.4	IEEE	1353	37.4	RELX Group (Elsevier)	268	7.4
30	Advanced Micro Devices Inc	1315	3451	38.1	IEEE	1315	38.1	Joint IEEE and ACM	504	14.6
31	Seiko Epson Corporation	1298	3567	36.4	IEEE	1298	36.4	Joint IEEE and ACM	478	13.4
32	Toshiba Corp	1284	2949	43.5	IEEE	1284	43.5	ACM-Assoc Comput Mach	230	7.8
33	Dell Technologies Inc	1219	4142	29.4	ACM-Assoc Comput Mach	1289	31.1	IEEE	1219	29.4
34	PACT XPP TECHNOLOGIE	1184	1996	59.3	IEEE	1184	59.3	ACM-Assoc Comput Mach	192	9.6
35	Columbia University	1183	4115	28.7	IEEE	1183	28.7	ACM-Assoc Comput Mach	904	22.0
36	Commvault Systems Inc.	1176	1805	65.2	IEEE	1176	65.2	ACM-Assoc Comput Mach	284	15.7
37	Cypress Semiconductor Corp.	1153	1845	62.5	IEEE	1153	62.5	Joint IEEE and ACM	237	12.8
38	Sap SE	1102	4274	25.8	ACM-Assoc Comput Mach	1412	33.0	IEEE	1102	25.8
39	STMicroelectronics	1094	1879	58.2	IEEE	1094	58.2	ACM-Assoc Comput Mach	104	5.5

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Marvell Technology Group Lt	1088	1572	69.2	IEEE	1088	69.2	ACM-Assoc Comput Mach	96	6.1
41	Ignis Innovation Inc	1072	1361	78.8	IEEE	1072	78.8	SID-Society for Information Display	133	9.8
42	Hitachi Ltd	1059	3791	27.9	IEEE	1059	27.9	ACM-Assoc Comput Mach	668	17.6
43	Xperi Corporation (Formerly	1033	1609	64.2	IEEE	1033	64.2	RELX Group (Elsevier)	109	6.8
44	Xerox Corp	1030	4175	24.7	ACM-Assoc Comput Mach	1121	26.9	IEEE	1030	24.7
45	IP RESERVOIR LLC	992	1868	53.1	IEEE	992	53.1	ACM-Assoc Comput Mach	315	16.9
46	Semiconductor Energy Labor	969	10823	9.0	SID-Society for Information Display	3892	36.0	American Institute of Physics	1897	17.5
47	Blackberry Ltd.	963	2477	38.9	IEEE	963	38.9	ACM-Assoc Comput Mach	332	13.4
48	Texas Instruments Inc	904	1676	53.9	IEEE	904	53.9	Joint IEEE and ACM	134	8.0
49	Tabula Inc	873	2330	37.5	IEEE	873	37.5	ACM-Assoc Comput Mach	864	37.1
50	Adobe Systems Inc.	872	3037	28.7	ACM-Assoc Comput Mach	1310	43.1	IEEE	872	28.7
51	Technicolor SA	870	1529	56.9	IEEE	870	56.9	ACM-Assoc Comput Mach	132	8.6
52	Softbank Corp	845	1701	49.7	IEEE	845	49.7	Joint IEEE and ACM	241	14.2
53	SRC Computers Inc.	814	911	89.4	IEEE	814	89.4	ACM-Assoc Comput Mach	30	3.3
54	Hon Hai Precision Industry C	777	3306	23.5	IEEE	777	23.5	SID-Society for Information Display	484	14.6
55	Imagination Technologies Gr	734	2348	31.3	IEEE	734	31.3	ACM-Assoc Comput Mach	447	19.0
56	LG Electronics Inc.	730	2380	30.7	IEEE	730	30.7	Audio Eng Soc	340	14.3
57	Massachusetts Institute of Te	721	1761	40.9	IEEE	721	40.9	ACM-Assoc Comput Mach	261	14.8
58	Amazon.com Inc.	698	2489	28.0	ACM-Assoc Comput Mach	867	34.8	IEEE	698	28.0
59	Fuji Film Holdings Corp	696	1995	34.9	IEEE	696	34.9	ACM-Assoc Comput Mach	486	24.4
60	Brain Corporation	682	1778	38.4	IEEE	682	38.4	MIT Press	343	19.3
61	Fraunhofer Gesellschaft	662	1171	56.5	IEEE	662	56.5	Audio Eng Soc	84	7.2
62	Huawei Technologies Compa	661	2144	30.8	IEEE	661	30.8	3GPP General Partnership Project Standards Body	299	13.9
63	Mitsubishi Electric Corp	658	1452	45.3	IEEE	658	45.3	ACM-Assoc Comput Mach	241	16.6
64	University of California	656	3122	21.0	IEEE	656	21.0	RELX Group (Elsevier)	373	11.9
65	Western Digital Corp.	654	1787	36.6	IEEE	654	36.6	ACM-Assoc Comput Mach	241	13.5
66	Tela Innovations inc	651	1730	37.6	IEEE	651	37.6	SPIE-Int Soc Opt Engineering	492	28.4
67	Koninklijke Philips N.V.	650	1631	39.9	IEEE	650	39.9	RELX Group (Elsevier)	141	8.6
68	NVIDIA Corp.	645	1593	40.5	IEEE	645	40.5	ACM-Assoc Comput Mach	472	29.6
69	NXP Semiconductors NV	637	1112	57.3	IEEE	637	57.3	Joint IEEE and ACM	166	14.9
70	Netapp Inc	634	3014	21.0	ACM-Assoc Comput Mach	1240	41.1	IEEE	634	21.0
71	ConvergeOne Inc	628	1857	33.8	IEEE	628	33.8	Joint IEEE and ACM	597	32.1
72	Ericsson	614	1895	32.4	IEEE	614	32.4	3GPP General Partnership Project Standards Body	299	15.8
73	General Electric Company	610	1694	36.0	IEEE	610	36.0	RELX Group (Elsevier)	170	10.0
74	Conversant Intellectual Prope	598	832	71.9	IEEE	598	71.9	Joint IEEE and ACM	53	6.4
75	Citrix Systems Inc	589	1791	32.9	IEEE	589	32.9	ACM-Assoc Comput Mach	268	15.0
76	Verizon Communications Inc	589	3071	19.2	ACM-Assoc Comput Mach	829	27.0	IEEE	589	19.2
77	Silverbrook Pty Ltd	588	1485	39.6	IEEE	588	39.6	RELX Group (Elsevier)	292	19.7
78	Irobot Corp	587	1123	52.3	IEEE	587	52.3	SPIE-Int Soc Opt Engineering	231	20.6
79	National Instruments Corp.	571	1081	52.8	IEEE	571	52.8	ACM-Assoc Comput Mach	134	12.4
80	Motorola Solutions Inc.	552	983	56.2	IEEE	552	56.2	ACM-Assoc Comput Mach	104	10.6



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	CREATIVE KINGDOMS LL	541	1634	33.1	IEEE	541	33.1	ACM-Assoc Comput Mach	447	27.4
82	Texas A&M University	524	609	86.0	IEEE	524	86.0	American Physical Society	13	2.1
83	Murata Manufacturing Co. Lt	521	676	77.1	IEEE	521	77.1	RELX Group (Elsevier)	23	3.4
84	Raytheon Co.	505	1266	39.9	IEEE	505	39.9	ACM-Assoc Comput Mach	132	10.4
85	Washington University in St.	504	1160	43.4	IEEE	504	43.4	ACM-Assoc Comput Mach	122	10.5
86	Math Works Inc (The)	492	1151	42.7	IEEE	492	42.7	ACM-Assoc Comput Mach	272	23.6
87	Industrial Techology Researc	490	907	54.0	IEEE	490	54.0	ACM-Assoc Comput Mach	86	9.5
88	ABB Ltd	487	748	65.1	IEEE	487	65.1	IVI Foundation/SCPI Consortium	93	12.4
89	RPX Corp	487	1232	39.5	IEEE	487	39.5	Internet Soc/IETF-Internet Eng Task Force	147	11.9
90	HRL Laboratories LLC	481	1004	47.9	IEEE	481	47.9	ACM-Assoc Comput Mach	93	9.3
91	EXEGY INC	473	907	52.1	IEEE	473	52.1	ACM-Assoc Comput Mach	141	15.5
92	InterDigital Inc	473	1148	41.2	IEEE	473	41.2	3GPP General Partnership Project Standards Body	319	27.8
93	Electronics and Telecommuni	455	1003	45.4	IEEE	455	45.4	ACM-Assoc Comput Mach	112	11.2
94	FireEye Inc	455	1106	41.1	IEEE	455	41.1	ACM-Assoc Comput Mach	208	18.8
95	SRI International	455	929	49.0	IEEE	455	49.0	ACM-Assoc Comput Mach	70	7.5
96	Symantec Corp.	453	1767	25.6	IEEE	453	25.6	ACM-Assoc Comput Mach	386	21.8
97	Digimarc Corp.	438	1219	35.9	IEEE	438	35.9	ACM-Assoc Comput Mach	188	15.4
98	INDIVIDUAL PATENTER	435	2096	20.8	IEEE	435	20.8	RELX Group (Elsevier)	270	12.9
99	Emerson Electric Co.	432	1430	30.2	IEEE	432	30.2	RELX Group (Elsevier)	121	8.5
100	Lenovo Group Ltd	419	878	47.7	IEEE	419	47.7	ACM-Assoc Comput Mach	121	13.8

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Computer Software</i>										
1	Microsoft Corporation	27119	78091	34.7	IEEE	27119	34.7	ACM-Assoc Comput Mach	21797	27.9
2	International Business Machi	14459	47207	30.6	IEEE	14459	30.6	ACM-Assoc Comput Mach	11035	23.4
3	Apple Inc	12986	29458	44.1	IEEE	12986	44.1	ACM-Assoc Comput Mach	6521	22.1
4	Google Inc.	7093	20820	34.1	IEEE	7093	34.1	ACM-Assoc Comput Mach	5701	27.4
5	Oracle Corporation	4043	15548	26.0	ACM-Assoc Comput Mach	5208	33.5	IEEE	4043	26.0
6	Siemens Aktiengesellschaft	3118	7573	41.2	IEEE	3118	41.2	SPIE-Int Soc Opt Engineering	908	12.0
7	Qualcomm Inc	3090	6086	50.8	IEEE	3090	50.8	ACM-Assoc Comput Mach	330	5.4
8	Xperi Corporation (Formerly	2932	4887	60.0	IEEE	2932	60.0	ACM-Assoc Comput Mach	331	6.8
9	Intel Corporation	2844	6285	45.3	IEEE	2844	45.3	ACM-Assoc Comput Mach	1261	20.1
10	Xerox Corp	2532	7368	34.4	IEEE	2532	34.4	ACM-Assoc Comput Mach	1579	21.4
11	HP Inc	2463	6497	37.9	IEEE	2463	37.9	ACM-Assoc Comput Mach	1380	21.2
12	Adobe Systems Inc.	2375	5859	40.5	IEEE	2375	40.5	ACM-Assoc Comput Mach	1963	33.5
13	AT&T Inc	2345	5829	40.2	IEEE	2345	40.2	ACM-Assoc Comput Mach	805	13.8
14	Nokia Corp	2228	5530	40.3	IEEE	2228	40.3	ACM-Assoc Comput Mach	570	10.3
15	Ricoh Co. Ltd.	2180	4648	46.9	IEEE	2180	46.9	ACM-Assoc Comput Mach	770	16.6
16	Cisco Systems Inc.	2010	6519	30.8	IEEE	2010	30.8	ACM-Assoc Comput Mach	1169	17.9
17	Dolby Laboratories Inc	1988	3569	55.7	IEEE	1988	55.7	Audio Eng Soc	622	17.4
18	Sap SE	1892	9044	20.9	ACM-Assoc Comput Mach	3273	36.2	IEEE	1892	20.9
19	Koninklijke Philips N.V.	1881	5848	32.2	IEEE	1881	32.2	RELX Group (Elsevier)	610	10.4
20	Cadence Design Systems Inc	1790	3727	48.0	IEEE	1790	48.0	Joint IEEE and ACM	1058	28.4
21	Digimarc Corp.	1698	4235	40.1	IEEE	1698	40.1	SPIE-Int Soc Opt Engineering	583	13.8
22	Broadcom Ltd	1694	3257	52.0	IEEE	1694	52.0	Joint IEEE and ACM	370	11.4
23	Sony Corp	1682	3462	48.6	IEEE	1682	48.6	ACM-Assoc Comput Mach	574	16.6
24	Cognex Corp.	1668	3783	44.1	IEEE	1668	44.1	RELX Group (Elsevier)	702	18.6
25	Synopsys Inc.	1566	5225	30.0	IEEE	1566	30.0	SPIE-Int Soc Opt Engineering	1269	24.3
26	Amazon.com Inc.	1503	6530	23.0	ACM-Assoc Comput Mach	1908	29.2	IEEE	1503	23.0
27	Irobot Corp	1460	2506	58.3	IEEE	1460	58.3	SPIE-Int Soc Opt Engineering	375	15.0
28	General Electric Company	1364	3229	42.2	IEEE	1364	42.2	RELX Group (Elsevier)	300	9.3
29	Verizon Communications Inc	1345	6825	19.7	ACM-Assoc Comput Mach	1663	24.4	IEEE	1345	19.7
30	Commvault Systems Inc.	1326	2013	65.9	IEEE	1326	65.9	ACM-Assoc Comput Mach	305	15.2
31	NEC Corp	1311	3018	43.4	IEEE	1311	43.4	ACM-Assoc Comput Mach	407	13.5
32	Applied Materials Inc.	1277	2195	58.2	IEEE	1277	58.2	American Institute of Physics	128	5.8
33	Accenture Ltd.	1244	3701	33.6	IEEE	1244	33.6	ACM-Assoc Comput Mach	587	15.9
34	Honeywell International Inc.	1217	2284	53.3	IEEE	1217	53.3	RELX Group (Elsevier)	183	8.0
35	Nuance Communications Inc	1200	3080	39.0	IEEE	1200	39.0	ISCA (International Speech Communication Association)	332	10.8
36	Blackberry Ltd.	1160	3118	37.2	IEEE	1160	37.2	ACM-Assoc Comput Mach	291	9.3
37	HRL Laboratories LLC	1145	2343	48.9	IEEE	1145	48.9	RELX Group (Elsevier)	223	9.5
38	PHOENIX SOLUTIONS INC	1070	3174	33.7	IEEE	1070	33.7	ISCA (International Speech Communication Association)	422	13.3
39	Raytheon Co.	957	1933	49.5	IEEE	957	49.5	SPIE-Int Soc Opt Engineering	156	8.1

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	MicroUnity Systems Enginee	941	1523	61.8	IEEE	941	61.8	Joint IEEE and ACM	140	9.2
41	LG Electronics Inc.	897	1902	47.2	IEEE	897	47.2	Audio Eng Soc	139	7.3
42	Honda Motor Co. Ltd.(Honda	891	1880	47.4	IEEE	891	47.4	RELX Group (Elsevier)	222	11.8
43	Canon Inc	879	2088	42.1	IEEE	879	42.1	ACM-Assoc Comput Mach	203	9.7
44	Samsung Electronics Co Ltd	860	1882	45.7	IEEE	860	45.7	ACM-Assoc Comput Mach	169	9.0
45	Ericsson	858	2605	32.9	IEEE	858	32.9	Internet Soc/IETF-Internet Eng Task Force	351	13.5
46	NVIDIA Corp.	857	2996	28.6	ACM-Assoc Comput Mach	1165	38.9	IEEE	857	28.6
47	STMicroelectronics	832	1327	62.7	IEEE	832	62.7	RELX Group (Elsevier)	70	5.3
48	Walt Disney Co.	819	3422	23.9	ACM-Assoc Comput Mach	1855	54.2	IEEE	819	23.9
49	eBay Inc	817	4389	18.6	IEEE	817	18.6	ACM-Assoc Comput Mach	555	12.6
50	Magna International Inc.	816	1321	61.8	IEEE	816	61.8	SAE-Society of Automobile Engineers	78	5.9
51	Panasonic Corporation	804	1629	49.4	IEEE	804	49.4	ACM-Assoc Comput Mach	110	6.8
52	ParkerVision Inc	792	1710	46.3	IEEE	792	46.3	IET/IEE	488	28.5
53	Dell Technologies Inc	788	3066	25.7	ACM-Assoc Comput Mach	1098	35.8	IEEE	788	25.7
54	Mitsubishi Electric Corp	755	1605	47.0	IEEE	755	47.0	ACM-Assoc Comput Mach	347	21.6
55	Intuitive Surgical Inc.	747	1229	60.8	IEEE	747	60.8	SAGES-Society of American Gastrointestinal and Endoscopic	71	5.8
56	Pelican Imaging Corporation	703	1524	46.1	IEEE	703	46.1	SPIE-Int Soc Opt Engineering	266	17.5
57	Facebook Inc	689	2776	24.8	ACM-Assoc Comput Mach	788	28.4	IEEE	689	24.8
58	Boeing Co. (The)	687	1930	35.6	IEEE	687	35.6	RELX Group (Elsevier)	239	12.4
59	Fujitsu Limited	679	1757	38.6	IEEE	679	38.6	Joint IEEE and ACM	330	18.8
60	Nant Holdings IP Llc	658	1821	36.1	IEEE	658	36.1	ACM-Assoc Comput Mach	478	26.2
61	Columbia University	655	1931	33.9	IEEE	655	33.9	ACM-Assoc Comput Mach	335	17.3
62	Tela Innovations inc	653	2031	32.2	SPIE-Int Soc Opt Engineering	697	34.3	IEEE	653	32.2
63	Hon Hai Precision Industry C	645	1405	45.9	IEEE	645	45.9	ACM-Assoc Comput Mach	136	9.7
64	BT Group PLC	635	1341	47.4	IEEE	635	47.4	ACM-Assoc Comput Mach	116	8.7
65	Technicolor SA	633	1251	50.6	IEEE	633	50.6	SPIE-Int Soc Opt Engineering	112	9.0
66	CenturyLink Inc	624	2549	24.5	ACM-Assoc Comput Mach	683	26.8	IEEE	624	24.5
67	Eastman Kodak Company	606	1373	44.1	IEEE	606	44.1	RELX Group (Elsevier)	130	9.5
68	Fraunhofer Gesellschaft	602	1240	48.5	IEEE	602	48.5	Audio Eng Soc	156	12.6
69	Texas Instruments Inc	599	884	67.8	IEEE	599	67.8	Joint IEEE and ACM	47	5.3
70	University of California	593	4071	14.6	IEEE	593	14.6	RELX Group (Elsevier)	496	12.2
71	Hewlett Packard Enterprises	592	1870	31.7	IEEE	592	31.7	ACM-Assoc Comput Mach	526	28.1
72	Solarflare Communications I	577	3784	15.2	ACM-Assoc Comput Mach	2211	58.4	Joint IEEE and ACM	794	21.0
73	Citrix Systems Inc	562	1788	31.4	IEEE	562	31.4	ACM-Assoc Comput Mach	310	17.3
74	Seiko Epson Corporation	551	1068	51.6	IEEE	551	51.6	ACM-Assoc Comput Mach	120	11.2
75	Massachusetts Institute of Te	545	2270	24.0	IEEE	545	24.0	RELX Group (Elsevier)	244	10.7
76	Intellectual Ventures Manage	540	1285	42.0	IEEE	540	42.0	ACM-Assoc Comput Mach	199	15.5
77	Xilinx Inc.	532	815	65.3	IEEE	532	65.3	Joint IEEE and ACM	133	16.3
78	Lockheed Martin Corp.	524	1146	45.7	IEEE	524	45.7	RELX Group (Elsevier)	115	10.0
79	Advanced Micro Devices Inc	509	1236	41.2	IEEE	509	41.2	ACM-Assoc Comput Mach	250	20.2
80	NOMADIX INC	497	1923	25.8	IEEE	497	25.8	Network Working Group RFC	307	16.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Hitachi Ltd	491	2256	21.8	IEEE	491	21.8	ACM-Assoc Comput Mach	380	16.8
82	Motorola Solutions Inc.	473	669	70.7	IEEE	473	70.7	Springer/Sp. Wien/Springer-Verlag/KluwAcad	18	2.7
83	INDIVIDUAL PATENTER	463	2043	22.7	IEEE	463	22.7	ACM-Assoc Comput Mach	274	13.4
84	Toshiba Corp	461	1062	43.4	IEEE	461	43.4	ACM-Assoc Comput Mach	93	8.8
85	Georgia Institute of Technolo	456	637	71.6	IEEE	456	71.6	ACM-Assoc Comput Mach	44	6.9
86	United States Navy	454	949	47.8	IEEE	454	47.8	SPIE-Int Soc Opt Engineering	74	7.8
87	Marvell Technology Group Lt	451	616	73.2	IEEE	451	73.2	ACM-Assoc Comput Mach	31	5.0
88	Math Works Inc (The)	437	974	44.9	IEEE	437	44.9	ACM-Assoc Comput Mach	187	19.2
89	Battelle Memorial Institute	435	651	66.8	IEEE	435	66.8	RELX Group (Elsevier)	61	9.4
90	Bosch (Robert) GmbH	430	3408	12.6	IEEE	430	12.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	353	10.4
91	TiVo Corp	418	1469	28.5	IEEE	418	28.5	ACM-Assoc Comput Mach	236	16.1
92	Huawei Technologies Compa	410	1275	32.2	IEEE	410	32.2	Internet Soc/IETF-Internet Eng Task Force	144	11.3
93	Harris Corp.	409	710	57.6	IEEE	409	57.6	Internet Soc/IETF-Internet Eng Task Force	74	10.4
94	JPMorgan	408	4447	9.2	Source Media	918	20.6	ACS-Am Chem Soc	419	9.4
95	VirnetX Holding Corp	400	6013	6.7	Network Working Group RFC	2794	46.5	Internet Soc/IETF-Internet Eng Task Force	1180	19.6
96	Cortica Ltd	399	546	73.1	IEEE	399	73.1	ACM-Assoc Comput Mach	59	10.8
97	Netapp Inc	396	3043	13.0	ACM-Assoc Comput Mach	1454	47.8	The USENIX Association	531	17.4
98	AVISTAR COMMUNICATI	386	773	49.9	IEEE	386	49.9	ACM-Assoc Comput Mach	228	29.5
99	INTOUCH HEALTH INC	384	819	46.9	IEEE	384	46.9	RELX Group (Elsevier)	40	4.9
100	Sonos Inc	384	930	41.3	IEEE	384	41.3	SPIE-Int Soc Opt Engineering	137	14.7

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Cybersecurity</i>										
1	Microsoft Corporation	6159	20345	30.3	IEEE	6159	30.3	ACM-Assoc Comput Mach	5011	24.6
2	International Business Machi	4007	15287	26.2	IEEE	4007	26.2	ACM-Assoc Comput Mach	3468	22.7
3	Cisco Systems Inc.	2347	8517	27.6	IEEE	2347	27.6	Internet Soc/IETF-Internet Eng Task Force	1293	15.2
4	Blackberry Ltd.	1626	5919	27.5	IEEE	1626	27.5	Internet Soc/IETF-Internet Eng Task Force	642	10.8
5	Intel Corporation	1602	3981	40.2	IEEE	1602	40.2	ACM-Assoc Comput Mach	461	11.6
6	Google Inc.	1483	4787	31.0	IEEE	1483	31.0	ACM-Assoc Comput Mach	1017	21.2
7	Oracle Corporation	1420	6258	22.7	IEEE	1420	22.7	ACM-Assoc Comput Mach	1408	22.5
8	Intertrust Technologies Corp	1417	9125	15.5	ACM-Assoc Comput Mach	1662	18.2	IEEE	1417	15.5
9	Wisteria Trading Inc	1212	2372	51.1	IEEE	1212	51.1	SPIE-Int Soc Opt Engineering	272	11.5
10	Columbia University	1133	4099	27.6	IEEE	1133	27.6	ACM-Assoc Comput Mach	864	21.1
11	AT&T Inc	1041	2750	37.9	IEEE	1041	37.9	ACM-Assoc Comput Mach	343	12.5
12	McAfee Inc	989	3770	26.2	IEEE	989	26.2	ACM-Assoc Comput Mach	794	21.1
13	Nokia Corp	958	4067	23.6	IEEE	958	23.6	3GPP General Partnership Project Standards Body	844	20.8
14	FireEye Inc	917	2158	42.5	IEEE	917	42.5	ACM-Assoc Comput Mach	433	20.1
15	Verizon Communications Inc	914	3560	25.7	IEEE	914	25.7	Internet Soc/IETF-Internet Eng Task Force	650	18.3
16	Apple Inc	897	2018	44.4	IEEE	897	44.4	ACM-Assoc Comput Mach	408	20.2
17	Massachusetts Institute of Te	885	1272	69.6	IEEE	885	69.6	ACM-Assoc Comput Mach	141	11.1
18	Citrix Systems Inc	883	2573	34.3	IEEE	883	34.3	ACM-Assoc Comput Mach	309	12.0
19	Digimarc Corp.	813	2143	37.9	IEEE	813	37.9	SPIE-Int Soc Opt Engineering	192	9.0
20	Qualcomm Inc	812	3174	25.6	3GPP General Partnership Project Standards	818	25.8	IEEE	812	25.6
21	X ONE INC	806	1770	45.5	IEEE	806	45.5	ACM-Assoc Comput Mach	343	19.4
22	InterDigital Inc	705	2893	24.4	3GPP General Partnership Project Standards	1856	64.2	IEEE	705	24.4
23	Symantec Corp.	641	2344	27.3	IEEE	641	27.3	ACM-Assoc Comput Mach	504	21.5
24	Juniper Networks Inc.	627	1350	46.4	IEEE	627	46.4	Internet Soc/IETF-Internet Eng Task Force	265	19.6
25	Dell Technologies Inc	617	2477	24.9	ACM-Assoc Comput Mach	750	30.3	IEEE	617	24.9
26	Broadcom Ltd	616	1671	36.9	IEEE	616	36.9	Network Working Group RFC	269	16.1
27	Marvell Technology Group Lt	595	875	68.0	IEEE	595	68.0	ACM-Assoc Comput Mach	57	6.5
28	Xerox Corp	580	1486	39.0	IEEE	580	39.0	ACM-Assoc Comput Mach	523	35.2
29	Ericsson	573	3155	18.2	3GPP General Partnership Project Standards	892	28.3	IEEE	573	18.2
30	Verance Corp	570	1061	53.7	IEEE	570	53.7	SPIE-Int Soc Opt Engineering	135	12.7
31	NOMADIX INC	568	2164	26.2	IEEE	568	26.2	Network Working Group RFC	354	16.4
32	Sony Corp	564	1488	37.9	IEEE	564	37.9	ACM-Assoc Comput Mach	173	11.6
33	Amazon.com Inc.	522	1844	28.3	IEEE	522	28.3	ACM-Assoc Comput Mach	386	20.9
34	HP Inc	521	2080	25.0	IEEE	521	25.0	Internet Soc/IETF-Internet Eng Task Force	358	17.2
35	VirnetX Holding Corp	503	8565	5.9	Network Working Group RFC	4279	50.0	Internet Soc/IETF-Internet Eng Task Force	1492	17.4
36	IP RESERVOIR LLC	492	876	56.2	IEEE	492	56.2	ACM-Assoc Comput Mach	134	15.3
37	Raytheon Co.	489	1605	30.5	IEEE	489	30.5	ACM-Assoc Comput Mach	224	14.0
38	Extreme Networks Inc	473	1024	46.2	IEEE	473	46.2	ACM-Assoc Comput Mach	127	12.4
39	Headwater Partners 1 LLC	453	1016	44.6	IEEE	453	44.6	ACM-Assoc Comput Mach	216	21.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Huawei Technologies Compa	409	2164	18.9	3GPP General Partnership Project Standards	636	29.4	IEEE	409	18.9
41	Samsung Electronics Co Ltd	392	1012	38.7	IEEE	392	38.7	3GPP General Partnership Project Standards Body	168	16.6
42	Harris Corp.	381	633	60.2	IEEE	381	60.2	RELX Group (Elsevier)	52	8.2
43	Assa Abloy AB	361	1922	18.8	International Association for Cryptologic Rese	371	19.3	IEEE	361	18.8
44	Ricoh Co. Ltd.	355	902	39.4	IEEE	355	39.4	ACM-Assoc Comput Mach	203	22.5
45	Fortinet Inc	350	684	51.2	IEEE	350	51.2	ACM-Assoc Comput Mach	126	18.4
46	Commvault Systems Inc.	349	541	64.5	IEEE	349	64.5	ACM-Assoc Comput Mach	90	16.6
47	Security First Corp	335	1056	31.7	IEEE	335	31.7	ACM-Assoc Comput Mach	309	29.3
48	TANGIS CORP	331	479	69.1	IEEE	331	69.1	ACM-Assoc Comput Mach	85	17.7
49	DAMBALLA INC	304	1124	27.0	IEEE	304	27.0	ACM-Assoc Comput Mach	292	26.0
50	Silverbrook Pty Ltd	293	564	52.0	IEEE	293	52.0	RELX Group (Elsevier)	150	26.6
51	LG Electronics Inc.	288	1033	27.9	3GPP General Partnership Project Standards	429	41.5	IEEE	288	27.9
52	Motorola Solutions Inc.	285	586	48.6	IEEE	285	48.6	Network Working Group RFC	60	10.2
53	Fujitsu Limited	278	853	32.6	IEEE	278	32.6	ACM-Assoc Comput Mach	111	13.0
54	ConvergeOne Inc	269	843	31.9	IEEE	269	31.9	ACM-Assoc Comput Mach	168	19.9
55	Duchossois Group Inc	262	758	34.6	IEEE	262	34.6	International Association for Cryptologic Research (IACR)	120	15.8
56	Toshiba Corp	246	1334	18.4	AACS-Advanced Access Content System	299	22.4	IEEE	246	18.4
57	Sap SE	242	885	27.3	ACM-Assoc Comput Mach	268	30.3	IEEE	242	27.3
58	CONVERGENT MEDIA SO	240	954	25.2	ACM-Assoc Comput Mach	257	26.9	IEEE	240	25.2
59	Rambus Inc.	235	812	28.9	IEEE	235	28.9	International Association for Cryptologic Research (IACR)	213	26.2
60	NXP Semiconductors NV	225	359	62.7	IEEE	225	62.7	ACM-Assoc Comput Mach	25	7.0
61	BLACK HILLS MEDIA LLC	222	861	25.8	Open Connectivity Foundation	412	47.9	IEEE	222	25.8
62	Nippon Telegraph & Telepho	217	1604	13.5	International Association for Cryptologic Rese	382	23.8	IEEE	217	13.5
63	NEC Corp	210	1080	19.4	3GPP General Partnership Project Standards	258	23.9	IEEE	210	19.4
64	Panasonic Corporation	202	833	24.2	IEEE	202	24.2	Internet Soc/IETF-Internet Eng Task Force	136	16.3
65	Quest Software Inc	197	396	49.7	IEEE	197	49.7	ACM-Assoc Comput Mach	88	22.2
66	Western Digital Corp.	196	632	31.0	IEEE	196	31.0	ACM-Assoc Comput Mach	69	10.9
67	ARRIS Group Inc	195	341	57.2	IEEE	195	57.2	Internet Soc/IETF-Internet Eng Task Force	29	8.5
68	West Corp	195	407	47.9	IEEE	195	47.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	48	11.8
69	Softbank Corp	188	578	32.5	IEEE	188	32.5	ACM-Assoc Comput Mach	61	10.6
70	PRISM TECHNOLOGIES L	186	1046	17.8	IEEE	186	17.8	Internet Soc/IETF-Internet Eng Task Force	183	17.5
71	Arizona State University	184	429	42.9	IEEE	184	42.9	ACM-Assoc Comput Mach	125	29.1
72	RPX Corp	184	748	24.6	Internet Soc/IETF-Internet Eng Task Force	208	27.8	IEEE	184	24.6
73	Facebook Inc	183	714	25.6	ACM-Assoc Comput Mach	217	30.4	IEEE	183	25.6
74	ODYSSEY WIRELESS INC	180	207	87.0	IEEE	180	87.0	3GPP General Partnership Project Standards Body	5	2.4
75	BLUERISC INC	177	498	35.5	IEEE	177	35.5	Joint IEEE and ACM	120	24.1
76	Electronics and Telecommuni	176	368	47.8	IEEE	176	47.8	International Association for Cryptologic Research (IACR)	31	8.4
77	TRILLIANT NETWORKS I	174	272	64.0	IEEE	174	64.0	Internet Soc/IETF-Internet Eng Task Force	17	6.3
78	JPMorgan	173	943	18.3	IEEE	173	18.3	Source Media	87	9.2
79	Via Technologies Inc.	173	300	57.7	IEEE	173	57.7	Joint IEEE and ACM	34	11.3
80	Lockheed Martin Corp.	172	323	53.3	IEEE	172	53.3	ACM-Assoc Comput Mach	21	6.5

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	ARC DEVICES LTD	168	623	27.0	ACM-Assoc Comput Mach	284	45.6	IEEE	168	27.0
82	Adidas AG	166	194	85.6	IEEE	166	85.6	RELX Group (Elsevier)	9	4.6
83	EICES RESEARCH INC	166	276	60.1	IEEE	166	60.1	3GPP General Partnership Project Standards Body	30	10.9
84	WEST VIEW RESEARCH L	162	353	45.9	IEEE	162	45.9	SAE-Society of Automobile Engineers	36	10.2
85	Canon Inc	161	437	36.8	IEEE	161	36.8	ACM-Assoc Comput Mach	49	11.2
86	UNIVERSIDADE DO PORT	160	195	82.1	IEEE	160	82.1	ACM-Assoc Comput Mach	23	11.8
87	Siemens Aktiengesellschaft	159	554	28.7	IEEE	159	28.7	Internet Soc/IETF-Internet Eng Task Force	82	14.8
88	Netapp Inc	152	742	20.5	The USENIX Association	163	22.0	ACM-Assoc Comput Mach	155	20.9
89	NXGEN PARTNERS IP LLC	147	231	63.6	IEEE	147	63.6	Optical Society of America	46	19.9
90	Global Tel Link Corp	145	227	63.9	IEEE	145	63.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	11	4.8
91	FINJAN INC	144	579	24.9	Virus Bulletin Ltd	145	25.0	IEEE	144	24.9
92	Micro Focus International PL	142	401	35.4	IEEE	142	35.4	ACM-Assoc Comput Mach	64	16.0
93	Solarflare Communications I	142	943	15.1	ACM-Assoc Comput Mach	546	57.9	Joint IEEE and ACM	205	21.7
94	Telefonica SA	142	186	76.3	IEEE	142	76.3	ACM-Assoc Comput Mach	20	10.8
95	Honeywell International Inc.	140	295	47.5	IEEE	140	47.5	Internet Soc/IETF-Internet Eng Task Force	31	10.5
96	Accenture Ltd.	139	394	35.3	IEEE	139	35.3	ACM-Assoc Comput Mach	115	29.2
97	Sonicwall Inc	139	569	24.4	ACM-Assoc Comput Mach	235	41.3	IEEE	139	24.4
98	VerintSys	139	820	17.0	International Data Group	198	24.1	ACM-Assoc Comput Mach	192	23.4
99	AUDIBLE MAGIC CORP	138	270	51.1	IEEE	138	51.1	MIT Press	32	11.9
100	Qinetiq Group Ltd	137	379	36.1	IEEE	137	36.1	American Institute of Physics	66	17.4

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Diagnosis/Surgery/Medical Instruments</i>										
1	Medtronic Inc	9968	1E+05	8.2	RELX Group (Elsevier)	20511	16.8	Lippincott Williams & Wilkins Ltd.	15309	12.5
2	Boston Scientific Corp.	4479	70270	6.4	RELX Group (Elsevier)	19535	27.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	7160	10.2
3	Dexcom Inc	4121	64779	6.4	RELX Group (Elsevier)	16496	25.5	American Diabetes Association	6768	10.4
4	Abbott Laboratories	3426	74700	4.6	RELX Group (Elsevier)	18114	24.2	ACS-Am Chem Soc	7474	10.0
5	Intuitive Surgical Inc.	2984	6148	48.5	IEEE	2984	48.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	335	5.4
6	Johnson & Johnson	1981	39017	5.1	RELX Group (Elsevier)	7760	19.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3596	9.2
7	Partners HealthCare Systems	1764	21480	8.2	Optical Society of America	5579	26.0	RELX Group (Elsevier)	3306	15.4
8	The Invention Science Fund	1599	10769	14.8	IEEE	1599	14.8	RELX Group (Elsevier)	1238	11.5
9	Koninklijke Philips N.V.	1335	9316	14.3	IEEE	1335	14.3	RELX Group (Elsevier)	1231	13.2
10	Massachusetts Institute of Te	1319	5363	24.6	IEEE	1319	24.6	RELX Group (Elsevier)	1159	21.6
11	Siemens Aktiengesellschaft	1297	4487	28.9	IEEE	1297	28.9	RELX Group (Elsevier)	532	11.9
12	GUIDED THERAPY SYSTE	995	2698	36.9	IEEE	995	36.9	RELX Group (Elsevier)	387	14.3
13	Smith & Nephew Plc.	975	13393	7.3	RELX Group (Elsevier)	2818	21.0	Lippincott Williams & Wilkins Ltd.	1209	9.0
14	General Electric Company	955	4860	19.7	IEEE	955	19.7	RELX Group (Elsevier)	698	14.4
15	LivaNova Plc	892	12560	7.1	RELX Group (Elsevier)	2510	20.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1739	13.8
16	Stryker Corp.	891	6119	14.6	RELX Group (Elsevier)	1012	16.5	IEEE	891	14.6
17	Masimo Corp	823	2079	39.6	IEEE	823	39.6	Lippincott Williams & Wilkins Ltd.	199	9.6
18	VIVAQUANT LLC	729	1169	62.4	IEEE	729	62.4	RELX Group (Elsevier)	91	7.8
19	University of California	655	7364	8.9	RELX Group (Elsevier)	1371	18.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	695	9.4
20	Stanford University	624	9979	6.3	RELX Group (Elsevier)	1605	16.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	841	8.4
21	BIONX MEDICAL TECHN	617	1262	48.9	IEEE	617	48.9	RELX Group (Elsevier)	207	16.4
22	Sotera Wireless	533	1028	51.8	IEEE	533	51.8	Springer/Sp. Wien/Springer-Verlag/KluwAcad	175	17.0
23	Vanderbilt University	484	1701	28.5	IEEE	484	28.5	RELX Group (Elsevier)	239	14.1
24	Cleveland Clinic (and Found	478	2718	17.6	RELX Group (Elsevier)	554	20.4	IEEE	478	17.6
25	MIRAMAR LABS INC	471	1115	42.2	IEEE	471	42.2	IOP Publishing	105	9.4
26	Columbia University	468	1854	25.2	IEEE	468	25.2	RELX Group (Elsevier)	358	19.3
27	University of Nebraska	463	1824	25.4	IEEE	463	25.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	282	15.5
28	BUTTERFLY NETWORKS I	461	522	88.3	IEEE	461	88.3	Acoustical Society of America	28	5.4
29	Google Inc.	451	936	48.2	IEEE	451	48.2	RELX Group (Elsevier)	111	11.9
30	IWALK INC	384	1017	37.8	IEEE	384	37.8	RELX Group (Elsevier)	207	20.4
31	BIO CONTROL MEDICAL (	383	1409	27.2	IEEE	383	27.2	Lippincott Williams & Wilkins Ltd.	221	15.7
32	Maui Diagnostic Imaging	364	459	79.3	IEEE	364	79.3	RELX Group (Elsevier)	28	6.1
33	University of Michigan	362	4544	8.0	RELX Group (Elsevier)	1176	25.9	IEEE	362	8.0
34	University of Texas	349	5057	6.9	RELX Group (Elsevier)	936	18.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	532	10.5
35	Ossur hf	323	1060	30.5	IEEE	323	30.5	RELX Group (Elsevier)	247	23.3
36	Johns Hopkins University	309	1870	16.5	IEEE	309	16.5	RELX Group (Elsevier)	282	15.1
37	University Health Network	309	680	45.4	IEEE	309	45.4	RELX Group (Elsevier)	86	12.6
38	Nyxoah SA	304	638	47.6	IEEE	304	47.6	RELX Group (Elsevier)	70	11.0
39	BIOSENSORS INTERNATI	301	968	31.1	IEEE	301	31.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	141	14.6



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Novartis AG	301	6822	4.4	RELX Group (Elsevier)	2043	29.9	Association for Research in Vision and Ophthalmology	557	8.2
41	University of Illinois	297	4131	7.2	ACS-Am Chem Soc	590	14.3	RELX Group (Elsevier)	538	13.0
42	University of Washington	293	2817	10.4	RELX Group (Elsevier)	551	19.6	IEEE	293	10.4
43	Cirrus Logic Inc.	290	407	71.3	IEEE	290	71.3	Acoustical Society of America	40	9.8
44	Bonutti Technologies LLC	286	1725	16.6	Springer/Sp. Wien/Springer-Verlag/KluwAca	397	23.0	RELX Group (Elsevier)	296	17.2
45	KONA MEDICAL INC	281	1806	15.6	RELX Group (Elsevier)	476	26.4	IEEE	281	15.6
46	Medispectra Inc	279	753	37.1	IEEE	279	37.1	RELX Group (Elsevier)	83	11.0
47	Becton Dickinson and Co.	277	18331	1.5	RELX Group (Elsevier)	3153	17.2	Wolters Kluwer	2777	15.1
48	Concormis Inc	277	7958	3.5	Springer/Sp. Wien/Springer-Verlag/KluwAca	1324	16.6	RELX Group (Elsevier)	992	12.5
49	University of Pittsburgh	268	2484	10.8	RELX Group (Elsevier)	619	24.9	IEEE	268	10.8
50	HIGHLAND INSTRUMENT	265	421	62.9	IEEE	265	62.9	RELX Group (Elsevier)	29	6.9
51	AngioDynamics Inc.	258	2779	9.3	RELX Group (Elsevier)	631	22.7	IEEE	258	9.3
52	California Institute of Techno	258	1809	14.3	RELX Group (Elsevier)	308	17.0	IEEE	258	14.3
53	BRAINGATE CO LLC	251	672	37.4	IEEE	251	37.4	RELX Group (Elsevier)	101	15.0
54	Mevion Medical Systems Inc	243	698	34.8	IEEE	243	34.8	RELX Group (Elsevier)	122	17.5
55	Proteus Biomedical Inc	236	988	23.9	IEEE	236	23.9	RELX Group (Elsevier)	188	19.0
56	University of Florida	235	1242	18.9	IEEE	235	18.9	RELX Group (Elsevier)	231	18.6
57	University of Pennsylvania	231	4196	5.5	RELX Group (Elsevier)	665	15.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	480	11.4
58	Elwha LLC	224	1059	21.2	IEEE	224	21.2	RELX Group (Elsevier)	105	9.9
59	Valencell Inc	222	488	45.5	IEEE	222	45.5	RELX Group (Elsevier)	31	6.4
60	HEMOSONICS LLC	220	426	51.6	IEEE	220	51.6	RELX Group (Elsevier)	45	10.6
61	Asahi Kasei Corp.	215	2390	9.0	Lippincott Williams & Wilkins Ltd.	649	27.2	RELX Group (Elsevier)	390	16.3
62	University of Minnesota (The	214	1692	12.6	RELX Group (Elsevier)	367	21.7	IEEE	214	12.6
63	FACENSE LTD	208	234	88.9	IEEE	208	88.9	ACM-Assoc Comput Mach	26	11.1
64	INDIVIDUAL PATENTER	203	6134	3.3	RELX Group (Elsevier)	1388	22.6	Lippincott Williams & Wilkins Ltd.	706	11.5
65	Varian Medical Systems Inc.	199	2193	9.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	593	27.0	RELX Group (Elsevier)	516	23.5
66	Nevro Corp	194	1521	12.8	Lippincott Williams & Wilkins Ltd.	354	23.3	IEEE	194	12.8
67	Hologic Inc	187	3279	5.7	RELX Group (Elsevier)	682	20.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	498	15.2
68	CLINICAL DECISION SUPP	183	865	21.2	RELX Group (Elsevier)	189	21.8	IEEE	183	21.2
69	GEARBOX LLC	178	669	26.6	IEEE	178	26.6	RELX Group (Elsevier)	60	9.0
70	Medrobotics Corp	177	377	46.9	IEEE	177	46.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	76	20.2
71	SRI International	175	315	55.6	IEEE	175	55.6	RELX Group (Elsevier)	25	7.9
72	Bardy Diagnostics Inc	173	313	55.3	IEEE	173	55.3	RELX Group (Elsevier)	47	15.0
73	Impulse Dynamics N.V.	171	2142	8.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	339	15.8	Lippincott Williams & Wilkins Ltd.	308	14.4
74	St. Louis University	171	1150	14.9	Lippincott Williams & Wilkins Ltd.	220	19.1	American Association of Neurological Surgeons	188	16.3
75	Virginia Tech University	170	743	22.9	IEEE	170	22.9	RELX Group (Elsevier)	129	17.4
76	Lockheed Martin Corp.	167	1688	9.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	183	10.8	RELX Group (Elsevier)	179	10.6
77	PHYSIOWAVE INC	166	266	62.4	IEEE	166	62.4	Lippincott Williams & Wilkins Ltd.	29	10.9
78	Victhom Human Bionics Inc	166	352	47.2	IEEE	166	47.2	RELX Group (Elsevier)	86	24.4
79	Hitachi Ltd	163	634	25.7	IEEE	163	25.7	RELX Group (Elsevier)	69	10.9
80	Washington University in St.	163	1704	9.6	RELX Group (Elsevier)	252	14.8	Lippincott Williams & Wilkins Ltd.	174	10.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Case Western Reserve Univer	161	558	28.9	IEEE	161	28.9	RELX Group (Elsevier)	64	11.5
82	Samsung Electronics Co Ltd	159	325	48.9	IEEE	159	48.9	RELX Group (Elsevier)	31	9.5
83	Northwestern University	153	1931	7.9	RELX Group (Elsevier)	339	17.6	American Institute of Physics	296	15.3
84	United States Department of	153	688	22.2	IEEE	153	22.2	RELX Group (Elsevier)	151	21.9
85	University of Virginia (and P	153	883	17.3	RELX Group (Elsevier)	153	17.3	IEEE	153	17.3
86	Bayer AG	150	1558	9.6	RELX Group (Elsevier)	264	16.9	Lippincott Williams & Wilkins Ltd.	205	13.2
87	NEUROVISTA CORP	150	1143	13.1	RELX Group (Elsevier)	335	29.3	IEEE	150	13.1
88	Georgia Institute of Technolo	147	1008	14.6	RELX Group (Elsevier)	184	18.3	IEEE	147	14.6
89	Sonova Holding AG	146	862	16.9	IEEE	146	16.9	RELX Group (Elsevier)	131	15.2
90	MC10 Inc	143	1303	11.0	American Institute of Physics	319	24.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	156	12.0
91	ALGODYNE LTD	140	248	56.5	IEEE	140	56.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	40	16.1
92	University of Wisconsin	140	1900	7.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	381	20.1	RELX Group (Elsevier)	215	11.3
93	BLUEWIND MEDICAL LT	138	217	63.6	IEEE	138	63.6	American Physiological Society	20	9.2
94	Electrocor Llc	138	570	24.2	IEEE	138	24.2	Natl Acad Sciences	72	12.6
95	Mayo Foundation for Medica	138	2144	6.4	RELX Group (Elsevier)	453	21.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	259	12.1
96	Fuji Film Holdings Corp	135	434	31.1	IEEE	135	31.1	RELX Group (Elsevier)	62	14.3
97	Nuvasive Inc	132	5656	2.3	Lippincott Williams & Wilkins Ltd.	2949	52.1	RELX Group (Elsevier)	670	11.8
98	Duke University	130	1409	9.2	RELX Group (Elsevier)	237	16.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	188	13.3
99	United States of America De	127	306	41.5	IEEE	127	41.5	RELX Group (Elsevier)	42	13.7
100	Zimmer Biomet Holdings	127	8935	1.4	RELX Group (Elsevier)	1901	21.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1075	12.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Information Storage</i>										
1	Micron Technology Inc.	14753	30298	48.7	IEEE	14753	48.7	RELX Group (Elsevier)	4621	15.3
2	Western Digital Corp.	6004	10956	54.8	IEEE	6004	54.8	American Institute of Physics	1191	10.9
3	International Business Machi	4451	12354	36.0	IEEE	4451	36.0	ACM-Assoc Comput Mach	2138	17.3
4	ZENO SEMICONDUCTOR I	3360	4326	77.7	IEEE	3360	77.7	IEEE/JPN Soc App Phys	823	19.0
5	Broadcom Ltd	2527	3112	81.2	IEEE	2527	81.2	ACM-Assoc Comput Mach	129	4.1
6	Macronix International Co. L	2458	4292	57.3	IEEE	2458	57.3	IEEE/JPN Soc App Phys	823	19.2
7	Conversant Intellectual Prope	2202	2677	82.3	IEEE	2202	82.3	IEEE/JPN Soc App Phys	199	7.4
8	Semiconductor Energy Labor	2107	18966	11.1	SID-Society for Information Display	6164	32.5	American Institute of Physics	2976	15.7
9	Rambus Inc.	1992	3319	60.0	IEEE	1992	60.0	JEDEC Semiconductor Standards Organization	265	8.0
10	Seagate Technology Plc	1978	4940	40.0	IEEE	1978	40.0	American Institute of Physics	1030	20.9
11	Toshiba Corp	1607	3494	46.0	IEEE	1607	46.0	American Institute of Physics	427	12.2
12	Innovative Silicon SA	1580	1959	80.7	IEEE	1580	80.7	RELX Group (Elsevier)	84	4.3
13	Apple Inc	1341	2034	65.9	IEEE	1341	65.9	Joint IEEE and ACM	122	6.0
14	Intel Corporation	1263	2895	43.6	IEEE	1263	43.6	Joint IEEE and ACM	428	14.8
15	Texas Instruments Inc	998	1361	73.3	IEEE	998	73.3	United Business Media/UBM Tech	79	5.8
16	Cypress Semiconductor Corp.	980	1195	82.0	IEEE	980	82.0	American Institute of Physics	64	5.4
17	Hitachi Ltd	957	2308	41.5	IEEE	957	41.5	ACM-Assoc Comput Mach	192	8.3
18	Innovative Network Corporat	949	1289	73.6	IEEE	949	73.6	IEEE/JPN Soc App Phys	93	7.2
19	ATTOPSEMI TECHNOLOG	944	1205	78.3	IEEE	944	78.3	IEEE/JPN Soc App Phys	174	14.4
20	Oracle Corporation	773	2723	28.4	ACM-Assoc Comput Mach	1075	39.5	IEEE	773	28.4
21	Netapp Inc	653	2816	23.2	ACM-Assoc Comput Mach	1198	42.5	IEEE	653	23.2
22	Samsung Electronics Co Ltd	651	1753	37.1	IEEE	651	37.1	American Institute of Physics	201	11.5
23	TDK Corporation	619	1796	34.5	IEEE	619	34.5	American Institute of Physics	415	23.1
24	Microsoft Corporation	602	2692	22.4	ACM-Assoc Comput Mach	997	37.0	IEEE	602	22.4
25	NXP Semiconductors NV	546	787	69.4	IEEE	546	69.4	Joint IEEE and ACM	65	8.3
26	MONOLITHIC 3D INC	489	894	54.7	IEEE	489	54.7	IEEE/JPN Soc App Phys	93	10.4
27	Qualcomm Inc	487	785	62.0	IEEE	487	62.0	Joint IEEE and ACM	71	9.0
28	Marvell Technology Group Lt	482	644	74.8	IEEE	482	74.8	ECMA International	34	5.3
29	Commvault Systems Inc.	477	744	64.1	IEEE	477	64.1	ACM-Assoc Comput Mach	124	16.7
30	Synopsys Inc.	472	935	50.5	IEEE	472	50.5	American Institute of Physics	134	14.3
31	HP Inc	468	1487	31.5	IEEE	468	31.5	ACM-Assoc Comput Mach	269	18.1
32	Infineon Technologies AG	449	712	63.1	IEEE	449	63.1	IEEE/JPN Soc App Phys	72	10.1
33	Fujitsu Limited	436	809	53.9	IEEE	436	53.9	American Institute of Physics	76	9.4
34	Avid Technology Inc.	435	844	51.5	IEEE	435	51.5	ACM-Assoc Comput Mach	269	31.9
35	STMicroelectronics	430	638	67.4	IEEE	430	67.4	RELX Group (Elsevier)	38	6.0
36	Dell Technologies Inc	419	1302	32.2	IEEE	419	32.2	ACM-Assoc Comput Mach	407	31.3
37	BTG Plc.	385	510	75.5	IEEE	385	75.5	IEEE/JPN Soc App Phys	52	10.2
38	Sony Corp	375	896	41.9	IEEE	375	41.9	Institute of Pure and Applied Physics	55	6.1
39	Mitsubishi Electric Corp	337	618	54.5	IEEE	337	54.5	ECMA International	99	16.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Microchip Technology Inc.	317	376	84.3	IEEE	317	84.3	IEEE/JPN Soc App Phys	16	4.3
41	Intertrust Technologies Corp	315	1918	16.4	ACM-Assoc Comput Mach	387	20.2	IEEE	315	16.4
42	Massachusetts Institute of Te	299	496	60.3	IEEE	299	60.3	ACM-Assoc Comput Mach	54	10.9
43	QST Holdings Llc	289	485	59.6	IEEE	289	59.6	Joint IEEE and ACM	56	11.5
44	Crossbar Inc	286	1112	25.7	IEEE	286	25.7	American Institute of Physics	152	13.7
45	Softbank Corp	282	486	58.0	IEEE	282	58.0	Joint IEEE and ACM	97	20.0
46	Densbits Technologies Ltd	271	502	54.0	IEEE	271	54.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	78	15.5
47	Panasonic Corporation	269	854	31.5	IEEE	269	31.5	Institute of Pure and Applied Physics	103	12.1
48	Taiwan Semiconductor Manu	268	363	73.8	IEEE	268	73.8	IEEE/JPN Soc App Phys	49	13.5
49	Intellectual Ventures Manage	262	292	89.7	IEEE	262	89.7	ACM-Assoc Comput Mach	23	7.9
50	California Institute of Techno	255	381	66.9	IEEE	255	66.9	AAAS-Am Assoc Advancement Sci	18	4.7
51	Advanced Micro Devices Inc	254	721	35.2	IEEE	254	35.2	Joint IEEE and ACM	131	18.2
52	Nantero Inc	236	2241	10.5	ACS-Am Chem Soc	580	25.9	American Institute of Physics	502	22.4
53	NEC Corp	230	575	40.0	IEEE	230	40.0	American Institute of Physics	99	17.2
54	Cirrus Logic Inc.	222	265	83.8	IEEE	222	83.8	Institute of Business Admistration (IBA) and IEEE	8	3.0
55	ConvergeOne Inc	220	410	53.7	IEEE	220	53.7	Joint IEEE and ACM	82	20.0
56	Google Inc.	219	528	41.5	IEEE	219	41.5	ACM-Assoc Comput Mach	174	33.0
57	Xilinx Inc.	214	301	71.1	IEEE	214	71.1	Joint IEEE and ACM	28	9.3
58	SK Hynix Inc	196	294	66.7	IEEE	196	66.7	Joint IEEE and ACM	22	7.5
59	Netlist Inc	193	847	22.8	IP.Com	251	29.6	JEDEC Semiconductor Standards Organization	219	25.9
60	Hon Hai Precision Industry C	187	448	41.7	IEEE	187	41.7	American Institute of Physics	61	13.6
61	PACT XPP TECHNOLOGIE	158	273	57.9	IEEE	158	57.9	ACM-Assoc Comput Mach	24	8.8
62	Pioneer Corp.	150	593	25.3	SPIE-Int Soc Opt Engineering	219	36.9	IEEE	150	25.3
63	Global Foundries Inc	145	244	59.4	IEEE	145	59.4	Joint IEEE and ACM	18	7.4
64	Avalanche Technology Inc	143	650	22.0	American Institute of Physics	202	31.1	IEEE	143	22.0
65	OVONYX MEMORY TECH	139	177	78.5	IEEE	139	78.5	IEEE/JPN Soc App Phys	10	5.6
66	Mellanox Technologies Ltd	135	314	43.0	IEEE	135	43.0	Joint IEEE and ACM	106	33.8
67	Arizona State University	134	238	56.3	IEEE	134	56.3	Joint IEEE and ACM	25	10.5
68	INDIVIDUAL PATENTER	131	262	50.0	IEEE	131	50.0	RELX Group (Elsevier)	25	9.5
69	Commissariat A L'Energie At	128	315	40.6	IEEE	128	40.6	American Institute of Physics	59	18.7
70	Hewlett Packard Enterprises	127	251	50.6	IEEE	127	50.6	ACM-Assoc Comput Mach	42	16.7
71	NVIDIA Corp.	127	239	53.1	IEEE	127	53.1	ACM-Assoc Comput Mach	37	15.5
72	Cisco Systems Inc.	125	270	46.3	IEEE	125	46.3	ACM-Assoc Comput Mach	63	23.3
73	OPTICAL DEVICES LLC	120	218	55.0	IEEE	120	55.0	American Automatic Control Council (AACC)	30	13.8
74	Nokia Corp	114	297	38.4	IEEE	114	38.4	ACM-Assoc Comput Mach	55	18.5
75	Soitec SA	110	137	80.3	IEEE	110	80.3	IET/IEE	7	5.1
76	Columbia University	109	284	38.4	IEEE	109	38.4	ACM-Assoc Comput Mach	48	16.9
77	Round Rock Research LLC	109	480	22.7	RELX Group (Elsevier)	136	28.3	IEEE	109	22.7
78	Sap SE	105	335	31.3	IEEE	105	31.3	ACM-Assoc Comput Mach	48	14.3
79	Industrial Technology Researc	102	179	57.0	IEEE	102	57.0	IEEE/JPN Soc App Phys	18	10.1
80	University of California	102	498	20.5	ACS-Am Chem Soc	126	25.3	IEEE	102	20.5

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Tela Innovations inc	101	289	34.9	IEEE	101	34.9	SPIE-Int Soc Opt Engineering	87	30.1
82	Kandou	99	108	91.7	IEEE	99	91.7	IET/IEE	8	7.4
83	Microsemi Corp	95	141	67.4	IEEE	95	67.4	RELX Group (Elsevier)	12	8.5
84	Integrated Device Technolog	92	109	84.4	IEEE	92	84.4	Pennwell Pub	6	5.5
85	Glassbridge Enterprises Inc	90	200	45.0	IEEE	90	45.0	RELX Group (Elsevier)	20	10.0
86	United Microelectronics Corp	89	158	56.3	IEEE	89	56.3	American Institute of Physics	30	19.0
87	Carnegie Mellon University	88	167	52.7	IEEE	88	52.7	American Institute of Physics	56	33.5
88	Texas A&M University	84	105	80.0	IEEE	84	80.0	Science Press	5	4.8
89	Waratek	83	220	37.7	IEEE	83	37.7	ACM-Assoc Comput Mach	55	25.0
90	Siemens Aktiengesellschaft	82	156	52.6	IEEE	82	52.6	American Institute of Physics	24	15.4
91	FireEye Inc	81	197	41.1	IEEE	81	41.1	ACM-Assoc Comput Mach	36	18.3
92	Interuniversity MicroElectron	78	133	58.6	IEEE	78	58.6	Joint IEEE and ACM	16	12.0
93	Koninklijke Philips N.V.	76	192	39.6	IEEE	76	39.6	Institute of Pure and Applied Physics	13	6.8
94	McAfee Inc	71	200	35.5	IEEE	71	35.5	ACM-Assoc Comput Mach	54	27.0
95	Yonsei University	70	99	70.7	IEEE	70	70.7	IEEE/JPN Soc App Phys	10	10.1
96	The Invention Science Fund	69	215	32.1	IEEE	69	32.1	Massachusetts Institute of Technology	38	17.7
97	Cadence Design Systems Inc	66	104	63.5	IEEE	66	63.5	Penton Media	20	19.2
98	BLUERISC INC	64	190	33.7	IEEE	64	33.7	Joint IEEE and ACM	50	26.3
99	Honeywell International Inc.	64	107	59.8	IEEE	64	59.8	RELX Group (Elsevier)	8	7.5
100	University of Michigan	64	124	51.6	IEEE	64	51.6	Joint IEEE and ACM	36	29.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>IOT/Internet of Things</i>										
1	Apple Inc	1778	3579	49.7	IEEE	1778	49.7	ACM-Assoc Comput Mach	913	25.5
2	Velatia Group	839	1125	74.6	IEEE	839	74.6	Echelon Corp	81	7.2
3	SIPCO LLC	598	1018	58.7	IEEE	598	58.7	Internet Soc/IETF-Internet Eng Task Force	88	8.6
4	SolarEdge Technologies Inc	338	365	92.6	IEEE	338	92.6	WIP-Renewable Energies	13	3.6
5	Honeywell International Inc.	291	372	78.2	IEEE	291	78.2	American Library Association	12	3.2
6	ORIGIN WIRELESS INC	230	286	80.4	IEEE	230	80.4	Acoustical Society of America	10	3.5
7	TRILLIANT NETWORKS I	230	339	67.8	IEEE	230	67.8	Internet Soc/IETF-Internet Eng Task Force	19	5.6
8	Rockwell Automation Inc	216	363	59.5	IEEE	216	59.5	ACM-Assoc Comput Mach	58	16.0
9	LG Electronics Inc.	210	287	73.2	IEEE	210	73.2	3GPP General Partnership Project Standards Body	69	24.0
10	EAGLE HARBOR HOLDIN	171	443	38.6	IEEE	171	38.6	SAE-Society of Automobile Engineers	117	26.4
11	Schneider Electric S.A.	159	1350	11.8	ISA - Instrumentation, Systems & Automation	252	18.7	IEEE	159	11.8
12	International Business Machi	155	318	48.7	IEEE	155	48.7	ACM-Assoc Comput Mach	25	7.9
13	General Electric Company	150	211	71.1	IEEE	150	71.1	IET/IEE	13	6.2
14	Microsoft Corporation	149	347	42.9	IEEE	149	42.9	ACM-Assoc Comput Mach	73	21.0
15	Sonos Inc	125	239	52.3	IEEE	125	52.3	SPIE-Int Soc Opt Engineering	22	9.2
16	ABB Ltd	124	150	82.7	IEEE	124	82.7	IET/IEE	6	4.0
17	Google Inc.	112	228	49.1	IEEE	112	49.1	ACM-Assoc Comput Mach	55	24.1
18	Qualcomm Inc	100	234	42.7	IEEE	100	42.7	3GPP General Partnership Project Standards Body	54	23.1
19	Samsung Electronics Co Ltd	92	240	38.3	IEEE	92	38.3	3GPP General Partnership Project Standards Body	67	27.9
20	Intel Corporation	84	187	44.9	IEEE	84	44.9	3GPP General Partnership Project Standards Body	65	34.8
21	EchoStar Corp	77	91	84.6	IEEE	77	84.6	Rajagiri School of Engineering & Technology, Cochin, Kerala,	8	8.8
22	STATSIGNAL SYSTEMS IN	75	132	56.8	IEEE	75	56.8	Internet Soc/IETF-Internet Eng Task Force	14	10.6
23	Extreme Networks Inc	74	156	47.4	IEEE	74	47.4	ACM-Assoc Comput Mach	20	12.8
24	Cisco Systems Inc.	73	179	40.8	IEEE	73	40.8	Network Working Group RFC	33	18.4
25	Adaptive Computing Enterpri	72	145	49.7	IEEE	72	49.7	ACM-Assoc Comput Mach	26	17.9
26	Toyota Motor Corp	71	162	43.8	IEEE	71	43.8	ACM-Assoc Comput Mach	43	26.5
27	California Institute of Techno	67	71	94.4	IEEE	67	94.4	American Automatic Control Council (AACC)	3	4.2
28	Alstom	66	77	85.7	IEEE	66	85.7	IET/IEE	7	9.1
29	BORGIA/CUMMINS LLC	66	99	66.7	IEEE	66	66.7	SPIE-Int Soc Opt Engineering	17	17.2
30	AT&T Inc	64	100	64.0	IEEE	64	64.0	3GPP General Partnership Project Standards Body	9	9.0
31	Battelle Memorial Institute	59	86	68.6	IEEE	59	68.6	ACM-Assoc Comput Mach	6	7.0
32	Comcast Corp	57	67	85.1	IEEE	57	85.1	SCTE - Society of Cable and Telecom Eng	8	11.9
33	Nokia Corp	57	134	42.5	IEEE	57	42.5	3GPP General Partnership Project Standards Body	28	20.9
34	Emerson Electric Co.	55	95	57.9	IEEE	55	57.9	RELX Group (Elsevier)	11	11.6
35	Sap SE	55	149	36.9	IEEE	55	36.9	ACM-Assoc Comput Mach	35	23.5
36	SOLAREEDGE TECHNOLO	55	68	80.9	IEEE	55	80.9	WIP-Renewable Energies	7	10.3
37	Western Digital Corp.	50	60	83.3	IEEE	50	83.3	RELX Group (Elsevier)	10	16.7
38	Irobot Corp	49	85	57.6	IEEE	49	57.6	SPIE-Int Soc Opt Engineering	9	10.6
39	ASTROLINK INTERNATIO	46	53	86.8	IEEE	46	86.8	IET/IEE	5	9.4

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	DOMINION ENERGY TEC	46	53	86.8	IEEE	46	86.8	IET/IEE	5	9.4
41	Deere & Co.	42	65	64.6	IEEE	42	64.6	SAGE Publications Ltd	4	6.2
42	Itron Inc.	41	72	56.9	IEEE	41	56.9	Joint IEEE and ACM	11	15.3
43	3M Co	40	48	83.3	IEEE	40	83.3	AIAA-Am Inst Aero Astro	3	6.3
44	Dexcom Inc	40	333	12.0	RELX Group (Elsevier)	80	24.0	IEEE	40	12.0
45	Hello Inc	39	44	88.6	IEEE	39	88.6	ACM-Assoc Comput Mach	5	11.4
46	Siemens Aktiengesellschaft	37	95	38.9	IEEE	37	38.9	United Business Media/UBM Tech	11	11.6
47	Zebra Technologies Corp.	37	47	78.7	IEEE	37	78.7	RFID Journal/YGS Group	6	12.8
48	University of Minnesota (The)	36	36	100.0	IEEE	36	100.0			
49	Georgia Institute of Technolo	34	91	37.4	ACM-Assoc Comput Mach	49	53.8	IEEE	34	37.4
50	Knowles Corp	32	49	65.3	IEEE	32	65.3	RELX Group (Elsevier)	4	8.2
51	Witricity Corp	32	36	88.9	IEEE	32	88.9	American Institute of Physics	3	8.3
52	Enphase Energy Inc	31	36	86.1	IEEE	31	86.1	EPE Association	4	11.1
53	SmartDrive Systems Inc	30	36	83.3	IEEE	30	83.3	ISIF/IEEE	3	8.3
54	University of Maryland	30	30	100.0	IEEE	30	100.0			
55	AFERO INC	29	35	82.9	IEEE	29	82.9	United Business Media/UBM Tech	5	14.3
56	PTC Inc	29	68	42.6	IEEE	29	42.6	ACM-Assoc Comput Mach	12	17.6
57	Boeing Co. (The)	28	50	56.0	IEEE	28	56.0	ACM-Assoc Comput Mach	3	6.0
58	Ericsson	28	213	13.1	3GPP General Partnership Project Standards	121	56.8	European Telecom Standards Institute (ETSI)	35	16.4
59	Koninklijke Philips N.V.	27	163	16.6	IEEE	27	16.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	25	15.3
60	AMPT LLC	26	28	92.9	IEEE	26	92.9	IET/IEE	2	7.1
61	Dell Technologies Inc	26	58	44.8	IEEE	26	44.8	ACM-Assoc Comput Mach	14	24.1
62	ENERGY TECHNOLOGY G	26	30	86.7	IEEE	26	86.7	ACM-Assoc Comput Mach	2	6.7
63	PRODEA SYSTEMS INC	26	26	100.0	IEEE	26	100.0			
64	Accenture Ltd.	25	35	71.4	IEEE	25	71.4	A B B Corporate Management Services AG	4	11.4
65	Immersion Corp.	25	70	35.7	IEEE	25	35.7	ACM-Assoc Comput Mach	11	15.7
66	Legrand S.A.	25	81	30.9	IEEE	25	30.9	TIMES MIRROR MAG INC	11	13.6
67	Fitbit Inc	24	61	39.3	IEEE	24	39.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	18	29.5
68	Mitsubishi Electric Corp	24	48	50.0	IEEE	24	50.0	3GPP General Partnership Project Standards Body	18	37.5
69	NETWORK-1 TECHNOLO	24	24	100.0	IEEE	24	100.0			
70	Panasonic Corporation	24	52	46.2	IEEE	24	46.2	Network Working Group RFC	3	5.8
71	Amazon.com Inc.	23	108	21.3	ACM-Assoc Comput Mach	31	28.7	IEEE	23	21.3
72	Canon Inc	23	28	82.1	IEEE	23	82.1	ACM-Assoc Comput Mach	2	7.1
73	SPARQ SYSTEMS INC	23	29	79.3	IEEE	23	79.3	RELX Group (Elsevier)	3	10.3
74	Tigo Energy Inc	23	31	74.2	IEEE	23	74.2	WIP-Renewable Energies	6	19.4
75	AXEDA CORP	22	53	41.5	IEEE	22	41.5	ACM-Assoc Comput Mach	9	17.0
76	Blackberry Ltd.	22	39	56.4	IEEE	22	56.4	ACM-Assoc Comput Mach	9	23.1
77	Johnson Controls Internation	22	41	53.7	IEEE	22	53.7	Ericsson	3	7.3
78	ConvergeOne Inc	21	23	91.3	IEEE	21	91.3	Condé Nast	1	4.3
79	Huawei Technologies Compa	21	168	12.5	3GPP General Partnership Project Standards	63	37.5	Open Mobile Alliance (Standards Org)	60	35.7
80	Sony Corp	21	73	28.8	SID-Society for Information Display	24	32.9	IEEE	21	28.8

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Taiwan Semiconductor Manu	21	39	53.8	IEEE	21	53.8	Electrostatic Discharge Association	15	38.5
82	Corning Inc.	20	31	64.5	IEEE	20	64.5	IET/IEE	3	9.7
83	ICON Health & Fitness Inc	20	105	19.0	Consumers Union of the United States	27	25.7	IEEE	20	19.0
84	M2M & IOT TECHNOLOGI	20	56	35.7	Internet Soc/IETF-Internet Eng Task Force	24	42.9	IEEE	20	35.7
85	TEMPORAL POWER LTD	20	20	100.0	IEEE	20	100.0			
86	CenturyLink Inc	19	98	19.4	IEEE	19	19.4	ACM-Assoc Comput Mach	18	18.4
87	PAXGRID TELEMETRIC S	19	22	86.4	IEEE	19	86.4	American Automatic Control Council (AACC)	1	4.5
88	SECURENET SOLUTIONS	19	39	48.7	IEEE	19	48.7	ACM-Assoc Comput Mach	9	23.1
89	Commscope Inc.	18	18	100.0	IEEE	18	100.0			
90	FedEx Corp	18	42	42.9	IEEE	18	42.9	Healthcare Financial Management Association	4	9.5
91	Toshiba Corp	18	27	66.7	IEEE	18	66.7	IEICE-Inst Elec Info Comm Eng	2	7.4
92	General Atomics Technolog	17	25	68.0	IEEE	17	68.0	ACM-Assoc Comput Mach	3	12.0
93	New Jersey Institute of Techn	17	17	100.0	IEEE	17	100.0			
94	BENHOV GMBH LLC	16	27	59.3	IEEE	16	59.3	SPIE-Int Soc Opt Engineering	5	18.5
95	Halliburton Co. (Holding)	16	17	94.1	IEEE	16	94.1	American Automatic Control Council (AACC)	1	5.9
96	InterDigital Inc	16	149	10.7	3GPP General Partnership Project Standards	116	77.9	IEEE	16	10.7
97	Massachusetts Institute of Te	16	32	50.0	IEEE	16	50.0	ACS-Am Chem Soc	6	18.8
98	Industrial Technology Researc	15	21	71.4	IEEE	15	71.4	3GPP General Partnership Project Standards Body	5	23.8
99	King Fahd University of Petr	15	18	83.3	IEEE	15	83.3	United Business Media/UBM Tech	3	16.7
100	Motorola Solutions Inc.	15	23	65.2	IEEE	15	65.2	Internet Soc/IETF-Internet Eng Task Force	2	8.7



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Measuring, Testing and Control Devices</i>										
1	Siemens Aktiengesellschaft	2961	6209	47.7	IEEE	2961	47.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1053	17.0
2	Partners HealthCare Systems	2881	41284	7.0	Optical Society of America	15111	36.6	RELX Group (Elsevier)	5664	13.7
3	Thermo Fisher Scientific Inc	2665	13724	19.4	RELX Group (Elsevier)	4446	32.4	IEEE	2665	19.4
4	Irobot Corp	2115	3936	53.7	IEEE	2115	53.7	SPIE-Int Soc Opt Engineering	578	14.7
5	International Business Machi	2026	5078	39.9	IEEE	2026	39.9	ACM-Assoc Comput Mach	284	5.6
6	FormFactor Inc	1774	3400	52.2	IEEE	1774	52.2	MacMillan Publishing Company	642	18.9
7	Microsoft Corporation	1620	3934	41.2	IEEE	1620	41.2	ACM-Assoc Comput Mach	946	24.0
8	Honeywell International Inc.	1612	4204	38.3	IEEE	1612	38.3	RELX Group (Elsevier)	505	12.0
9	Texas Instruments Inc	1511	1856	81.4	IEEE	1511	81.4	Joint IEEE and ACM	65	3.5
10	Sanken Electric Co. Ltd.	1464	1824	80.3	IEEE	1464	80.3	RELX Group (Elsevier)	230	12.6
11	General Electric Company	1353	8467	16.0	IEEE	1353	16.0	RELX Group (Elsevier)	1054	12.4
12	Illumina Inc.	958	3415	28.1	IEEE	958	28.1	Royal Society of Chemistry	477	14.0
13	Emerson Electric Co.	782	3414	22.9	IEEE	782	22.9	RELX Group (Elsevier)	417	12.2
14	Apple Inc	755	1476	51.2	IEEE	755	51.2	ACM-Assoc Comput Mach	197	13.3
15	California Institute of Techno	733	5979	12.3	RELX Group (Elsevier)	882	14.8	IEEE	733	12.3
16	Applied Materials Inc.	698	1481	47.1	IEEE	698	47.1	American Institute of Physics	150	10.1
17	ABB Ltd	659	1027	64.2	IEEE	659	64.2	RELX Group (Elsevier)	64	6.2
18	Intel Corporation	646	1490	43.4	IEEE	646	43.4	3GPP General Partnership Project Standards Body	116	7.8
19	Massachusetts Institute of Te	638	3575	17.8	IEEE	638	17.8	RELX Group (Elsevier)	478	13.4
20	Nokia Corp	635	1595	39.8	IEEE	635	39.8	3GPP General Partnership Project Standards Body	103	6.5
21	Qualcomm Inc	628	1354	46.4	IEEE	628	46.4	3GPP General Partnership Project Standards Body	222	16.4
22	Broadcom Ltd	599	967	61.9	IEEE	599	61.9	Joint IEEE and ACM	45	4.7
23	Midtronics Inc.	562	1309	42.9	IEEE	562	42.9	RELX Group (Elsevier)	234	17.9
24	Intuitive Surgical Inc.	536	1174	45.7	IEEE	536	45.7	SAGES-Society of American Gastrointestinal and Endoscopic	166	14.1
25	NXP Semiconductors NV	524	801	65.4	IEEE	524	65.4	RELX Group (Elsevier)	55	6.9
26	Schlumberger Ltd.	496	7773	6.4	Society of Petroleum Engineers	1240	16.0	Society of Exploration Geophysicists	1154	14.8
27	University of Illinois	493	5189	9.5	American Institute of Physics	884	17.0	RELX Group (Elsevier)	771	14.9
28	Boeing Co. (The)	484	1632	29.7	IEEE	484	29.7	RELX Group (Elsevier)	189	11.6
29	Synopsys Inc.	474	586	80.9	IEEE	474	80.9	Joint IEEE and ACM	35	6.0
30	Google Inc.	459	1238	37.1	IEEE	459	37.1	ACM-Assoc Comput Mach	261	21.1
31	Abbott Laboratories	452	13478	3.4	ACS-Am Chem Soc	3519	26.1	RELX Group (Elsevier)	3141	23.3
32	Honda Motor Co. Ltd.(Honda	446	1001	44.6	IEEE	446	44.6	RELX Group (Elsevier)	122	12.2
33	INTOUCH HEALTH INC	443	985	45.0	IEEE	443	45.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	57	5.8
34	Lockheed Martin Corp.	426	3748	11.4	American Institute of Physics	668	17.8	IEEE	426	11.4
35	Schneider Electric S.A.	418	2709	15.4	IEEE	418	15.4	RELX Group (Elsevier)	313	11.6
36	Infineon Technologies AG	408	636	64.2	IEEE	408	64.2	RELX Group (Elsevier)	66	10.4
37	University of Minnesota (The	403	1497	26.9	IEEE	403	26.9	RELX Group (Elsevier)	245	16.4
38	Koninklijke Philips N.V.	400	2479	16.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	602	24.3	Society of Magnetic Resonance in Medicine (SMRM)	422	17.0
39	Marvell Technology Group Lt	396	455	87.0	IEEE	396	87.0	Joint IEEE and ACM	12	2.6

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Duke University	394	1698	23.2	IEEE	394	23.2	Optical Society of America	215	12.7
41	STMicroelectronics	393	610	64.4	IEEE	393	64.4	RELX Group (Elsevier)	76	12.5
42	Cypress Semiconductor Corp.	387	547	70.7	IEEE	387	70.7	Joint IEEE and ACM	41	7.5
43	Samsung Electronics Co Ltd	379	917	41.3	IEEE	379	41.3	RELX Group (Elsevier)	92	10.0
44	Ericsson	374	904	41.4	IEEE	374	41.4	3GPP General Partnership Project Standards Body	169	18.7
45	Agilent Technologies Inc	369	1538	24.0	IEEE	369	24.0	RELX Group (Elsevier)	249	16.2
46	Commissariat A L'Energie At	360	1465	24.6	RELX Group (Elsevier)	371	25.3	IEEE	360	24.6
47	AT&T Inc	359	700	51.3	IEEE	359	51.3	ACM-Assoc Comput Mach	67	9.6
48	University of California	353	6419	5.5	RELX Group (Elsevier)	966	15.0	ACS-Am Chem Soc	919	14.3
49	HP Inc	350	1276	27.4	IEEE	350	27.4	ACS-Am Chem Soc	123	9.6
50	Advantest Corp.	345	480	71.9	IEEE	345	71.9	American Institute of Physics	26	5.4
51	Rockwell Automation Inc	339	573	59.2	IEEE	339	59.2	RELX Group (Elsevier)	66	11.5
52	Analog Devices Inc.	333	473	70.4	IEEE	333	70.4	American Institute of Physics	19	4.0
53	ParkerVision Inc	332	531	62.5	IEEE	332	62.5	IET/IEE	50	9.4
54	University of Texas	329	2296	14.3	RELX Group (Elsevier)	350	15.2	IEEE	329	14.3
55	FARO Technologies Inc.	324	884	36.7	IEEE	324	36.7	SPIE-Int Soc Opt Engineering	152	17.2
56	NEC Corp	319	741	43.0	IEEE	319	43.0	IEICE-Inst Elec Info Comm Eng	41	5.5
57	Industrial Technology Researc	318	701	45.4	IEEE	318	45.4	RELX Group (Elsevier)	109	15.5
58	Micron Technology Inc.	318	582	54.6	IEEE	318	54.6	American Institute of Physics	38	6.5
59	HRL Laboratories LLC	315	709	44.4	IEEE	315	44.4	RELX Group (Elsevier)	81	11.4
60	INDIVIDUAL PATENTER	314	1391	22.6	IEEE	314	22.6	RELX Group (Elsevier)	139	10.0
61	SolarEdge Technologies Inc	313	363	86.2	IEEE	313	86.2	WIP-Renewable Energies	26	7.2
62	Stanford University	312	3133	10.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	396	12.6	Optical Society of America	385	12.3
63	CPG TECHNOLOGIES LLC	304	368	82.6	IEEE	304	82.6	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	20	5.4
64	Georgia Institute of Technolo	295	968	30.5	IEEE	295	30.5	Optical Society of America	123	12.7
65	Cisco Systems Inc.	294	1335	22.0	Internet Soc/IETF-Internet Eng Task Force	405	30.3	IEEE	294	22.0
66	United States Navy	293	1724	17.0	IEEE	293	17.0	RELX Group (Elsevier)	251	14.6
67	Panasonic Corporation	286	995	28.7	IEEE	286	28.7	RELX Group (Elsevier)	204	20.5
68	Toyota Motor Corp	280	608	46.1	IEEE	280	46.1	ACM-Assoc Comput Mach	77	12.7
69	Advanced Micro Devices Inc	278	622	44.7	IEEE	278	44.7	SPIE-Int Soc Opt Engineering	70	11.3
70	Bosch (Robert) GmbH	264	796	33.2	IEEE	264	33.2	RELX Group (Elsevier)	110	13.8
71	Raytheon Co.	262	848	30.9	IEEE	262	30.9	SPIE-Int Soc Opt Engineering	120	14.2
72	Xerox Corp	261	998	26.2	IEEE	261	26.2	American Institute of Physics	97	9.7
73	HEMOSONICS LLC	260	353	73.7	IEEE	260	73.7	RELX Group (Elsevier)	25	7.1
74	Brain Corporation	258	470	54.9	IEEE	258	54.9	MIT Press	64	13.6
75	Adaptix	252	373	67.6	IEEE	252	67.6	European Telecom Standards Institute (ETSI)	47	12.6
76	Fujitsu Limited	252	545	46.2	IEEE	252	46.2	Internet Soc/IETF-Internet Eng Task Force	31	5.7
77	Schweitzer Engineering Labo	252	289	87.2	IEEE	252	87.2	RELX Group (Elsevier)	11	3.8
78	General Motors Corp	244	484	50.4	IEEE	244	50.4	RELX Group (Elsevier)	49	10.1
79	Mitsubishi Electric Corp	242	491	49.3	IEEE	242	49.3	RELX Group (Elsevier)	34	6.9
80	University of Southern Califo	241	560	43.0	IEEE	241	43.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	37	6.6

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Battelle Memorial Institute	239	1208	19.8	RELX Group (Elsevier)	270	22.4	IEEE	239	19.8
82	Taiwan Semiconductor Manu	239	367	65.1	IEEE	239	65.1	American Institute of Physics	23	6.3
83	Nintendo Co. Ltd.	238	818	29.1	IEEE	238	29.1	ACM-Assoc Comput Mach	165	20.2
84	University of Michigan	227	1266	17.9	IEEE	227	17.9	RELX Group (Elsevier)	191	15.1
85	Toshiba Corp	226	991	22.8	IEEE	226	22.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	222	22.4
86	Verizon Communications Inc	225	526	42.8	IEEE	225	42.8	Internet Soc/IETF-Internet Eng Task Force	61	11.6
87	Sony Corp	221	552	40.0	IEEE	221	40.0	RELX Group (Elsevier)	43	7.8
88	Teradyne Inc.	221	491	45.0	IEEE	221	45.0	ASME-Am Soc Mech Eng	78	15.9
89	Hitachi Ltd	220	1404	15.7	IEEE	220	15.7	RELX Group (Elsevier)	200	14.2
90	Purdue University	215	1460	14.7	RELX Group (Elsevier)	277	19.0	ACS-Am Chem Soc	245	16.8
91	Immersion Corp.	214	492	43.5	IEEE	214	43.5	ASME-Am Soc Mech Eng	41	8.3
92	MACAU UNIVERSITY OF	214	222	96.4	IEEE	214	96.4	IEEE/ASME	4	1.8
93	Halliburton Co. (Holding)	211	4303	4.9	Society of Petroleum Engineers	1396	32.4	SPWLA-Society of Petrophysicists and Well Log Analysts	634	14.7
94	TROXLER ELECTRONIC L	211	505	41.8	IEEE	211	41.8	AMER SOC TESTING MATERIALS	123	24.4
95	Fluidigm Corp	209	1449	14.4	ACS-Am Chem Soc	236	16.3	IEEE	209	14.4
96	NANONEXUS INC	209	306	68.3	IEEE	209	68.3	American Institute of Physics	28	9.2
97	Canon Inc	207	1525	13.6	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	265	17.4	IEEE	207	13.6
98	Oracle Corporation	204	419	48.7	IEEE	204	48.7	3GPP General Partnership Project Standards Body	37	8.8
99	Cadence Design Systems Inc	203	349	58.2	IEEE	203	58.2	Joint IEEE and ACM	67	19.2
100	KLA-Tencor Corp.	194	3026	6.4	SPIE-Int Soc Opt Engineering	746	24.7	Optical Society of America	547	18.1

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Optics/Photography/Electrophotography</i>										
1	Qualcomm Inc	1833	5117	35.8	IEEE	1833	35.8	SID-Society for Information Display	924	18.1
2	Infinera Corporation	1177	2186	53.8	IEEE	1177	53.8	IET/IEE	356	16.3
3	Partners HealthCare Systems	932	13642	6.8	Optical Society of America	5110	37.5	RELX Group (Elsevier)	1910	14.0
4	IDC Llc	641	1778	36.1	IEEE	641	36.1	SID-Society for Information Display	236	13.3
5	Nikon Corp.	592	4044	14.6	SPIE-Int Soc Opt Engineering	1807	44.7	SEMATECH Consortium	802	19.8
6	Finisar Corp	573	1623	35.3	IEEE	573	35.3	Optical Society of America	270	16.6
7	Corning Inc.	510	3470	14.7	Optical Society of America	770	22.2	IEEE	510	14.7
8	Massachusetts Institute of Te	467	2811	16.6	IEEE	467	16.6	American Institute of Physics	450	16.0
9	Nokia Corp	467	2130	21.9	IEEE	467	21.9	Optical Society of America	361	16.9
10	Synopsys Inc.	439	3099	14.2	SPIE-Int Soc Opt Engineering	1450	46.8	Institute of Pure and Applied Physics	462	14.9
11	Hoya Corp	421	1301	32.4	IEEE	421	32.4	American Institute of Physics	262	20.1
12	YFY Inc	420	4724	8.9	SID-Society for Information Display	1839	38.9	National Symposium on Information Display	491	10.4
13	Google Inc.	405	879	46.1	IEEE	405	46.1	RELX Group (Elsevier)	73	8.3
14	Microsoft Corporation	401	1111	36.1	IEEE	401	36.1	ACM-Assoc Comput Mach	258	23.2
15	The Invention Science Fund	389	1647	23.6	IEEE	389	23.6	American Physical Society	228	13.8
16	Screen Holdings Co Ltd (For	368	1371	26.8	IEEE	368	26.8	RELX Group (Elsevier)	211	15.4
17	Intel Corporation	330	1118	29.5	IEEE	330	29.5	SPIE-Int Soc Opt Engineering	170	15.2
18	Ericsson	311	1354	23.0	Optical Society of America	521	38.5	IEEE	311	23.0
19	Mellanox Technologies Ltd	311	999	31.1	IEEE	311	31.1	IET/IEE	239	23.9
20	Cheetah Omni LLC	294	1151	25.5	IEEE	294	25.5	Optical Society of America	274	23.8
21	International Business Machi	293	1873	15.6	SPIE-Int Soc Opt Engineering	475	25.4	IEEE	293	15.6
22	Stanford University	245	1651	14.8	Optical Society of America	312	18.9	IEEE	245	14.8
23	Xperi Corporation (Formerly	241	565	42.7	IEEE	241	42.7	Optical Society of America	94	16.6
24	Texas Instruments Inc	232	855	27.1	IEEE	232	27.1	American Institute of Physics	149	17.4
25	California Institute of Techno	221	1661	13.3	Optical Society of America	493	29.7	IEEE	221	13.3
26	Adobe Systems Inc.	219	512	42.8	IEEE	219	42.8	ACM-Assoc Comput Mach	127	24.8
27	University of California	212	1493	14.2	IEEE	212	14.2	Optical Society of America	191	12.8
28	Viavi Solutions Inc	198	853	23.2	IEEE	198	23.2	Optical Society of America	147	17.2
29	ASML Holding NV	196	7399	2.6	SPIE-Int Soc Opt Engineering	2605	35.2	American Institute of Physics	1501	20.3
30	Osterhout Design Group	196	531	36.9	IEEE	196	36.9	ACM-Assoc Comput Mach	157	29.6
31	3M Co	193	3786	5.1	Optical Society of America	575	15.2	RELX Group (Elsevier)	373	9.9
32	Siemens Aktiengesellschaft	183	582	31.4	IEEE	183	31.4	SPIE-Int Soc Opt Engineering	121	20.8
33	Micron Technology Inc.	180	1888	9.5	American Institute of Physics	370	19.6	SPIE-Int Soc Opt Engineering	337	17.8
34	HP Inc	174	890	19.6	IEEE	174	19.6	Optical Society of America	102	11.5
35	Princeton University	172	392	43.9	IEEE	172	43.9	American Institute of Physics	44	11.2
36	University of Colorado ( The	171	1414	12.1	Optical Society of America	482	34.1	IEEE	171	12.1
37	Fujitsu Limited	169	873	19.4	IEEE	169	19.4	Optical Society of America	135	15.5
38	STEYPHI SERVICES DE LL	166	459	36.2	IEEE	166	36.2	Optical Society of America	104	22.7
39	Prysmian SPA	165	920	17.9	Optical Society of America	211	22.9	IEEE	165	17.9

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Lockheed Martin Corp.	163	962	16.9	Optical Society of America	257	26.7	IEEE	163	16.9
41	United States of America De	163	652	25.0	IEEE	163	25.0	IET/IEE	131	20.1
42	Electronics and Telecommuni	149	415	35.9	IEEE	149	35.9	Optical Society of America	52	12.5
43	Cisco Systems Inc.	143	324	44.1	IEEE	143	44.1	Optical Society of America	65	20.1
44	Canon Inc	140	1798	7.8	SPIE-Int Soc Opt Engineering	262	14.6	American Institute of Physics	234	13.0
45	Pelican Imaging Corporation	137	299	45.8	IEEE	137	45.8	SPIE-Int Soc Opt Engineering	53	17.7
46	CIRREX SYSTEMS LLC	136	615	22.1	IEEE	136	22.1	Optical Society of America	89	14.5
47	Georgia Institute of Technolo	135	437	30.9	IEEE	135	30.9	Optical Society of America	80	18.3
48	OmniGuide Inc	134	1015	13.2	Optical Society of America	242	23.8	IEEE	134	13.2
49	Emcore Corp.	133	168	79.2	IEEE	133	79.2	IEEE/OSA	11	6.5
50	Honeywell International Inc.	133	569	23.4	IEEE	133	23.4	SPIE-Int Soc Opt Engineering	104	18.3
51	VASCULAR IMAGING CO	133	280	47.5	IEEE	133	47.5	IET/IEE	80	28.6
52	University of Texas	127	1033	12.3	American Institute of Physics	185	17.9	IEEE	127	12.3
53	Cubic Wafer Inc	125	223	56.1	IEEE	125	56.1	SPIE-Int Soc Opt Engineering	42	18.8
54	Xerox Corp	124	1234	10.0	ACS-Am Chem Soc	240	19.4	RELX Group (Elsevier)	165	13.4
55	University of Arizona	118	522	22.6	Optical Society of America	122	23.4	IEEE	118	22.6
56	Koninklijke Philips N.V.	109	611	17.8	SPIE-Int Soc Opt Engineering	166	27.2	IEEE	109	17.8
57	Furukawa Electric Co. Ltd.	106	781	13.6	Optical Society of America	255	32.7	IEEE	106	13.6
58	Sumitomo Electric Industries	106	984	10.8	Optical Society of America	246	25.0	European Conference on Optical Communication (ECOC) Soc	152	15.4
59	PTS Corporation	102	232	44.0	IEEE	102	44.0	Optical Society of America	34	14.7
60	Calient Technologies Inc.	101	200	50.5	IEEE	101	50.5	Optical Society of America	29	14.5
61	Nippon Telegraph & Telepho	101	580	17.4	IET/IEE	102	17.6	IEEE	101	17.4
62	NEC Corp	97	651	14.9	IEEE	97	14.9	Technical Association of Photopolymers	66	10.1
63	Lumentum Holdings Inc	93	368	25.3	IEEE	93	25.3	Optical Society of America	77	20.9
64	Neophotonics Corporation	93	296	31.4	IEEE	93	31.4	Optical Society of America	51	17.2
65	Broadcom Ltd	91	315	28.9	IEEE	91	28.9	SPIE-Int Soc Opt Engineering	65	20.6
66	Eastman Kodak Company	88	1247	7.1	RELX Group (Elsevier)	168	13.5	ACS-Am Chem Soc	165	13.2
67	Mitsubishi Electric Corp	87	271	32.1	IEEE	87	32.1	SPIE-Int Soc Opt Engineering	40	14.8
68	Applied Materials Inc.	86	524	16.4	SPIE-Int Soc Opt Engineering	124	23.7	American Institute of Physics	92	17.6
69	KOTUSA INC	85	236	36.0	IEEE	85	36.0	IET/IEE	51	21.6
70	OMM INC	85	194	43.8	IEEE	85	43.8	SPIE-Int Soc Opt Engineering	43	22.2
71	Huawei Technologies Compa	84	170	49.4	IEEE	84	49.4	Optical Society of America	27	15.9
72	RPX Corp	84	216	38.9	IEEE	84	38.9	IEEE/OSA	30	13.9
73	NXP Semiconductors NV	83	269	30.9	IEEE	83	30.9	American Institute of Physics	45	16.7
74	Panasonic Corporation	82	583	14.1	SPIE-Int Soc Opt Engineering	101	17.3	IEEE	82	14.1
75	Industrial Technology Researc	77	339	22.7	IEEE	77	22.7	SPIE-Int Soc Opt Engineering	49	14.5
76	Motorola Solutions Inc.	77	313	24.6	American Institute of Physics	92	29.4	IEEE	77	24.6
77	Oewaves Inc	76	253	30.0	Optical Society of America	100	39.5	IEEE	76	30.0
78	Oracle Corporation	74	135	54.8	IEEE	74	54.8	Optical Society of America	21	15.6
79	Seiko Epson Corporation	73	286	25.5	IEEE	73	25.5	SID-Society for Information Display	61	21.3
80	Extreme Networks Inc	72	166	43.4	IEEE	72	43.4	ACM-Assoc Comput Mach	22	13.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	HRL Laboratories LLC	70	289	24.2	IEEE	70	24.2	American Institute of Physics	47	16.3
82	Samsung Electronics Co Ltd	70	872	8.0	ACS-Am Chem Soc	108	12.4	American Institute of Physics	93	10.7
83	Apple Inc	69	219	31.5	IEEE	69	31.5	Optical Society of America	47	21.5
84	Hong Kong University of Sci	66	108	61.1	IEEE	66	61.1	American Institute of Physics	5	4.6
85	Cornell University	65	500	13.0	IEEE	65	13.0	RELX Group (Elsevier)	58	11.6
86	Fujikara Ltd.	63	574	11.0	Optical Society of America	157	27.4	IEICE-Inst Elec Info Comm Eng	113	19.7
87	Olympus Corp.	63	402	15.7	Optical Society of America	107	26.6	IEEE	63	15.7
88	ALENTIC MICROSCIENCE	61	98	62.2	IEEE	61	62.2	American Institute of Physics	11	11.2
89	Shin-Etsu Chemical Co. Ltd.	61	1482	4.1	SPIE-Int Soc Opt Engineering	739	49.9	Technical Association of Photopolymers	372	25.1
90	Velatia Group	61	80	76.3	IEEE	61	76.3	Echelon Corp	7	8.8
91	OMNI MEDSCI INC	60	555	10.8	Optical Society of America	159	28.6	RELX Group (Elsevier)	90	16.2
92	United States Navy	60	433	13.9	Optical Society of America	79	18.2	IEEE	60	13.9
93	University of Illinois	60	370	16.2	American Institute of Physics	111	30.0	IEEE	60	16.2
94	LIGHTCHIP INC	58	481	12.1	Optical Society of America	107	22.2	IEEE/OSA	101	21.0
95	Carl-Zeiss Stiftung	56	2507	2.2	SPIE-Int Soc Opt Engineering	1014	40.4	Optical Society of America	492	19.6
96	NANOOPTO CORP	56	327	17.1	American Institute of Physics	111	33.9	IEEE	56	17.1
97	Ohio State University	56	234	23.9	Optical Society of America	71	30.3	IEEE	56	23.9
98	Aisin Seiki Co. Ltd.	55	520	10.6	Optical Society of America	270	51.9	IEEE	55	10.6
99	University of Michigan	55	331	16.6	IEEE	55	16.6	Optical Society of America	43	13.0
100	Columbia University	54	453	11.9	ACS-Am Chem Soc	102	22.5	IEEE	54	11.9

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Power Systems</i>										
1	Witricity Corp	3322	5695	58.3	IEEE	3322	58.3	American Institute of Physics	500	8.8
2	SolarEdge Technologies Inc	2653	3049	87.0	IEEE	2653	87.0	WIP-Renewable Energies	208	6.8
3	Flex Ltd (Formerly Flextronics)	1605	1731	92.7	IEEE	1605	92.7	United Business Media/UBM Tech	71	4.1
4	Cirrus Logic Inc.	1568	1724	91.0	IEEE	1568	91.0	ISO-International Standards Organization	50	2.9
5	ABB Ltd	1396	2142	65.2	IEEE	1396	65.2	IVI Foundation/SCPI Consortium	94	4.4
6	CPG TECHNOLOGIES LLC	1309	1685	77.7	IEEE	1309	77.7	American Institute of Physics	87	5.2
7	Massachusetts Institute of Technology	1161	2928	39.7	IEEE	1161	39.7	Electrochemical Society, Inc.	421	14.4
8	Rockwell Automation Inc	1101	1190	92.5	IEEE	1101	92.5	EPE Association	33	2.8
9	General Electric Company	1007	2681	37.6	IEEE	1007	37.6	US Dept of Energy	771	28.8
10	Total SA	921	1047	88.0	IEEE	921	88.0	IET/IEE	36	3.4
11	SYNQOR INC	892	1023	87.2	IEEE	892	87.2	Penton Media	45	4.4
12	Energous Corporation	878	1107	79.3	IEEE	878	79.3	Rajagiri School of Engineering & Technology, Cochin, Kerala,	110	9.9
13	Texas Instruments Inc	725	851	85.2	IEEE	725	85.2	IET/IEE	24	2.8
14	Enphase Energy Inc	652	715	91.2	IEEE	652	91.2	IET/IEE	22	3.1
15	MOJO MOBILITY INC	614	784	78.3	IEEE	614	78.3	RELX Group (Elsevier)	54	6.9
16	Intel Corporation	588	706	83.3	IEEE	588	83.3	IEEE/JPN Soc App Phys	19	2.7
17	Infineon Technologies AG	505	569	88.8	IEEE	505	88.8	EPE Association	11	1.9
18	AMPT LLC	503	637	79.0	IEEE	503	79.0	IET/IEE	34	5.3
19	Maxim Integrated Products Inc	435	468	92.9	IEEE	435	92.9	Texas Instruments	14	3.0
20	Innovative Network Corporation	384	471	81.5	IEEE	384	81.5	IEEE/JPN Soc App Phys	11	2.3
21	STMicroelectronics	374	460	81.3	IEEE	374	81.3	RELX Group (Elsevier)	20	4.3
22	Analog Devices Inc.	367	1015	36.2	RELX Group (Elsevier)	399	39.3	IEEE	367	36.2
23	Qualcomm Inc	363	478	75.9	IEEE	363	75.9	RELX Group (Elsevier)	32	6.7
24	NXP Semiconductors NV	351	417	84.2	IEEE	351	84.2	IET/IEE	12	2.9
25	Qorvo	341	398	85.7	IEEE	341	85.7	European Microwave Association	12	3.0
26	Irobot Corp	325	591	55.0	IEEE	325	55.0	SPIE-Int Soc Opt Engineering	92	15.6
27	Industrial Technology Research Institute	298	531	56.1	IEEE	298	56.1	RELX Group (Elsevier)	121	22.8
28	Alstom	290	378	76.7	IEEE	290	76.7	IET/IEE	23	6.1
29	Siemens Aktiengesellschaft	281	567	49.6	IEEE	281	49.6	AIAA-Am Inst Aero Astro	68	12.0
30	International Business Machines Corporation	266	415	64.1	IEEE	266	64.1	RELX Group (Elsevier)	17	4.1
31	Power Integrations Inc.	259	398	65.1	IEEE	259	65.1	Penton Media	62	15.6
32	Murata Manufacturing Co. Ltd	244	295	82.7	IEEE	244	82.7	RELX Group (Elsevier)	14	4.7
33	Tigo Energy Inc	234	325	72.0	IEEE	234	72.0	WIP-Renewable Energies	68	20.9
34	Broadcom Ltd	225	285	78.9	IEEE	225	78.9	American Institute of Physics	10	3.5
35	Dialog Semiconductor Plc.	223	260	85.8	IEEE	223	85.8	ONLINE INC	18	6.9
36	Eaton Corp.	215	287	74.9	IEEE	215	74.9	RELX Group (Elsevier)	16	5.6
37	University of Illinois	211	929	22.7	RELX Group (Elsevier)	347	37.4	IEEE	211	22.7
38	Toshiba Corp	210	647	32.5	IEEE	210	32.5	RELX Group (Elsevier)	198	30.6
39	Vicor Corp	200	277	72.2	IEEE	200	72.2	Center for Power Electronics Systems (Virginia Tech)	42	15.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Midtronics Inc.	189	482	39.2	IEEE	189	39.2	RELX Group (Elsevier)	81	16.8
41	Schneider Electric S.A.	186	247	75.3	IEEE	186	75.3	IEEE/DOE/JPL	9	3.6
42	Vertiv Corp	182	197	92.4	IEEE	182	92.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	1.5
43	Semiconductor Energy Labor	178	2628	6.8	SID-Society for Information Display	634	24.1	American Institute of Physics	363	13.8
44	University of Wisconsin	176	220	80.0	IEEE	176	80.0	RELX Group (Elsevier)	10	4.5
45	Delta Electronics Inc	168	189	88.9	IEEE	168	88.9	Korean Institute of Power Electronics	10	5.3
46	Nokia Corp	168	321	52.3	IEEE	168	52.3	RELX Group (Elsevier)	29	9.0
47	Hong Kong University of Sci	162	258	62.8	IEEE	162	62.8	RELX Group (Elsevier)	34	13.2
48	R2 SEMICONDUCTOR INC	158	161	98.1	IEEE	158	98.1	European Microwave Association	2	1.2
49	Micron Technology Inc.	155	226	68.6	IEEE	155	68.6	IEEE/JPN Soc App Phys	22	9.7
50	Marvell Technology Group Lt	153	187	81.8	IEEE	153	81.8	Texas Instruments	16	8.6
51	O2Micro International Ltd.	152	232	65.5	IEEE	152	65.5	Texas Instruments	33	14.2
52	General Motors Corp	150	1756	8.5	RELX Group (Elsevier)	719	40.9	Electrochemical Society, Inc.	290	16.5
53	Powwermat Technologies Ltd	147	151	97.4	IEEE	147	97.4	American Institute of Physics	4	2.6
54	California Institute of Techno	145	2211	6.6	RELX Group (Elsevier)	769	34.8	Electrochemical Society, Inc.	369	16.7
55	On Semiconductor Corporati	143	167	85.6	IEEE	143	85.6	Penton Media	8	4.8
56	Silicon Laboratories Inc	139	157	88.5	IEEE	139	88.5	SAE-Society of Automobile Engineers	12	7.6
57	Apple Inc	137	460	29.8	IEEE	137	29.8	RELX Group (Elsevier)	67	14.6
58	Emerson Electric Co.	137	210	65.2	IEEE	137	65.2	IET/IEE	18	8.6
59	United Technologies Corp	137	638	21.5	IEEE	137	21.5	NASA-National Aeronautics and Space Admin	70	11.0
60	Boeing Co. (The)	135	341	39.6	IEEE	135	39.6	RELX Group (Elsevier)	47	13.8
61	Western Digital Corp.	135	164	82.3	IEEE	135	82.3	McGraw Hill	16	9.8
62	Samsung Electronics Co Ltd	133	917	14.5	RELX Group (Elsevier)	281	30.6	IEEE	133	14.5
63	THE FLORIDA INTERNATI	131	138	94.9	IEEE	131	94.9	IET/IEE	4	2.9
64	INFINITE POWER SOLUTI	130	1395	9.3	RELX Group (Elsevier)	317	22.7	American Institute of Physics	309	22.2
65	Mitsubishi Electric Corp	129	192	67.2	IEEE	129	67.2	IET/IEE	21	10.9
66	Tesla Motors Inc	126	138	91.3	IEEE	126	91.3	China Electrochemical Society	5	3.6
67	SRI International	124	705	17.6	SPIE-Int Soc Opt Engineering	152	21.6	IEEE	124	17.6
68	Koninklijke Philips N.V.	123	171	71.9	IEEE	123	71.9	SPIE-Int Soc Opt Engineering	5	2.9
69	Raytheon Co.	122	158	77.2	IEEE	122	77.2	AIAA-Am Inst Aero Astro	6	3.8
70	Conversant Intellectual Prope	120	144	83.3	IEEE	120	83.3	Joint IEEE and ACM	12	8.3
71	Panasonic Corporation	120	1208	9.9	RELX Group (Elsevier)	368	30.5	Electrochemical Society, Inc.	314	26.0
72	Microsoft Corporation	118	269	43.9	IEEE	118	43.9	ACM-Assoc Comput Mach	33	12.3
73	Arizona State University	115	444	25.9	IEEE	115	25.9	RELX Group (Elsevier)	91	20.5
74	Microchip Technology Inc.	112	128	87.5	IEEE	112	87.5	IEICE-Inst Elec Info Comm Eng	9	7.0
75	MOTOR EXCELLENCE LL	111	125	88.8	IEEE	111	88.8	IEEE/ASME	14	11.2
76	Advanced Energy Industries I	106	113	93.8	IEEE	106	93.8	IET/IEE	3	2.7
77	TDK Corporation	106	235	45.1	IEEE	106	45.1	RELX Group (Elsevier)	50	21.3
78	Utah State University	106	121	87.6	IEEE	106	87.6	IET/IEE	6	5.0
79	Cypress Semiconductor Corp.	105	121	86.8	IEEE	105	86.8	IEEE/JPN Soc App Phys	6	5.0
80	FYRE STORM INC	105	110	95.5	IEEE	105	95.5	Scripta Pub Co.	2	1.8



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Huawei Technologies Compa	104	112	92.9	IEEE	104	92.9	Audio Eng Soc	3	2.7
82	University of California	104	973	10.7	RELX Group (Elsevier)	196	20.1	ACS-Am Chem Soc	158	16.2
83	University of Colorado ( The	100	109	91.7	IEEE	100	91.7	RELX Group (Elsevier)	3	2.8
84	Lockheed Martin Corp.	99	697	14.2	RELX Group (Elsevier)	169	24.2	ACS-Am Chem Soc	106	15.2
85	Lenovo Group Ltd	95	118	80.5	IEEE	95	80.5	RELX Group (Elsevier)	9	7.6
86	Alticor Inc	94	121	77.7	IEEE	94	77.7	RELX Group (Elsevier)	9	7.4
87	ENECSYS LTD	91	101	90.1	IEEE	91	90.1	WIP-Renewable Energies	5	5.0
88	Honeywell International Inc.	90	321	28.0	RELX Group (Elsevier)	111	34.6	IEEE	90	28.0
89	Microsemi Corp	88	108	81.5	IEEE	88	81.5	Universal Serial Bus Specification	4	3.7
90	IDEAL POWER INC	87	106	82.1	IEEE	87	82.1	EPE Association	15	14.2
91	University of Texas	87	595	14.6	RELX Group (Elsevier)	167	28.1	Electrochemical Society, Inc.	103	17.3
92	Hitachi Ltd	86	260	33.1	IEEE	86	33.1	IET/IEE	45	17.3
93	TechnipFMC	86	119	72.3	IEEE	86	72.3	ASME-Am Soc Mech Eng	12	10.1
94	GENESIS ROBOTICS LLP	85	112	75.9	IEEE	85	75.9	World Academy of Science Engineering and Technology	5	4.5
95	Cree Inc.	84	104	80.8	IEEE	84	80.8	SID-Society for Information Display	6	5.8
96	Ericsson	81	104	77.9	IEEE	81	77.9	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	5	4.8
97	INI POWER SYSTEMS INC	81	816	9.9	RELX Group (Elsevier)	306	37.5	Electrochemical Society, Inc.	148	18.1
98	Schweitzer Engineering Labo	81	83	97.6	IEEE	81	97.6	IET/IEE	1	1.2
99	Sony Corp	80	333	24.0	IEEE	80	24.0	RELX Group (Elsevier)	77	23.1
100	Commissariat A L'Energie At	79	446	17.7	RELX Group (Elsevier)	155	34.8	IEEE	79	17.7

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Robotics and Intelligent Manufacturing</i>										
1	Irobot Corp	5590	9596	58.3	IEEE	5590	58.3	SPIE-Int Soc Opt Engineering	1270	13.2
2	Intuitive Surgical Inc.	3868	6868	56.3	IEEE	3868	56.3	SAGES-Society of American Gastrointestinal and Endoscopic	380	5.5
3	Applied Materials Inc.	1593	2699	59.0	IEEE	1593	59.0	American Institute of Physics	155	5.7
4	INTOUCH HEALTH INC	1078	2263	47.6	IEEE	1078	47.6	IEEE/RSJ	111	4.9
5	Honda Motor Co. Ltd.(Honda	693	1549	44.7	IEEE	693	44.7	RELX Group (Elsevier)	183	11.8
6	Microsoft Corporation	674	1644	41.0	IEEE	674	41.0	ACM-Assoc Comput Mach	343	20.9
7	Brain Corporation	669	1288	51.9	IEEE	669	51.9	MIT Press	201	15.6
8	International Business Machi	518	1436	36.1	IEEE	518	36.1	ACM-Assoc Comput Mach	182	12.7
9	University of Nebraska	506	1813	27.9	IEEE	506	27.9	Springer/Sp. Wien/Springer-Verlag/KluwAcad	277	15.3
10	Massachusetts Institute of Te	467	1140	41.0	IEEE	467	41.0	RELX Group (Elsevier)	165	14.5
11	Vanderbilt University	425	560	75.9	IEEE	425	75.9	IEEE/RSJ	37	6.6
12	Sony Corp	404	530	76.2	IEEE	404	76.2	IEEE/RSJ	23	4.3
13	Stryker Corp.	356	1015	35.1	IEEE	356	35.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	186	18.3
14	Siemens Aktiengesellschaft	322	758	42.5	IEEE	322	42.5	RELX Group (Elsevier)	80	10.6
15	PDF Solutions	315	403	78.2	IEEE	315	78.2	SPIE-Int Soc Opt Engineering	61	15.1
16	Immersion Corp.	313	777	40.3	IEEE	313	40.3	ACM-Assoc Comput Mach	76	9.8
17	HRL Laboratories LLC	249	411	60.6	IEEE	249	60.6	SPIE-Int Soc Opt Engineering	26	6.3
18	BIONX MEDICAL TECHN	241	391	61.6	IEEE	241	61.6	RELX Group (Elsevier)	43	11.0
19	SIPCO LLC	237	414	57.2	IEEE	237	57.2	Internet Soc/IETF-Internet Eng Task Force	35	8.5
20	Google Inc.	221	415	53.3	IEEE	221	53.3	ACM-Assoc Comput Mach	77	18.6
21	Samsung Electronics Co Ltd	221	346	63.9	IEEE	221	63.9	IEEE/RSJ	32	9.2
22	Advanced Micro Devices Inc	219	449	48.8	IEEE	219	48.8	RELX Group (Elsevier)	51	11.4
23	Medrobotics Corp	200	446	44.8	IEEE	200	44.8	Springer/Sp. Wien/Springer-Verlag/KluwAcad	95	21.3
24	MACAU UNIVERSITY OF	196	203	96.6	IEEE	196	96.6	IEEE/ASME	3	1.5
25	Cadence Design Systems Inc	186	442	42.1	IEEE	186	42.1	Joint IEEE and ACM	157	35.5
26	SRI International	181	411	44.0	IEEE	181	44.0	SPIE-Int Soc Opt Engineering	56	13.6
27	Cimpress NV	179	435	41.1	IEEE	179	41.1	RELX Group (Elsevier)	121	27.8
28	Emerson Electric Co.	153	632	24.2	IEEE	153	24.2	RELX Group (Elsevier)	90	14.2
29	Johns Hopkins University	152	284	53.5	IEEE	152	53.5	RELX Group (Elsevier)	21	7.4
30	ICOSYSTEM CORP	150	198	75.8	IEEE	150	75.8	IET/IEE	10	5.1
31	Boeing Co. (The)	148	396	37.4	IEEE	148	37.4	RELX Group (Elsevier)	83	21.0
32	Harris Corp.	148	212	69.8	IEEE	148	69.8	American Institute of Physics	11	5.2
33	Battelle Memorial Institute	144	195	73.8	IEEE	144	73.8	IEEE/RSJ	19	9.7
34	ABB Ltd	138	202	68.3	IEEE	138	68.3	RELX Group (Elsevier)	20	9.9
35	Johnson & Johnson	138	769	17.9	IEEE	138	17.9	RELX Group (Elsevier)	133	17.3
36	General Electric Company	137	263	52.1	IEEE	137	52.1	RELX Group (Elsevier)	17	6.5
37	ZOOX INC	135	165	81.8	IEEE	135	81.8	IEEE/RSJ	11	6.7
38	X Development Llc	134	193	69.4	IEEE	134	69.4	IEEE/RSJ	25	13.0
39	University of Southern Califo	128	189	67.7	IEEE	128	67.7	Springer/Sp. Wien/Springer-Verlag/KluwAcad	15	7.9

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	IWALK INC	127	259	49.0	IEEE	127	49.0	RELX Group (Elsevier)	38	14.7
41	Fanuc Ltd.	125	182	68.7	IEEE	125	68.7	RELX Group (Elsevier)	16	8.8
42	MONOLITHIC 3D INC	123	220	55.9	IEEE	123	55.9	IEEE/JPN Soc App Phys	23	10.5
43	ROY-G-BIV CORP	123	384	32.0	IEEE	123	32.0	ISO-International Standards Organization	67	17.4
44	Xerox Corp	121	275	44.0	IEEE	121	44.0	ACM-Assoc Comput Mach	37	13.5
45	Rockwell Automation Inc	117	222	52.7	IEEE	117	52.7	RELX Group (Elsevier)	27	12.2
46	Taiwan Semiconductor Manu	112	202	55.4	IEEE	112	55.4	RELX Group (Elsevier)	16	7.9
47	Walt Disney Co.	111	240	46.3	IEEE	111	46.3	ACM-Assoc Comput Mach	51	21.3
48	INDIVIDUAL PATENTER	108	235	46.0	IEEE	108	46.0	ACM-Assoc Comput Mach	10	4.3
49	Honeywell International Inc.	105	252	41.7	IEEE	105	41.7	RELX Group (Elsevier)	37	14.7
50	Toshiba Corp	103	163	63.2	IEEE	103	63.2	IEICE-Inst Elec Info Comm Eng	6	3.7
51	Fujitsu Limited	100	168	59.5	IEEE	100	59.5	RELX Group (Elsevier)	14	8.3
52	Amada Holdings Co. Ltd.	97	271	35.8	IEEE	97	35.8	RELX Group (Elsevier)	61	22.5
53	American Express Co.	96	343	28.0	IEEE	96	28.0	The USENIX Association	39	11.4
54	Panasonic Corporation	96	184	52.2	IEEE	96	52.2	IEICE-Inst Elec Info Comm Eng	11	6.0
55	Lockheed Martin Corp.	95	234	40.6	IEEE	95	40.6	RELX Group (Elsevier)	19	8.1
56	Tela Innovations inc	94	207	45.4	IEEE	94	45.4	Joint IEEE and ACM	52	25.1
57	Tokyo Electron Limited	93	237	39.2	IEEE	93	39.2	RELX Group (Elsevier)	25	10.5
58	CA Inc	92	161	57.1	IEEE	92	57.1	RELX Group (Elsevier)	37	23.0
59	Bonutti Technologies LLC	91	394	23.1	Springer/Sp. Wien/Springer-Verlag/KluwAca	110	27.9	IEEE	91	23.1
60	3D Systems Corp.	85	201	42.3	IEEE	85	42.3	ACM-Assoc Comput Mach	40	19.9
61	GENESIS ROBOTICS LLP	85	110	77.3	IEEE	85	77.3	World Academy of Science Engineering and Technology	5	4.5
62	HP Inc	85	206	41.3	IEEE	85	41.3	ACM-Assoc Comput Mach	25	12.1
63	ALOFT MEDIA LLC	82	102	80.4	IEEE	82	80.4	ASCE-AMER SOC CIVIL ENGINEERS	6	5.9
64	ARCHI CON DES INVENTI	82	393	20.9	ACM-Assoc Comput Mach	125	31.8	IEEE	82	20.9
65	Caterpillar Inc.	81	221	36.7	IEEE	81	36.7	SAE-Society of Automobile Engineers	35	15.8
66	Sap SE	80	289	27.7	IEEE	80	27.7	ACM-Assoc Comput Mach	49	17.0
67	University of Washington	79	186	42.5	IEEE	79	42.5	RELX Group (Elsevier)	16	8.6
68	Canon Inc	78	181	43.1	IEEE	78	43.1	SPIE-Int Soc Opt Engineering	20	11.0
69	NEC Corp	76	149	51.0	IEEE	76	51.0	ACM-Assoc Comput Mach	12	8.1
70	Rethink Robotics Inc	76	122	62.3	IEEE	76	62.3	RELX Group (Elsevier)	16	13.1
71	Toyota Motor Corp	74	148	50.0	IEEE	74	50.0	RELX Group (Elsevier)	13	8.8
72	HURCO COMPANIES INC	72	167	43.1	IEEE	72	43.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	19	11.4
73	Kuka AG	72	97	74.2	IEEE	72	74.2	IEEE/RSJ	7	7.2
74	MKS Instruments Inc.	72	171	42.1	IEEE	72	42.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	27	15.8
75	University of California	71	116	61.2	IEEE	71	61.2	RELX Group (Elsevier)	9	7.8
76	General Motors Corp	70	171	40.9	IEEE	70	40.9	RELX Group (Elsevier)	19	11.1
77	Health Discovery Corp	70	281	24.9	IEEE	70	24.9	IWDM Org	24	8.5
78	Align Technology Inc	68	454	15.0	JCO - Journal of Clinical Orthodontics	79	17.4	RELX Group (Elsevier)	78	17.2
79	AUREON LABORATORIES	67	273	24.5	IEEE	67	24.5	RELX Group (Elsevier)	35	12.8
80	United Technologies Corp	66	97	68.0	IEEE	66	68.0	EPE Association	7	7.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Arizona State University	65	106	61.3	IEEE	65	61.3	RELX Group (Elsevier)	7	6.6
82	Oracle Corporation	64	119	53.8	IEEE	64	53.8	ACM-Assoc Comput Mach	17	14.3
83	University of Pennsylvania	62	75	82.7	IEEE	62	82.7	IEEE/RSJ	7	9.3
84	TEST ADVANTAGE INC	60	71	84.5	IEEE	60	84.5	SPIE-Int Soc Opt Engineering	4	5.6
85	University of Minnesota (The)	60	101	59.4	IEEE	60	59.4	Emerald Group Publishing Ltd.	9	8.9
86	Texas Instruments Inc	59	113	52.2	IEEE	59	52.2	Penton Media	13	11.5
87	Ford Motor Co.	58	150	38.7	IEEE	58	38.7	Winter Simulation Conference Board of Directors	24	16.0
88	Procter & Gamble Co.	58	102	56.9	IEEE	58	56.9	IEC-International Electrotechnical Commission	10	9.8
89	Brooks Automation Inc.	57	123	46.3	IEEE	57	46.3	ASME-Am Soc Mech Eng	10	8.1
90	Georgia Institute of Technolo	57	113	50.4	IEEE	57	50.4	American Automatic Control Council (AACC)	22	19.5
91	SPHERO INC	57	58	98.3	IEEE	57	98.3	American Automatic Control Council (AACC)	1	1.7
92	The Invention Science Fund	57	311	18.3	IEEE	57	18.3	RELX Group (Elsevier)	43	13.8
93	Delphi Automotive PLC	56	135	41.5	IEEE	56	41.5	RELX Group (Elsevier)	40	29.6
94	Nokia Corp	56	96	58.3	IEEE	56	58.3	ACM-Assoc Comput Mach	7	7.3
95	Agilent Technologies Inc	55	103	53.4	IEEE	55	53.4	American Association for Clinical Chemistry, Inc.	8	7.8
96	KNOWMTECH LLC	54	490	11.0	American Institute of Physics	98	20.0	ACS-Am Chem Soc	92	18.8
97	Motorola Solutions Inc.	54	75	72.0	IEEE	54	72.0	ISCA (International Speech Communication Association)	4	5.3
98	Deere & Co.	51	102	50.0	IEEE	51	50.0	RELX Group (Elsevier)	11	10.8
99	Raytheon Co.	51	159	32.1	IEEE	51	32.1	SAGE Publications Ltd	19	11.9
100	California Institute of Techno	50	80	62.5	IEEE	50	62.5	American Physical Society	5	6.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Semiconductors/Solid-State Devices/Electronics</i>										
1	Micron Technology Inc.	23822	85412	27.9	IEEE	23822	27.9	RELX Group (Elsevier)	15326	17.9
2	Semiconductor Energy Labor	10950	1E+05	9.5	SID-Society for Information Display	33899	29.4	American Institute of Physics	22362	19.4
3	International Business Machi	8724	19674	44.3	IEEE	8724	44.3	American Institute of Physics	3074	15.6
4	MONOLITHIC 3D INC	8048	14054	57.3	IEEE	8048	57.3	IEEE/JPN Soc App Phys	1503	10.7
5	Taiwan Semiconductor Manu	7266	21422	33.9	IEEE	7266	33.9	American Institute of Physics	6788	31.7
6	Tela Innovations inc	4669	14821	31.5	SPIE-Int Soc Opt Engineering	5066	34.2	IEEE	4669	31.5
7	Macronix International Co. L	4587	8723	52.6	IEEE	4587	52.6	IEEE/JPN Soc App Phys	1643	18.8
8	Intel Corporation	4370	8188	53.4	IEEE	4370	53.4	American Institute of Physics	944	11.5
9	Cree Inc.	4070	11151	36.5	IEEE	4070	36.5	American Institute of Physics	2546	22.8
10	Western Digital Corp.	3727	7451	50.0	IEEE	3727	50.0	American Institute of Physics	944	12.7
11	Chipbond Technology Corp	2898	3631	79.8	IEEE	2898	79.8	RELX Group (Elsevier)	268	7.4
12	Qorvo	2727	3224	84.6	IEEE	2727	84.6	American Institute of Physics	271	8.4
13	Infineon Technologies AG	2615	5220	50.1	IEEE	2615	50.1	American Institute of Physics	751	14.4
14	On Semiconductor Corporati	2594	3516	73.8	IEEE	2594	73.8	RELX Group (Elsevier)	259	7.4
15	NXP Semiconductors NV	2397	4870	49.2	IEEE	2397	49.2	American Institute of Physics	779	16.0
16	Texas Instruments Inc	2349	4176	56.3	IEEE	2349	56.3	American Institute of Physics	438	10.5
17	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
18	Applied Materials Inc.	2188	12406	17.6	American Institute of Physics	2741	22.1	IEEE	2188	17.6
19	Broadcom Ltd	2156	6314	34.1	IEEE	2156	34.1	SMTA-Surface Mount Technology Association	1017	16.1
20	Toshiba Corp	2082	5193	40.1	IEEE	2082	40.1	American Institute of Physics	833	16.0
21	Murata Manufacturing Co. Lt	1910	2637	72.4	IEEE	1910	72.4	American Institute of Physics	105	4.0
22	University of Illinois	1894	17773	10.7	American Institute of Physics	4130	23.2	ACS-Am Chem Soc	2684	15.1
23	Advanced Micro Devices Inc	1542	2907	53.0	IEEE	1542	53.0	American Institute of Physics	311	10.7
24	PDF Solutions	1380	1814	76.1	IEEE	1380	76.1	SPIE-Int Soc Opt Engineering	343	18.9
25	Global Foundries Inc	1377	2695	51.1	IEEE	1377	51.1	American Institute of Physics	397	14.7
26	STMicroelectronics	1340	3044	44.0	IEEE	1340	44.0	RELX Group (Elsevier)	435	14.3
27	Innovative Network Corporat	1305	2486	52.5	IEEE	1305	52.5	IEEE/JPN Soc App Phys	288	11.6
28	University of California	1260	13239	9.5	American Institute of Physics	3569	27.0	RELX Group (Elsevier)	1761	13.3
29	Samsung Electronics Co Ltd	1258	6254	20.1	American Institute of Physics	1330	21.3	IEEE	1258	20.1
30	California Institute of Techno	1252	7189	17.4	IEEE	1252	17.4	American Institute of Physics	1197	16.7
31	Qualcomm Inc	1204	2406	50.0	IEEE	1204	50.0	American Institute of Physics	211	8.8
32	Finisar Corp	1141	3267	34.9	IEEE	1141	34.9	American Institute of Physics	611	18.7
33	Transphorm Inc	1101	2163	50.9	IEEE	1101	50.9	American Institute of Physics	424	19.6
34	Panasonic Corporation	1060	4808	22.0	IEEE	1060	22.0	American Institute of Physics	885	18.4
35	Fujitsu Limited	1014	2731	37.1	IEEE	1014	37.1	American Institute of Physics	369	13.5
36	Motorola Solutions Inc.	972	3156	30.8	IEEE	972	30.8	American Institute of Physics	811	25.7
37	Massachusetts Institute of Te	968	6573	14.7	American Institute of Physics	1485	22.6	IEEE	968	14.7
38	Cypress Semiconductor Corp.	940	1509	62.3	IEEE	940	62.3	American Institute of Physics	113	7.5
39	HRL Laboratories LLC	921	1852	49.7	IEEE	921	49.7	American Institute of Physics	325	17.5

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Commissariat A L'Energie At	919	4795	19.2	American Institute of Physics	1140	23.8	IEEE	919	19.2
41	ASM International N.V.	886	7053	12.6	American Institute of Physics	1658	23.5	RELX Group (Elsevier)	1480	21.0
42	United Microelectronics Corp	833	1638	50.9	IEEE	833	50.9	American Institute of Physics	248	15.1
43	Xperi Corporation (Formerly	809	2672	30.3	IEEE	809	30.3	American Institute of Physics	633	23.7
44	Mitsubishi Electric Corp	798	1609	49.6	IEEE	798	49.6	American Institute of Physics	150	9.3
45	Synopsys Inc.	758	1664	45.6	IEEE	758	45.6	American Institute of Physics	292	17.5
46	NEC Corp	707	1984	35.6	IEEE	707	35.6	American Institute of Physics	342	17.2
47	Lam Research Corp.	698	3922	17.8	American Institute of Physics	1081	27.6	IEEE	698	17.8
48	ZENO SEMICONDUCTOR I	677	856	79.1	IEEE	677	79.1	IEEE/JPN Soc App Phys	156	18.2
49	Hon Hai Precision Industry C	673	3423	19.7	American Institute of Physics	907	26.5	IEEE	673	19.7
50	Crossbar Inc	668	2307	29.0	IEEE	668	29.0	American Institute of Physics	340	14.7
51	Hitachi Ltd	625	2128	29.4	IEEE	625	29.4	American Institute of Physics	421	19.8
52	Analog Devices Inc.	581	883	65.8	IEEE	581	65.8	RELX Group (Elsevier)	58	6.6
53	Unisantis Electronics Ltd	579	661	87.6	IEEE	579	87.6	RELX Group (Elsevier)	36	5.4
54	Michigan State University	544	6895	7.9	Optical Society of America	1522	22.1	American Institute of Physics	1073	15.6
55	Mevion Medical Systems Inc	527	1894	27.8	IEEE	527	27.8	RELX Group (Elsevier)	388	20.5
56	SK Hynix Inc	502	987	50.9	IEEE	502	50.9	American Institute of Physics	117	11.9
57	Industrial Technology Researc	497	1430	34.8	IEEE	497	34.8	American Institute of Physics	228	15.9
58	Thermo Fisher Scientific Inc	492	2401	20.5	RELX Group (Elsevier)	791	32.9	IEEE	492	20.5
59	Interuniversity MicroElectron	478	1446	33.1	IEEE	478	33.1	American Institute of Physics	252	17.4
60	Aisin Seiki Co. Ltd.	469	3220	14.6	Optical Society of America	1173	36.4	IEEE	469	14.6
61	Hong Kong University of Sci	460	864	53.2	IEEE	460	53.2	American Institute of Physics	187	21.6
62	Nokia Corp	456	2456	18.6	American Institute of Physics	512	20.8	IEEE	456	18.6
63	Innovative Silicon SA	453	556	81.5	IEEE	453	81.5	RELX Group (Elsevier)	24	4.3
64	Sulvolta Inc	448	930	48.2	IEEE	448	48.2	American Institute of Physics	139	14.9
65	Nantero Inc	447	7030	6.4	ACS-Am Chem Soc	2087	29.7	American Institute of Physics	1539	21.9
66	Maxim Integrated Products In	446	549	81.2	IEEE	446	81.2	Joint IEEE and ACM	19	3.5
67	Partners HealthCare Systems	432	6063	7.1	Optical Society of America	2222	36.6	RELX Group (Elsevier)	833	13.7
68	Electronics and Telecommuni	428	1213	35.3	IEEE	428	35.3	American Institute of Physics	271	22.3
69	Power Integrations Inc.	426	630	67.6	IEEE	426	67.6	Institute of Pure and Applied Physics	58	9.2
70	Apple Inc	404	810	49.9	IEEE	404	49.9	American Institute of Physics	76	9.4
71	Soraa Inc	403	4964	8.1	American Institute of Physics	1645	33.1	Institute of Pure and Applied Physics	865	17.4
72	Xerox Corp	390	2201	17.7	American Institute of Physics	630	28.6	IEEE	390	17.7
73	Lockheed Martin Corp.	386	2127	18.1	American Institute of Physics	466	21.9	IEEE	386	18.1
74	Sony Corp	381	1744	21.8	IEEE	381	21.8	American Institute of Physics	376	21.6
75	Jiangsu ChangJiang Electroni	378	479	78.9	IEEE	378	78.9	International Microelectronics And Packaging Society	49	10.2
76	Canon Inc	377	3451	10.9	American Institute of Physics	848	24.6	RELX Group (Elsevier)	494	14.3
77	Xtera Communications Inc.	375	1110	33.8	IEEE	375	33.8	Optical Society of America	263	23.7
78	Georgia Institute of Technolo	367	1099	33.4	IEEE	367	33.4	American Institute of Physics	157	14.3
79	University of Wisconsin	367	1501	24.5	American Institute of Physics	448	29.8	IEEE	367	24.5
80	United States Navy	366	1850	19.8	American Institute of Physics	505	27.3	IEEE	366	19.8

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Siemens Aktiengesellschaft	351	1007	34.9	IEEE	351	34.9	American Institute of Physics	170	16.9
82	Soitec SA	342	1798	19.0	American Institute of Physics	498	27.7	IEEE	342	19.0
83	Silicon Genesis Corporation	335	1616	20.7	IEEE	335	20.7	RELX Group (Elsevier)	328	20.3
84	Viavi Solutions Inc	331	960	34.5	IEEE	331	34.5	American Institute of Physics	302	31.5
85	ACORN TECHNOLOGIES I	329	1282	25.7	American Institute of Physics	437	34.1	IEEE	329	25.7
86	General Electric Company	327	1320	24.8	IEEE	327	24.8	American Institute of Physics	234	17.7
87	Columbia University	325	4087	8.0	American Institute of Physics	1522	37.2	MRS-Materials Research Soc	436	10.7
88	Seiko Epson Corporation	322	1377	23.4	IEEE	322	23.4	American Institute of Physics	259	18.8
89	Sanan Optoelectronics Techn	315	1253	25.1	American Institute of Physics	560	44.7	IEEE	315	25.1
90	Vishay Intertechnology Inc.	314	481	65.3	IEEE	314	65.3	RELX Group (Elsevier)	26	5.4
91	TDK Corporation	313	1148	27.3	IEEE	313	27.3	American Institute of Physics	289	25.2
92	Bosch (Robert) GmbH	312	531	58.8	IEEE	312	58.8	RELX Group (Elsevier)	93	17.5
93	University of Michigan	306	1473	20.8	American Institute of Physics	344	23.4	IEEE	306	20.8
94	Enphase Energy Inc	298	464	64.2	IEEE	298	64.2	WIP-Renewable Energies	45	9.7
95	Honeywell International Inc.	292	1963	14.9	ACS-Am Chem Soc	424	21.6	IEEE	292	14.9
96	Seoul Semiconductor Co Ltd	292	2213	13.2	American Institute of Physics	903	40.8	IEEE	292	13.2
97	ZENA TECHNOLOGIES IN	287	1105	26.0	IEEE	287	26.0	American Institute of Physics	233	21.1
98	Emcore Corp.	286	566	50.5	IEEE	286	50.5	American Institute of Physics	83	14.7
99	Xilinx Inc.	283	411	68.9	IEEE	283	68.9	IEEE/JPN Soc App Phys	25	6.1
100	MC10 Inc	277	3329	8.3	American Institute of Physics	603	18.1	ACS-Am Chem Soc	527	15.8

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Smart Grid/Smart Meters/Energy Infrastructure</i>										
1	Velatia Group	839	1125	74.6	IEEE	839	74.6	Echelon Corp	81	7.2
2	SolarEdge Technologies Inc	338	365	92.6	IEEE	338	92.6	WIP-Renewable Energies	13	3.6
3	Honeywell International Inc.	234	291	80.4	IEEE	234	80.4	American Library Association	12	4.1
4	TRILLIANT NETWORKS I	218	320	68.1	IEEE	218	68.1	Internet Soc/IETF-Internet Eng Task Force	18	5.6
5	SIPCO LLC	155	269	57.6	IEEE	155	57.6	Internet Soc/IETF-Internet Eng Task Force	27	10.0
6	ABB Ltd	111	135	82.2	IEEE	111	82.2	IET/IEE	6	4.4
7	General Electric Company	101	141	71.6	IEEE	101	71.6	IET/IEE	9	6.4
8	California Institute of Techno	67	71	94.4	IEEE	67	94.4	American Automatic Control Council (AACC)	3	4.2
9	Alstom	66	77	85.7	IEEE	66	85.7	IET/IEE	7	9.1
10	Battelle Memorial Institute	59	86	68.6	IEEE	59	68.6	ACM-Assoc Comput Mach	6	7.0
11	SOLAREEDGE TECHNOLO	55	68	80.9	IEEE	55	80.9	WIP-Renewable Energies	7	10.3
12	International Business Machi	47	72	65.3	IEEE	47	65.3	ACM-Assoc Comput Mach	5	6.9
13	ASTROLINK INTERNATIO	46	53	86.8	IEEE	46	86.8	IET/IEE	5	9.4
14	DOMINION ENERGY TEC	46	53	86.8	IEEE	46	86.8	IET/IEE	5	9.4
15	Qualcomm Inc	43	68	63.2	IEEE	43	63.2	3GPP General Partnership Project Standards Body	5	7.4
16	3M Co	40	48	83.3	IEEE	40	83.3	AIAA-Am Inst Aero Astro	3	6.3
17	University of Minnesota (The	36	36	100.0	IEEE	36	100.0			
18	Itron Inc.	35	62	56.5	IEEE	35	56.5	Joint IEEE and ACM	8	12.9
19	Witricity Corp	32	36	88.9	IEEE	32	88.9	American Institute of Physics	3	8.3
20	Enphase Energy Inc	31	36	86.1	IEEE	31	86.1	EPE Association	4	11.1
21	Microsoft Corporation	31	63	49.2	IEEE	31	49.2	ACM-Assoc Comput Mach	11	17.5
22	University of Maryland	30	30	100.0	IEEE	30	100.0			
23	Georgia Institute of Technolo	28	83	33.7	ACM-Assoc Comput Mach	47	56.6	IEEE	28	33.7
24	AMPT LLC	26	28	92.9	IEEE	26	92.9	IET/IEE	2	7.1
25	ENERGY TECHNOLOGY G	26	30	86.7	IEEE	26	86.7	RELX Group (Elsevier)	2	6.7
26	Rockwell Automation Inc	24	34	70.6	IEEE	24	70.6	AIAA-Am Inst Aero Astro	3	8.8
27	SPARQ SYSTEMS INC	23	29	79.3	IEEE	23	79.3	RELX Group (Elsevier)	3	10.3
28	Siemens Aktiengesellschaft	22	46	47.8	IEEE	22	47.8	United Business Media/UBM Tech	11	23.9
29	Taiwan Semiconductor Manu	21	39	53.8	IEEE	21	53.8	Electrostatic Discharge Association	15	38.5
30	Schneider Electric S.A.	20	103	19.4	ANSI-American National Standards Institute	27	26.2	IEEE	20	19.4
31	TEMPORAL POWER LTD	20	20	100.0	IEEE	20	100.0			
32	ConvergeOne Inc	19	21	90.5	IEEE	19	90.5	Condé Nast	1	4.8
33	Commscope Inc.	18	18	100.0	IEEE	18	100.0			
34	Mitsubishi Electric Corp	18	19	94.7	IEEE	18	94.7	Hindawi Publishing Corporation	1	5.3
35	New Jersey Institute of Techn	17	17	100.0	IEEE	17	100.0			
36	Massachusetts Institute of Te	16	22	72.7	IEEE	16	72.7	AMER SOC NAVAL ENG INC	4	18.2
37	Tigo Energy Inc	16	20	80.0	IEEE	16	80.0	WIP-Renewable Energies	3	15.0
38	Accenture Ltd.	13	18	72.2	IEEE	13	72.2	A B B Corporate Management Services AG	4	22.2
39	Sony Corp	13	44	29.5	SID-Society for Information Display	24	54.5	IEEE	13	29.5



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	AT&T Inc	12	14	85.7	IEEE	12	85.7	ACM-Assoc Comput Mach	1	7.1
41	DELTA ENERGY & COMM	12	15	80.0	IEEE	12	80.0	ACM-Assoc Comput Mach	3	20.0
42	LSIS Co Ltd (Formerly LS In	12	13	92.3	IEEE	12	92.3	EPE Association	1	7.7
43	Panasonic Corporation	12	15	80.0	IEEE	12	80.0	IEICE-Inst Elec Info Comm Eng	2	13.3
44	Schweitzer Engineering Labo	12	13	92.3	IEEE	12	92.3	IEC-International Electrotechnical Commission	1	7.7
45	Google Inc.	11	17	64.7	IEEE	11	64.7	Penton Media	1	5.9
46	THE DETROIT EDISON CO	11	11	100.0	IEEE	11	100.0			
47	Elwha LLC	10	18	55.6	IEEE	10	55.6	RELX Group (Elsevier)	3	16.7
48	Hubbell Inc.	10	12	83.3	IEEE	10	83.3	Research Institute of Intelligent Computer Systems	1	8.3
49	Nokia Corp	10	17	58.8	IEEE	10	58.8	Joint IEEE and ACM	2	11.8
50	Roche Holding Ltd.	10	10	100.0	IEEE	10	100.0			
51	THE FLORIDA INTERNATI	10	13	76.9	IEEE	10	76.9	Joint IEEE and ACM	2	15.4
52	Cisco Systems Inc.	9	13	69.2	IEEE	9	69.2	Internet Soc/IETF-Internet Eng Task Force	4	30.8
53	Eaton Corp.	9	13	69.2	IEEE	9	69.2	IET/IEE	2	15.4
54	Hon Hai Precision Industry C	9	33	27.3	ACM-Assoc Comput Mach	16	48.5	IEEE	9	27.3
55	INTERNATIONAL BROAD	9	17	52.9	IEEE	9	52.9	ISO-International Standards Organization	6	35.3
56	University of Missouri	9	10	90.0	IEEE	9	90.0	Summit Technical Media	1	10.0
57	University of Wisconsin	9	10	90.0	IEEE	9	90.0	MONTANA HISTORICAL SOC	1	10.0
58	Energous Corporation	8	10	80.0	IEEE	8	80.0	Rajagiri School of Engineering & Technology, Cochin, Kerala,	1	10.0
59	NORWEB PLC	8	22	36.4	IEEE	8	36.4	Pennwell Pub	4	18.2
60	The Invention Science Fund	8	15	53.3	IEEE	8	53.3	ANSI-American National Standards Institute	4	26.7
61	Clemson University	7	9	77.8	IEEE	7	77.8	ACS-Am Chem Soc	1	11.1
62	CURRENT GRID LLC	7	11	63.6	IEEE	7	63.6	Echelon Corp	2	18.2
63	CURRENT TECHNOLOGIE	7	12	58.3	IEEE	7	58.3	Hewlett-Packard Company	2	16.7
64	Johnson Controls Internation	7	10	70.0	IEEE	7	70.0	RELX Group (Elsevier)	2	20.0
65	Nth Degree Technologies Wo	7	13	53.8	IEEE	7	53.8	American Institute of Physics	6	46.2
66	POWER TAGGING TECHN	7	8	87.5	IEEE	7	87.5	IET/IEE	1	12.5
67	STMicroelectronics	7	12	58.3	IEEE	7	58.3	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3	25.0
68	Toshiba Corp	7	12	58.3	IEEE	7	58.3	Internet Soc/IETF-Internet Eng Task Force	2	16.7
69	Boeing Co. (The)	6	12	50.0	IEEE	6	50.0	Lawrence Erlbaum Associates Inc.	1	8.3
70	Danfoss A/S	6	6	100.0	IEEE	6	100.0			
71	Digimarc Corp.	6	6	100.0	IEEE	6	100.0			
72	Electro Industries Gauge Tec	6	15	40.0	IEEE	6	40.0	ACM-Assoc Comput Mach	5	33.3
73	EMPOWER MICRO SYSTE	6	6	100.0	IEEE	6	100.0			
74	King Fahd University of Petr	6	9	66.7	IEEE	6	66.7	United Business Media/UBM Tech	3	33.3
75	Signify NV	6	7	85.7	IEEE	6	85.7	IEEE/OSA	1	14.3
76	STEM INC	6	6	100.0	IEEE	6	100.0			
77	TACTILIS SDN BHD	6	6	100.0	IEEE	6	100.0			
78	University of Oxford	6	6	100.0	IEEE	6	100.0			
79	UT-Battelle LLC	6	38	15.8	RELX Group (Elsevier)	12	31.6	Electrochemical Society, Inc.	12	31.6
80	COM/ENERGY TECHNOL	5	16	31.3	RELX Group (Elsevier)	6	37.5	IEEE	5	31.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	DGI CREATIONS LLC	5	5	100.0	IEEE	5	100.0			
82	D-Wave Systems Inc.	5	29	17.2	American Physical Society	9	31.0	American Institute of Physics	5	17.2
83	Electric Power Research Insti	5	11	45.5	Electric Power Research Institute	6	54.5	IEEE	5	45.5
84	Korea Electrotechnology Res	5	5	100.0	IEEE	5	100.0			
85	On Semiconductor Corporati	5	5	100.0	IEEE	5	100.0			
86	Samsung Electronics Co Ltd	5	19	26.3	IEEE	5	26.3	ACS-Am Chem Soc	3	15.8
87	State University of New York	5	6	83.3	IEEE	5	83.3	RELX Group (Elsevier)	1	16.7
88	University of Alberta	5	8	62.5	IEEE	5	62.5	RELX Group (Elsevier)	1	12.5
89	University of Connecticut	5	5	100.0	IEEE	5	100.0			
90	ANGAZA DESIGN INC	4	4	100.0	IEEE	4	100.0			
91	Broadcom Ltd	4	5	80.0	IEEE	4	80.0	IET/IEE	1	20.0
92	Hello Inc	4	4	100.0	IEEE	4	100.0			
93	HUDSON BAY WIRELESS	4	5	80.0	IEEE	4	80.0	Condé Nast	1	20.0
94	LUMIRADX UK LTD	4	5	80.0	IEEE	4	80.0	Bluetooth Special Interest Group	1	20.0
95	National Instruments Corp.	4	7	57.1	IEEE	4	57.1	RELX Group (Elsevier)	2	28.6
96	Northeastern University (Bost	4	8	50.0	IEEE	4	50.0	International Network for Scientific Information Publication (I	2	25.0
97	Vestas Wind Systems A/S	4	6	66.7	IEEE	4	66.7	Institution of Engineering and Technology	1	16.7
98	Walt Disney Co.	4	4	100.0	IEEE	4	100.0			
99	American Superconductor Co	3	8	37.5	RELX Group (Elsevier)	5	62.5	IEEE	3	37.5
100	ASOKA USA CORP	3	4	75.0	IEEE	3	75.0	National Association of Industrial Technology	1	25.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Solar/Photovoltaic</i>										
1	SolarEdge Technologies Inc	1509	1706	88.5	IEEE	1509	88.5	WIP-Renewable Energies	105	6.2
2	Enphase Energy Inc	437	627	69.7	IEEE	437	69.7	WIP-Renewable Energies	49	7.8
3	Tigo Energy Inc	286	386	74.1	IEEE	286	74.1	WIP-Renewable Energies	75	19.4
4	Taiwan Semiconductor Manu	272	1072	25.4	American Institute of Physics	474	44.2	IEEE	272	25.4
5	SolAero Technologies Corp	266	427	62.3	IEEE	266	62.3	American Institute of Physics	69	16.2
6	Sanan Optoelectronics Techn	258	610	42.3	IEEE	258	42.3	US Dept of Energy	246	40.3
7	Emcore Corp.	247	488	50.6	IEEE	247	50.6	US Dept of Energy	76	15.6
8	AMPT LLC	246	283	86.9	IEEE	246	86.9	IET/IEE	16	5.7
9	University of Illinois	237	2559	9.3	American Institute of Physics	516	20.2	ACS-Am Chem Soc	457	17.9
10	International Business Machi	204	817	25.0	IEEE	204	25.0	American Institute of Physics	169	20.7
11	Total SA	156	253	61.7	IEEE	156	61.7	RELX Group (Elsevier)	23	9.1
12	Xerox Corp	152	483	31.5	IEEE	152	31.5	RELX Group (Elsevier)	88	18.2
13	SEMPRIUS INC	150	1692	8.9	American Institute of Physics	319	18.9	ACS-Am Chem Soc	307	18.1
14	Solexel Inc	132	558	23.7	RELX Group (Elsevier)	180	32.3	IEEE	132	23.7
15	Hanergy Holding Group Ltd	121	363	33.3	IEEE	121	33.3	RELX Group (Elsevier)	58	16.0
16	Solar Junction Corp	113	515	21.9	American Institute of Physics	171	33.2	RELX Group (Elsevier)	121	23.5
17	Tesla Motors Inc	98	134	73.1	IEEE	98	73.1	American Institute of Physics	8	6.0
18	Advanced Energy Industries I	84	91	92.3	IEEE	84	92.3	IET/IEE	4	4.4
19	Alliance for Sustainable Ener	84	528	15.9	American Institute of Physics	164	31.1	RELX Group (Elsevier)	105	19.9
20	Lockheed Martin Corp.	80	285	28.1	IEEE	80	28.1	American Institute of Physics	63	22.1
21	Applied Materials Inc.	79	241	32.8	IEEE	79	32.8	WIP-Renewable Energies	51	21.2
22	Massachusetts Institute of Te	78	317	24.6	IEEE	78	24.6	American Institute of Physics	59	18.6
23	Stion Corp	77	671	11.5	RELX Group (Elsevier)	225	33.5	American Institute of Physics	146	21.8
24	California Institute of Techno	76	431	17.6	American Institute of Physics	151	35.0	IEEE	76	17.6
25	Canon Inc	76	200	38.0	IEEE	76	38.0	American Institute of Physics	34	17.0
26	Witricity Corp	71	106	67.0	IEEE	71	67.0	American Institute of Physics	9	8.5
27	Solyndra Inc	68	361	18.8	RELX Group (Elsevier)	117	32.4	IEEE	68	18.8
28	Nanosolar Inc	61	872	7.0	RELX Group (Elsevier)	247	28.3	Electrochemical Society, Inc.	107	12.3
29	Texas Instruments Inc	57	68	83.8	IEEE	57	83.8	Electrochemical Society, Inc.	4	5.9
30	First Solar Inc	52	211	24.6	RELX Group (Elsevier)	88	41.7	IEEE	52	24.6
31	General Electric Company	52	310	16.8	ACS-Am Chem Soc	83	26.8	IEEE	52	16.8
32	ZENA TECHNOLOGIES IN	49	120	40.8	IEEE	49	40.8	American Institute of Physics	35	29.2
33	Boeing Co. (The)	48	136	35.3	IEEE	48	35.3	RELX Group (Elsevier)	24	17.6
34	Dartmouth College	48	60	80.0	IEEE	48	80.0	RELX Group (Elsevier)	4	6.7
35	Hon Hai Precision Industry C	46	192	24.0	IEEE	46	24.0	RELX Group (Elsevier)	36	18.8
36	LG Electronics Inc.	46	135	34.1	IEEE	46	34.1	American Institute of Physics	28	20.7
37	SUNIVA INC	45	88	51.1	IEEE	45	51.1	WIP-Renewable Energies	12	13.6
38	TESLA INC	45	130	34.6	IEEE	45	34.6	American Institute of Physics	43	33.1
39	United States Navy	43	157	27.4	IEEE	43	27.4	American Institute of Physics	27	17.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	JXTG Holdings Inc	39	130	30.0	IEEE	39	30.0	RELX Group (Elsevier)	30	23.1
41	Ignis Innovation Inc	38	45	84.4	IEEE	38	84.4	SID-Society for Information Display	4	8.9
42	University of Toledo	37	138	26.8	RELX Group (Elsevier)	80	58.0	IEEE	37	26.8
43	Azur Space Solar Power Gmb	36	88	40.9	IEEE	36	40.9	RELX Group (Elsevier)	21	23.9
44	University of Minnesota (The	36	92	39.1	IEEE	36	39.1	American Institute of Physics	25	27.2
45	APOLLO PRECISION FUJI	35	47	74.5	IEEE	35	74.5	RELX Group (Elsevier)	5	10.6
46	EVERGREEN SOLAR INC	35	73	47.9	IEEE	35	47.9	ACS-Am Chem Soc	34	46.6
47	Ostendo Technologies Inc	35	89	39.3	IEEE	35	39.3	RELX Group (Elsevier)	23	25.8
48	4POWER LLC	34	66	51.5	IEEE	34	51.5	American Institute of Physics	18	27.3
49	DowDuPont	34	300	11.3	RELX Group (Elsevier)	97	32.3	American Institute of Physics	60	20.0
50	Commissariat A L'Energie At	32	188	17.0	RELX Group (Elsevier)	75	39.9	IEEE	32	17.0
51	University of California	32	673	4.8	ACS-Am Chem Soc	116	17.2	American Institute of Physics	114	16.9
52	Panasonic Corporation	31	174	17.8	American Institute of Physics	49	28.2	RELX Group (Elsevier)	35	20.1
53	AMI RESAERCH & DEVEL	27	65	41.5	IEEE	27	41.5	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	12.3
54	Koch Industries Inc	27	309	8.7	RELX Group (Elsevier)	120	38.8	American Institute of Physics	83	26.9
55	Semiconductor Energy Labor	27	407	6.6	SID-Society for Information Display	141	34.6	American Institute of Physics	71	17.4
56	Arizona State University	26	123	21.1	American Institute of Physics	39	31.7	IEEE	26	21.1
57	GTAT Corp (AT Advanced T	26	124	21.0	IEEE	26	21.0	American Institute of Physics	25	20.2
58	Teijin Ltd.	26	68	38.2	IEEE	26	38.2	WIP-Renewable Energies	11	16.2
59	The National Aeronautical an	26	194	13.4	MacMillan Publishing Company	29	14.9	IEEE	26	13.4
60	Hanwha Group	25	67	37.3	IEEE	25	37.3	American Institute of Physics	18	26.9
61	Imperial College	25	76	32.9	IEEE	25	32.9	American Institute of Physics	23	30.3
62	Compagnie de Saint-Gobain	23	126	18.3	SPIE-Int Soc Opt Engineering	32	25.4	RELX Group (Elsevier)	27	21.4
63	Precursor Energetics Inc	23	1095	2.1	ACS-Am Chem Soc	481	43.9	RELX Group (Elsevier)	237	21.6
64	Solopower Inc	23	211	10.9	RELX Group (Elsevier)	101	47.9	American Institute of Physics	43	20.4
65	Mitsubishi Electric Corp	22	44	50.0	IEEE	22	50.0	WIP-Renewable Energies	8	18.2
66	NATIONAL TECHNOLOGY	22	38	57.9	IEEE	22	57.9	ACS-Am Chem Soc	7	18.4
67	Nth Degree Technologies Wo	22	167	13.2	MacMillan Publishing Company	29	17.4	IEEE	22	13.2
68	Qualcomm Inc	22	65	33.8	IEEE	22	33.8	SID-Society for Information Display	11	16.9
69	Shin-Etsu Chemical Co. Ltd.	22	54	40.7	IEEE	22	40.7	RELX Group (Elsevier)	8	14.8
70	City University of Hong Kon	21	38	55.3	IEEE	21	55.3	IET/IEE	12	31.6
71	University of Michigan	21	230	9.1	American Institute of Physics	58	25.2	ACS-Am Chem Soc	39	17.0
72	Interuniversity MicroElectron	20	89	22.5	IEEE	20	22.5	RELX Group (Elsevier)	19	21.3
73	Raytheon Co.	20	43	46.5	IEEE	20	46.5	SPIE-Int Soc Opt Engineering	6	14.0
74	Fraunhofer Gesellschaft	19	76	25.0	IEEE	19	25.0	RELX Group (Elsevier)	18	23.7
75	Industrial Technology Researc	19	150	12.7	RELX Group (Elsevier)	44	29.3	American Institute of Physics	19	12.7
76	Toshiba Corp	19	102	18.6	ACS-Am Chem Soc	21	20.6	IEEE	19	18.6
77	ATHENAEUM LLC	18	104	17.3	RELX Group (Elsevier)	30	28.8	American Institute of Physics	18	17.3
78	CLEAN POWER RESEARC	18	29	62.1	IEEE	18	62.1	RELX Group (Elsevier)	8	27.6
79	Ebara Corp.	18	32	56.3	IEEE	18	56.3	RELX Group (Elsevier)	6	18.8
80	Laird Ltd	18	63	28.6	IEEE	18	28.6	American Institute of Physics	16	25.4

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Midwest Research Institute	18	74	24.3	RELX Group (Elsevier)	21	28.4	IEEE	18	24.3
82	New Jersey Institute of Techn	18	24	75.0	IEEE	18	75.0	American Institute of Physics	3	12.5
83	Toyota Motor Corp	18	64	28.1	IEEE	18	28.1	RELX Group (Elsevier)	12	18.8
84	ASCENT SOLAR TECHNO	17	43	39.5	IEEE	17	39.5	RELX Group (Elsevier)	11	25.6
85	SMA Solar Technology AG	17	18	94.4	IEEE	17	94.4	IET/IEE	1	5.6
86	VERLIY LIFE SCIENCES L	16	17	94.1	IEEE	16	94.1	IEEE/OSA	1	5.9
87	1366 TECHNOLOGIES INC	15	87	17.2	RELX Group (Elsevier)	45	51.7	IEEE	15	17.2
88	Intevac Inc	15	72	20.8	American Institute of Physics	24	33.3	IEEE	15	20.8
89	Siemens Aktiengesellschaft	15	33	45.5	IEEE	15	45.5	RELX Group (Elsevier)	11	33.3
90	Solfocus Inc	15	59	25.4	IEEE	15	25.4	RELX Group (Elsevier)	15	25.4
91	Sony Corp	15	87	17.2	RELX Group (Elsevier)	20	23.0	IEEE	15	17.2
92	United States of America De	15	48	31.3	IEEE	15	31.3	RELX Group (Elsevier)	8	16.7
93	ARCHITECTURAL GLASS	14	42	33.3	RELX Group (Elsevier)	14	33.3	IEEE	14	33.3
94	Kyocera Corp.	14	58	24.1	IEEE	14	24.1	American Institute of Physics	11	19.0
95	ROSESTREET LABS ENER	14	44	31.8	American Institute of Physics	17	38.6	IEEE	14	31.8
96	Showa Shell Sekiyu KK	14	28	50.0	IEEE	14	50.0	Japan Standards Assoc	4	14.3
97	Catholic University Leuven	13	35	37.1	IEEE	13	37.1	RELX Group (Elsevier)	7	20.0
98	Centre National De La Reche	13	143	9.1	RELX Group (Elsevier)	40	28.0	ACS-Am Chem Soc	24	16.8
99	INDIVIDUAL PATENTER	13	124	10.5	American Institute of Physics	23	18.5	RELX Group (Elsevier)	16	12.9
100	China National Chemical Cor	12	22	54.5	IEEE	12	54.5	WIP-Renewable Energies	4	18.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Telecom and Other Communications</i>										
1	Qualcomm Inc	25670	62065	41.4	IEEE	25670	41.4	3GPP General Partnership Project Standards Body	15146	24.4
2	Marvell Technology Group Lt	19052	24096	79.1	IEEE	19052	79.1	3GPP General Partnership Project Standards Body	3057	12.7
3	AT&T Inc	18150	32121	56.5	IEEE	18150	56.5	ACM-Assoc Comput Mach	1846	5.7
4	Broadcom Ltd	17077	26120	65.4	IEEE	17077	65.4	International Telecommunication Union	1162	4.4
5	Microsoft Corporation	14733	32490	45.3	IEEE	14733	45.3	ACM-Assoc Comput Mach	5125	15.8
6	Nokia Corp	11905	31063	38.3	IEEE	11905	38.3	3GPP General Partnership Project Standards Body	8268	26.6
7	Intel Corporation	10918	22958	47.6	IEEE	10918	47.6	3GPP General Partnership Project Standards Body	6149	26.8
8	InterDigital Inc	10796	43053	25.1	3GPP General Partnership Project Standards	27510	63.9	IEEE	10796	25.1
9	Ericsson	10504	34481	30.5	3GPP General Partnership Project Standards	14094	40.9	IEEE	10504	30.5
10	ParkerVision Inc	9929	19554	50.8	IEEE	9929	50.8	IET/IEE	4586	23.5
11	Cisco Systems Inc.	8108	26171	31.0	IEEE	8108	31.0	Internet Soc/IETF-Internet Eng Task Force	4292	16.4
12	Samsung Electronics Co Ltd	7312	20395	35.9	3GPP General Partnership Project Standards	8237	40.4	IEEE	7312	35.9
13	LG Electronics Inc.	6802	34060	20.0	3GPP General Partnership Project Standards	20095	59.0	IEEE	6802	20.0
14	Personalized Media Commun	6770	40884	16.6	Society of Motion Picture and Television Engi	12099	29.6	IEEE	6770	16.6
15	International Business Machi	6672	16222	41.1	IEEE	6672	41.1	ACM-Assoc Comput Mach	2422	14.9
16	Apple Inc	6202	12823	48.4	IEEE	6202	48.4	ACM-Assoc Comput Mach	1184	9.2
17	Sony Corp	5743	12467	46.1	IEEE	5743	46.1	3GPP General Partnership Project Standards Body	1529	12.3
18	Huawei Technologies Compa	5729	23068	24.8	3GPP General Partnership Project Standards	10284	44.6	IEEE	5729	24.8
19	Panasonic Corporation	5488	15394	35.7	IEEE	5488	35.7	3GPP General Partnership Project Standards Body	4373	28.4
20	Massachusetts Institute of Te	5359	8862	60.5	IEEE	5359	60.5	ACM-Assoc Comput Mach	438	4.9
21	Fractus SA	5073	8552	59.3	IEEE	5073	59.3	IET/IEE	1264	14.8
22	Adaptix	4353	6322	68.9	IEEE	4353	68.9	European Telecom Standards Institute (ETSI)	683	10.8
23	Fujitsu Limited	4203	11580	36.3	IEEE	4203	36.3	3GPP General Partnership Project Standards Body	2601	22.5
24	Blackberry Ltd.	4201	17066	24.6	3GPP General Partnership Project Standards	8345	48.9	IEEE	4201	24.6
25	Google Inc.	4068	11024	36.9	IEEE	4068	36.9	ACM-Assoc Comput Mach	1188	10.8
26	Nippon Telegraph & Telepho	3856	11718	32.9	3GPP General Partnership Project Standards	4035	34.4	IEEE	3856	32.9
27	Texas Instruments Inc	3772	5688	66.3	IEEE	3772	66.3	3GPP General Partnership Project Standards Body	486	8.5
28	RPX Corp	3653	8528	42.8	IEEE	3653	42.8	IEEE/OSA	843	9.9
29	REARDEN LLC	3386	3786	89.4	IEEE	3386	89.4	IET/IEE	123	3.2
30	Rambus Inc.	3313	4662	71.1	IEEE	3313	71.1	IEEE/JPN Soc App Phys	200	4.3
31	University of Minnesota (The	3206	3578	89.6	IEEE	3206	89.6	ACM-Assoc Comput Mach	50	1.4
32	Commscope Inc.	3186	4859	65.6	IEEE	3186	65.6	3GPP General Partnership Project Standards Body	426	8.8
33	NEC Corp	3177	10035	31.7	3GPP General Partnership Project Standards	3767	37.5	IEEE	3177	31.7
34	Electronics and Telecommuni	3059	5238	58.4	IEEE	3059	58.4	3GPP General Partnership Project Standards Body	690	13.2
35	Conversant Intellectual Prope	2953	5565	53.1	IEEE	2953	53.1	Primedia Business Magazines & Media Inc.	216	3.9
36	Murata Manufacturing Co. Lt	2907	3787	76.8	IEEE	2907	76.8	IEICE-Inst Elec Info Comm Eng	111	2.9
37	Raytheon Co.	2879	4837	59.5	IEEE	2879	59.5	IET/IEE	210	4.3
38	NXP Semiconductors NV	2753	3626	75.9	IEEE	2753	75.9	3GPP General Partnership Project Standards Body	105	2.9
39	STMicroelectronics	2643	3567	74.1	IEEE	2643	74.1	RELX Group (Elsevier)	78	2.2

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	Comcast Corp	2628	6753	38.9	3GPP General Partnership Project Standards	2662	39.4	IEEE	2628	38.9
41	Motorola Solutions Inc.	2576	4437	58.1	IEEE	2576	58.1	3GPP General Partnership Project Standards Body	345	7.8
42	Xperi Corporation (Formerly	2554	4489	56.9	IEEE	2554	56.9	SPIE-Int Soc Opt Engineering	443	9.9
43	Verizon Communications Inc	2499	6860	36.4	IEEE	2499	36.4	Internet Soc/IETF-Internet Eng Task Force	1238	18.0
44	Technicolor SA	2421	4723	51.3	IEEE	2421	51.3	ISO/IEC/JTC/ANSI	263	5.6
45	Columbia University	2381	3801	62.6	IEEE	2381	62.6	ACM-Assoc Comput Mach	370	9.7
46	Industrial Technology Researc	2204	3271	67.4	IEEE	2204	67.4	3GPP General Partnership Project Standards Body	322	9.8
47	Mitsubishi Electric Corp	2150	5040	42.7	IEEE	2150	42.7	3GPP General Partnership Project Standards Body	1051	20.9
48	Toshiba Corp	2132	4380	48.7	IEEE	2132	48.7	IEICE-Inst Elec Info Comm Eng	313	7.1
49	Honeywell International Inc.	2099	3589	58.5	IEEE	2099	58.5	RELX Group (Elsevier)	150	4.2
50	Digimarc Corp.	2093	5110	41.0	IEEE	2093	41.0	SPIE-Int Soc Opt Engineering	575	11.3
51	DIRECTV Group Inc. (The)	2052	3180	64.5	IEEE	2052	64.5	Elettronica e Telecomunicazioni	161	5.1
52	Silicon Laboratories Inc	2049	2608	78.6	IEEE	2049	78.6	RELX Group (Elsevier)	113	4.3
53	Analog Devices Inc.	1890	2355	80.3	IEEE	1890	80.3	IET/IEE	70	3.0
54	SIPCO LLC	1841	3104	59.3	IEEE	1841	59.3	ACM-Assoc Comput Mach	239	7.7
55	Corning Inc.	1828	3009	60.8	IEEE	1828	60.8	IET/IEE	281	9.3
56	Micron Technology Inc.	1800	2924	61.6	IEEE	1800	61.6	IEEE/JPN Soc App Phys	174	6.0
57	TiVo Corp	1796	6428	27.9	IEEE	1796	27.9	ACM-Assoc Comput Mach	472	7.3
58	Softbank Corp	1774	6584	26.9	International Telecommunication Union	1846	28.0	IEEE	1774	26.9
59	Harris Corp.	1765	3109	56.8	IEEE	1765	56.8	Internet Soc/IETF-Internet Eng Task Force	240	7.7
60	HP Inc	1764	5377	32.8	IEEE	1764	32.8	Internet Soc/IETF-Internet Eng Task Force	704	13.1
61	Semiconductor Energy Labor	1758	15666	11.2	SID-Society for Information Display	5351	34.2	American Institute of Physics	2709	17.3
62	Pelican Imaging Corporation	1757	3585	49.0	IEEE	1757	49.0	SPIE-Int Soc Opt Engineering	555	15.5
63	University of California	1748	2924	59.8	IEEE	1748	59.8	American Institute of Physics	128	4.4
64	Hon Hai Precision Industry C	1686	9458	17.8	3GPP General Partnership Project Standards	4622	48.9	IEEE	1686	17.8
65	Koninklijke Philips N.V.	1664	3418	48.7	IEEE	1664	48.7	3GPP General Partnership Project Standards Body	286	8.4
66	Fraunhofer Gesellschaft	1625	3193	50.9	IEEE	1625	50.9	MPEG.org	264	8.3
67	Innovative Network Corporat	1606	2693	59.6	IEEE	1606	59.6	IEEE/OSA	215	8.0
68	Oracle Corporation	1605	5884	27.3	IEEE	1605	27.3	3GPP General Partnership Project Standards Body	740	12.6
69	Quarterhill Inc	1552	2308	67.2	IEEE	1552	67.2	3GPP General Partnership Project Standards Body	108	4.7
70	HRL Laboratories LLC	1549	2582	60.0	IEEE	1549	60.0	IET/IEE	236	9.1
71	ARRIS Group Inc	1510	2698	56.0	IEEE	1510	56.0	International Telecommunication Union	122	4.5
72	Qorvo	1466	1811	80.9	IEEE	1466	80.9	European Microwave Association	81	4.5
73	Juniper Networks Inc.	1458	4321	33.7	IEEE	1458	33.7	Network Working Group RFC	1110	25.7
74	Mediatek Inc.	1440	2476	58.2	IEEE	1440	58.2	3GPP General Partnership Project Standards Body	706	28.5
75	Infineon Technologies AG	1372	1977	69.4	IEEE	1372	69.4	3GPP General Partnership Project Standards Body	88	4.5
76	L-3 Communications Holdin	1356	1776	76.4	IEEE	1356	76.4	IET/IEE	89	5.0
77	California Institute of Techno	1350	2560	52.7	IEEE	1350	52.7	Optical Society of America	183	7.1
78	CPG TECHNOLOGIES LLC	1347	1682	80.1	IEEE	1347	80.1	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	87	5.2
79	Tabula Inc	1316	3545	37.1	ACM-Assoc Comput Mach	1337	37.7	IEEE	1316	37.1
80	LibertyMedia	1308	2244	58.3	IEEE	1308	58.3	ACM-Assoc Comput Mach	153	6.8

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Siemens Aktiengesellschaft	1305	2824	46.2	IEEE	1305	46.2	3GPP General Partnership Project Standards Body	232	8.2
82	Hitachi Ltd	1290	3652	35.3	IEEE	1290	35.3	IEICE-Inst Elec Info Comm Eng	308	8.4
83	Dolby Laboratories Inc	1250	3637	34.4	IEEE	1250	34.4	International Telecommunication Union	802	22.1
84	Canon Inc	1222	2860	42.7	IEEE	1222	42.7	International Telecommunication Union	243	8.5
85	Xilinx Inc.	1181	1540	76.7	IEEE	1181	76.7	ACM-Assoc Comput Mach	75	4.9
86	Xerox Corp	1125	2658	42.3	IEEE	1125	42.3	ACM-Assoc Comput Mach	714	26.9
87	Wisteria Trading Inc	1100	2152	51.1	IEEE	1100	51.1	SPIE-Int Soc Opt Engineering	249	11.6
88	MagnaCom Ltd	1072	1133	94.6	IEEE	1072	94.6	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	61	5.4
89	MONOLITHIC 3D INC	1072	1906	56.2	IEEE	1072	56.2	IEEE/JPN Soc App Phys	204	10.7
90	Boeing Co. (The)	1045	2092	50.0	IEEE	1045	50.0	SPIE-Int Soc Opt Engineering	79	3.8
91	Lenovo Group Ltd	1034	3498	29.6	3GPP General Partnership Project Standards	1907	54.5	IEEE	1034	29.6
92	Lockheed Martin Corp.	1018	2685	37.9	IEEE	1018	37.9	Optical Society of America	231	8.6
93	SUN PATENT TRUST	978	3981	24.6	3GPP General Partnership Project Standards	1586	39.8	IEEE	978	24.6
94	Viasat	977	1420	68.8	IEEE	977	68.8	European Microwave Association	53	3.7
95	BT Group PLC	958	1945	49.3	IEEE	958	49.3	Internet Soc/IETF-Internet Eng Task Force	174	8.9
96	Kyocera Corp.	951	2382	39.9	3GPP General Partnership Project Standards	1128	47.4	IEEE	951	39.9
97	NUVOTRONICS INC	948	1124	84.3	IEEE	948	84.3	IET/IEE	50	4.4
98	United States Navy	947	1776	53.3	IEEE	947	53.3	American Physical Society	113	6.4
99	Texas A&M University	935	1050	89.0	IEEE	935	89.0	IET/IEE	18	1.7
100	CenturyLink Inc	914	2224	41.1	IEEE	914	41.1	Internet Soc/IETF-Internet Eng Task Force	270	12.1



## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Virtual/Augmented Reality</i>										
1	Microsoft Corporation	2849	5814	49.0	IEEE	2849	49.0	ACM-Assoc Comput Mach	1367	23.5
2	Immersion Corp.	1540	4009	38.4	IEEE	1540	38.4	ACM-Assoc Comput Mach	466	11.6
3	Apple Inc	691	1625	42.5	IEEE	691	42.5	ACM-Assoc Comput Mach	318	19.6
4	TANGIS CORP	329	470	70.0	IEEE	329	70.0	ACM-Assoc Comput Mach	81	17.2
5	Sony Corp	325	753	43.2	IEEE	325	43.2	ACM-Assoc Comput Mach	144	19.1
6	Qualcomm Inc	258	518	49.8	IEEE	258	49.8	ACM-Assoc Comput Mach	73	14.1
7	Google Inc.	231	541	42.7	IEEE	231	42.7	ACM-Assoc Comput Mach	121	22.4
8	Osterhout Design Group	198	549	36.1	IEEE	198	36.1	ACM-Assoc Comput Mach	170	31.0
9	3D Systems Corp.	190	420	45.2	IEEE	190	45.2	ACM-Assoc Comput Mach	107	25.5
10	Intellectual Ventures Manage	149	353	42.2	IEEE	149	42.2	ACM-Assoc Comput Mach	111	31.4
11	Lincoln Electric Holdings Inc	145	399	36.3	ACM-Assoc Comput Mach	190	47.6	IEEE	145	36.3
12	Massachusetts Institute of Te	145	297	48.8	IEEE	145	48.8	ACM-Assoc Comput Mach	58	19.5
13	International Business Machi	125	334	37.4	IEEE	125	37.4	ACM-Assoc Comput Mach	69	20.7
14	BRAINGATE CO LLC	118	306	38.6	IEEE	118	38.6	RELX Group (Elsevier)	45	14.7
15	AT&T Inc	100	227	44.1	IEEE	100	44.1	ACM-Assoc Comput Mach	65	28.6
16	P4TENTS1 LLC	96	145	66.2	IEEE	96	66.2	Joint IEEE and ACM	13	9.0
17	Digimarc Corp.	95	187	50.8	IEEE	95	50.8	ACM-Assoc Comput Mach	33	17.6
18	Intel Corporation	91	187	48.7	IEEE	91	48.7	ACM-Assoc Comput Mach	51	27.3
19	University of North Carolina	91	215	42.3	IEEE	91	42.3	ACM-Assoc Comput Mach	72	33.5
20	Nokia Corp	83	165	50.3	IEEE	83	50.3	ACM-Assoc Comput Mach	31	18.8
21	ConvergeOne Inc	77	175	44.0	IEEE	77	44.0	ACM-Assoc Comput Mach	20	11.4
22	Samsung Electronics Co Ltd	71	183	38.8	IEEE	71	38.8	ACM-Assoc Comput Mach	40	21.9
23	Walt Disney Co.	71	194	36.6	IEEE	71	36.6	ACM-Assoc Comput Mach	59	30.4
24	HRL Laboratories LLC	68	142	47.9	IEEE	68	47.9	ACM-Assoc Comput Mach	17	12.0
25	Facebook Inc	63	150	42.0	IEEE	63	42.0	ACM-Assoc Comput Mach	28	18.7
26	Magic Leap Inc	62	126	49.2	IEEE	62	49.2	Joint IEEE and ACM	18	14.3
27	Medtronic Inc	58	104	55.8	IEEE	58	55.8	Lippincott Williams & Wilkins Ltd.	6	5.8
28	Canon Inc	56	185	30.3	IEEE	56	30.3	ACM-Assoc Comput Mach	38	20.5
29	THALMIC LABS INC	56	75	74.7	IEEE	56	74.7	ACM-Assoc Comput Mach	19	25.3
30	Honda Motor Co. Ltd.(Honda	55	88	62.5	IEEE	55	62.5	RELX Group (Elsevier)	7	8.0
31	BUTTERFLY NETWORKS I	52	60	86.7	IEEE	52	86.7	Acoustical Society of America	4	6.7
32	California Institute of Techno	50	135	37.0	IEEE	50	37.0	American Physiological Society	18	13.3
33	Xperi Corporation (Formerly	49	118	41.5	IEEE	49	41.5	SPIE-Int Soc Opt Engineering	20	16.9
34	Amazon.com Inc.	46	147	31.3	ACM-Assoc Comput Mach	69	46.9	IEEE	46	31.3
35	Oracle Corporation	46	104	44.2	IEEE	46	44.2	ACM-Assoc Comput Mach	37	35.6
36	Autodesk Inc.	45	292	15.4	ACM-Assoc Comput Mach	190	65.1	IEEE	45	15.4
37	Technicolor SA	45	59	76.3	IEEE	45	76.3	ACM-Assoc Comput Mach	4	6.8
38	Knauf Gips Kg	43	120	35.8	IEEE	43	35.8	RELX Group (Elsevier)	16	13.3
39	Siemens Aktiengesellschaft	43	102	42.2	IEEE	43	42.2	Joint IEEE and ACM	26	25.5

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	The Invention Science Fund	42	87	48.3	IEEE	42	48.3	Condé Nast	10	11.5
41	Ohio State University	40	59	67.8	IEEE	40	67.8	RELX Group (Elsevier)	5	8.5
42	ORCAM TECHNOLOGIES	40	48	83.3	IEEE	40	83.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	4	8.3
43	ELECTRONIC SCRIPTING	36	69	52.2	IEEE	36	52.2	Joint IEEE and ACM	13	18.8
44	Johnson & Johnson	36	126	28.6	RELX Group (Elsevier)	38	30.2	IEEE	36	28.6
45	Surefire LLC	35	46	76.1	IEEE	35	76.1	IEEE/OSA	11	23.9
46	Elwha LLC	34	55	61.8	IEEE	34	61.8	ACM-Assoc Comput Mach	8	14.5
47	Tobii Ab	34	68	50.0	IEEE	34	50.0	ACM-Assoc Comput Mach	21	30.9
48	Cisco Systems Inc.	33	73	45.2	IEEE	33	45.2	Internet Soc/IETF-Internet Eng Task Force	10	13.7
49	Lockheed Martin Corp.	33	187	17.6	IEEE	33	17.6	RELX Group (Elsevier)	26	13.9
50	Toshiba Corp	33	46	71.7	IEEE	33	71.7	International Association for Pattern Recognition (IAPR)	5	10.9
51	TANGIS CORP MICROSOFT	32	56	57.1	IEEE	32	57.1	ACM-Assoc Comput Mach	13	23.2
52	HP Inc	31	76	40.8	IEEE	31	40.8	ACM-Assoc Comput Mach	19	25.0
53	Nant Holdings IP Llc	30	44	68.2	IEEE	30	68.2	DOW JONES & CO, INC	3	6.8
54	Nintendo Co. Ltd.	30	217	13.8	Nintendo of America	130	59.9	IEEE	30	13.8
55	Rethink Robotics Inc	30	41	73.2	IEEE	30	73.2	RELX Group (Elsevier)	6	14.6
56	Toyota Motor Corp	30	66	45.5	IEEE	30	45.5	ACM-Assoc Comput Mach	23	34.8
57	APPLIED RESEARCH ASS	29	54	53.7	IEEE	29	53.7	MIT/MIT Press	5	9.3
58	Intuitive Surgical Inc.	29	40	72.5	IEEE	29	72.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	2	5.0
59	Pelican Imaging Corporation	29	35	82.9	IEEE	29	82.9	ACM-Assoc Comput Mach	4	11.4
60	University of South Florida	28	56	50.0	IEEE	28	50.0	RELX Group (Elsevier)	10	17.9
61	Adidas AG	27	79	34.2	IEEE	27	34.2	RELX Group (Elsevier)	12	15.2
62	Fitbit Inc	27	60	45.0	IEEE	27	45.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	7	11.7
63	Ford Motor Co.	26	64	40.6	IEEE	26	40.6	ACM-Assoc Comput Mach	19	29.7
64	North Carolina State University	25	27	92.6	IEEE	25	92.6	International Association for Pattern Recognition (IAPR)	1	3.7
65	INDIVIDUAL PATENTER	24	52	46.2	IEEE	24	46.2	RELX Group (Elsevier)	6	11.5
66	ULTIMATEPOINTER LLC	24	49	49.0	IEEE	24	49.0	ACM-Assoc Comput Mach	17	34.7
67	Drexel University	23	24	95.8	IEEE	23	95.8	International Association for Pattern Recognition (IAPR)	1	4.2
68	Harvard University	23	53	43.4	IEEE	23	43.4	American Institute of Physics	7	13.2
69	Panasonic Corporation	22	47	46.8	IEEE	22	46.8	RELX Group (Elsevier)	5	10.6
70	University of Washington	22	51	43.1	IEEE	22	43.1	ACM-Assoc Comput Mach	10	19.6
71	ZSPACE INC	22	93	23.7	IEEE	22	23.7	ACM-Assoc Comput Mach	19	20.4
72	Acuity Brands Inc.	21	25	84.0	IEEE	21	84.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	12.0
73	Boeing Co. (The)	21	54	38.9	IEEE	21	38.9	ACM-Assoc Comput Mach	10	18.5
74	Cedar Ridge Research LLC	21	34	61.8	IEEE	21	61.8	American Institute of Physics	8	23.5
75	Comcast Corp	21	44	47.7	IEEE	21	47.7	SPIE-Int Soc Opt Engineering	17	38.6
76	Koninklijke Philips N.V.	21	64	32.8	IEEE	21	32.8	ACM-Assoc Comput Mach	8	12.5
77	LEGEND3D INC	21	24	87.5	IEEE	21	87.5	International Association for Pattern Recognition (IAPR)	3	12.5
78	ULTRAHAPTICS IP LTD	21	36	58.3	IEEE	21	58.3	ACM-Assoc Comput Mach	13	36.1
79	University of Arizona	21	122	17.2	Optical Society of America	34	27.9	IEEE	21	17.2
80	Oblong Industries Inc	20	30	66.7	IEEE	20	66.7	ACM-Assoc Comput Mach	10	33.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	BERTEC CORP	19	30	63.3	IEEE	19	63.3	BioMed Central	4	13.3
82	Harris Corp.	19	33	57.6	IEEE	19	57.6	MIT/MIT Press	6	18.2
83	Lenovo Group Ltd	19	49	38.8	IEEE	19	38.8	ACM-Assoc Comput Mach	16	32.7
84	University of Maryland	19	19	100.0	IEEE	19	100.0			
85	Agency for Science Technolo	18	34	52.9	IEEE	18	52.9	RELX Group (Elsevier)	8	23.5
86	COMPUTERIZED MEDICA	18	50	36.0	IEEE	18	36.0	RELX Group (Elsevier)	9	18.0
87	Honeywell International Inc.	18	48	37.5	IEEE	18	37.5	RELX Group (Elsevier)	4	8.3
88	SYNAPIX INC	18	30	60.0	IEEE	18	60.0	RELX Group (Elsevier)	4	13.3
89	University of Central Florida	18	35	51.4	IEEE	18	51.4	ACM-Assoc Comput Mach	8	22.9
90	Searete LLC	17	47	36.2	IEEE	17	36.2	ACM-Assoc Comput Mach	15	31.9
91	Washington University in St.	17	36	47.2	IEEE	17	47.2	RELX Group (Elsevier)	5	13.9
92	FACENSE LTD	16	18	88.9	IEEE	16	88.9	ACM-Assoc Comput Mach	2	11.1
93	McGill University	16	53	30.2	IEEE	16	30.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	6	11.3
94	MIMIC TECHNOLOGIES I	16	51	31.4	IEEE	16	31.4	ASME-Am Soc Mech Eng	12	23.5
95	Queen's Univerity of Kingsto	16	117	13.7	ACM-Assoc Comput Mach	75	64.1	IEEE	16	13.7
96	Uber Technologies Inc	16	20	80.0	IEEE	16	80.0	Joint IEEE and ACM	4	20.0
97	University of California	16	35	45.7	IEEE	16	45.7	RELX Group (Elsevier)	9	25.7
98	Bosch (Robert) GmbH	15	27	55.6	IEEE	15	55.6	SPIE-Int Soc Opt Engineering	3	11.1
99	Fujitsu Limited	15	40	37.5	IEEE	15	37.5	ACM-Assoc Comput Mach	8	20.0
100	Daqri Llc	14	18	77.8	IEEE	14	77.8	ACM-Assoc Comput Mach	3	16.7

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
<i>Wind Energy</i>										
1	Vestas Wind Systems A/S	398	876	45.4	IEEE	398	45.4	AWEA-American Wind Energy Association	98	11.2
2	General Electric Company	158	472	33.5	IEEE	158	33.5	US Dept of Energy	114	24.2
3	ABB Ltd	142	244	58.2	IEEE	142	58.2	EWEA-European Wind Energy Association	18	7.4
4	Siemens Aktiengesellschaft	65	110	59.1	IEEE	65	59.1	RELX Group (Elsevier)	11	10.0
5	SolarEdge Technologies Inc	61	76	80.3	IEEE	61	80.3	WIP-Renewable Energies	7	9.2
6	Ingeteam Corporation SA	41	66	62.1	IEEE	41	62.1	Oxford University Press	6	9.1
7	Enercon GmbH	34	39	87.2	IEEE	34	87.2	RELX Group (Elsevier)	2	5.1
8	University of Alabama	29	36	80.6	IEEE	29	80.6	IET/IEE	6	16.7
9	Arizona State University	28	32	87.5	IEEE	28	87.5	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AV	2	6.3
10	University of New Brunswick	25	27	92.6	IEEE	25	92.6	AIAA-Am Inst Aero Astro	1	3.7
11	National Cheng Kung Univer	18	19	94.7	IEEE	18	94.7	IET/IEE	1	5.3
12	UWM Research Foundation	17	19	89.5	IEEE	17	89.5	IET/IEE	1	5.3
13	Senvion SE	15	50	30.0	IEEE	15	30.0	AIAA-Am Inst Aero Astro	10	20.0
14	Tigo Energy Inc	14	14	100.0	IEEE	14	100.0			
15	TechnipFMC	13	17	76.5	IEEE	13	76.5	ASME-Am Soc Mech Eng	1	5.9
16	Fujitsu Limited	12	13	92.3	IEEE	12	92.3	RELX Group (Elsevier)	1	7.7
17	Nordex SE	12	20	60.0	IEEE	12	60.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	4	20.0
18	NRG SYSTEMS INC	12	22	54.5	IEEE	12	54.5	RELX Group (Elsevier)	4	18.2
19	UNIVERSITY OF ZAGREB	12	14	85.7	IEEE	12	85.7	EWEA-European Wind Energy Association	1	7.1
20	SPARQ SYSTEMS INC	11	14	78.6	IEEE	11	78.6	IET/IEE	2	14.3
21	Woodward Inc	10	10	100.0	IEEE	10	100.0			
22	Kite Gen Research Srl	9	20	45.0	IEEE	9	45.0	RELX Group (Elsevier)	6	30.0
23	ZOND ENERGY SYSTEMS	9	11	81.8	IEEE	9	81.8	EPE Association	1	9.1
24	GENEDICS CLEAN ENERG	7	63	11.1	RELX Group (Elsevier)	49	77.8	IEEE	7	11.1
25	GENEDICS LLC	6	47	12.8	RELX Group (Elsevier)	35	74.5	IEEE	6	12.8
26	INDIVIDUAL PATENTER	6	24	25.0	ASME-Am Soc Mech Eng	7	29.2	IEEE	6	25.0
27	Medtronic Inc	6	7	85.7	IEEE	6	85.7	MacMillan Publishing Company	1	14.3
28	GREEN ENERGY CORP	5	5	100.0	IEEE	5	100.0			
29	Mitsubishi Heavy Industries	5	53	9.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	25	47.2	ASME-Am Soc Mech Eng	13	24.5
30	NEC Corp	5	5	100.0	IEEE	5	100.0			
31	RHEINISCH-WESTFALISC	5	5	100.0	IEEE	5	100.0			
32	University of Western Ontari	5	5	100.0	IEEE	5	100.0			
33	Alstom	4	6	66.7	IEEE	4	66.7	A B B Corporate Management Services AG	2	33.3
34	Hitachi Ltd	4	7	57.1	IEEE	4	57.1	Hitachi Ltd.	3	42.9
35	HYPER TECH RESEARCH	4	4	100.0	IEEE	4	100.0			
36	KK WIND SOLUTIONS A/S	4	4	100.0	IEEE	4	100.0			
37	NORTHERN POWER SYST	4	5	80.0	IEEE	4	80.0	PennWell Publishing Co.	1	20.0
38	UNIVERSIDAD PUBLICA	4	5	80.0	IEEE	4	80.0	Instrument Society of America	1	20.0
39	X Development Llc	4	10	40.0	IEEE	4	40.0	AIAA-Am Inst Aero Astro	3	30.0

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
40	AB SKF	3	3	100.0	IEEE	3	100.0			
41	Daewoo Shipbuilding & Mari	3	6	50.0	IEEE	3	50.0	ISA - Instrumentation, Systems & Automation Society	1	16.7
42	DowDuPont	3	24	12.5	RELX Group (Elsevier)	7	29.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	3	12.5
43	EMPIRE MAGNETICS INC	3	3	100.0	IEEE	3	100.0			
44	GLOBAL ENERGYCONCE	3	5	60.0	IEEE	3	60.0	AWEA-American Wind Energy Association	1	20.0
45	Honeywell International Inc.	3	5	60.0	IEEE	3	60.0	AIAA-Am Inst Aero Astro	1	20.0
46	SAMAYS INNOVACIONES	3	5	60.0	IEEE	3	60.0	RELX Group (Elsevier)	1	20.0
47	Schweitzer Engineering Labo	3	3	100.0	IEEE	3	100.0			
48	University of Wisconsin	3	3	100.0	IEEE	3	100.0			
49	ADVANCED MAGNET LA	2	2	100.0	IEEE	2	100.0			
50	Alliance for Sustainable Ener	2	12	16.7	ASME-Am Soc Mech Eng	7	58.3	IEEE	2	16.7
51	Apple Inc	2	2	100.0	IEEE	2	100.0			
52	Bosch (Robert) GmbH	2	2	100.0	IEEE	2	100.0			
53	COMBINED ENERGIES LL	2	2	100.0	IEEE	2	100.0			
54	Consiglio Nazionale Delle Ri	2	2	100.0	IEEE	2	100.0			
55	Dana Holding Corp.	2	3	66.7	IEEE	2	66.7	EVS.org	1	33.3
56	Harris Corp.	2	4	50.0	IEEE	2	50.0	RELX Group (Elsevier)	2	50.0
57	HAWAIIAN ELECTRIC CO	2	4	50.0	IEEE	2	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0
58	International Business Machi	2	6	33.3	RELX Group (Elsevier)	3	50.0	IEEE	2	33.3
59	ONSEMBLE LLC	2	4	50.0	IEEE	2	50.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	2	50.0
60	PRENAV INC	2	2	100.0	IEEE	2	100.0			
61	Rockwell Automation Inc	2	2	100.0	IEEE	2	100.0			
62	ROCKY RESEARCH	2	4	50.0	IEEE	2	50.0	MacMillan Publishing Company	1	25.0
63	Rolls Royce Holdings Plc	2	7	28.6	ASME-Am Soc Mech Eng	4	57.1	IEEE	2	28.6
64	Trevii - Finanziaria Industrial	2	2	100.0	IEEE	2	100.0			
65	University of Florida	2	34	5.9	American Institute of Physics	8	23.5	ACS-Am Chem Soc	6	17.6
66	Airbus SE	1	4	25.0	RELX Group (Elsevier)	1	25.0	American Institute of Physics	1	25.0
67	American Superconductor Co	1	1	100.0	IEEE	1	100.0			
68	BASELOAD ENERGY INC	1	2	50.0	Konggansa	1	50.0	IEEE	1	50.0
69	BLUE WATER SHIPPING A	1	1	100.0	IEEE	1	100.0			
70	California Institute of Techno	1	6	16.7	RELX Group (Elsevier)	4	66.7	IEEE	1	16.7
71	Cisco Systems Inc.	1	1	100.0	IEEE	1	100.0			
72	CLEAN CURRENT LP	1	3	33.3	PROFESSIONAL ENGINEERING PUBLISHI	1	33.3	AIAA-Am Inst Aero Astro	1	33.3
73	DOMETIC SWEDEN AB	1	1	100.0	IEEE	1	100.0			
74	Fiat Chrysler Automobiles N	1	1	100.0	IEEE	1	100.0			
75	Florida State University	1	1	100.0	IEEE	1	100.0			
76	General Motors Corp	1	4	25.0	China Electrochemical Society	2	50.0	IEEE	1	25.0
77	GLOUSTER APPLICATION	1	8	12.5	RELX Group (Elsevier)	6	75.0	AAAS-Am Assoc Advancement Sci	1	12.5
78	Google Inc.	1	5	20.0	Royal Society of Chemistry	2	40.0	ASME-Am Soc Mech Eng	2	40.0
79	Indiana University	1	5	20.0	RELX Group (Elsevier)	2	40.0	SAE-Society of Automobile Engineers	1	20.0
80	Institut Francais du Petrole	1	3	33.3	American Automatic Control Council (AACC)	2	66.7	IEEE	1	33.3

## Appendix B: Top 100 Organizations That Cite IEEE; (1999-2018 Patents by Category)

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	INVENTUS HOLDINGS LL	1	1	100.0	IEEE	1	100.0			
82	JST LLC	1	2	50.0	Konggansa	1	50.0	IEEE	1	50.0
83	Khalifa University of Science	1	1	100.0	IEEE	1	100.0			
84	KITENERGY S R L	1	2	50.0	American Automatic Control Council (AACC)	1	50.0	IEEE	1	50.0
85	LSIS Co Ltd (Formerly LS In	1	2	50.0	EPE Association	1	50.0	IEEE	1	50.0
86	MAGNOMATICS LTD	1	2	50.0	IET/IEE	1	50.0	IEEE	1	50.0
87	Mitsuba Corp.	1	1	100.0	IEEE	1	100.0			
88	Naval Group	1	1	100.0	IEEE	1	100.0			
89	Ogin Inc (Formerly FloDesig	1	20	5.0	AIAA-Am Inst Aero Astro	11	55.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	8	40.0
90	OXFORD BROOKES UNIV	1	3	33.3	RELX Group (Elsevier)	2	66.7	IEEE	1	33.3
91	POWEROASIS LTD	1	2	50.0	IEEE	1	50.0	RELX Group (Elsevier)	1	50.0
92	PV SOLUTIONS LLC	1	1	100.0	IEEE	1	100.0			
93	QFE 002 LLC	1	1	100.0	IEEE	1	100.0			
94	SATCON TECHNOLOGY C	1	1	100.0	IEEE	1	100.0			
95	Schneider Electric S.A.	1	2	50.0	IET/IEE	1	50.0	IEEE	1	50.0
96	TECHNOLOGY SERVICE C	1	2	50.0	IEEE	1	50.0	IOP Publishing	1	50.0
97	TECNOTURBINES S L	1	3	33.3	IEEE	1	33.3	PROFESSIONAL ENGINEERING PUBLISHING LTD	1	33.3
98	TIDNAB INNOVATIONS IN	1	1	100.0	IEEE	1	100.0			
99	Toshiba Corp	1	2	50.0	IEEE	1	50.0	AIAA-Am Inst Aero Astro	1	50.0
100	Tsinghua University	1	1	100.0	IEEE	1	100.0			

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
1	Microsoft Corporation	59272	171868	34.5	IEEE	59272	34.5	ACM-Assoc Comput Mach	48334	28.1
2	International Business Machin	52836	155892	33.9	IEEE	52836	33.9	ACM-Assoc Comput Mach	28712	18.4
3	Micron Technology Inc.	43060	128967	33.4	IEEE	43060	33.4	RELX Group (Elsevier)	20939	16.2
4	Qualcomm Inc	36557	86035	42.5	IEEE	36557	42.5	3GPP General Partnership Project Standards Body	15934	18.5
5	Apple Inc	30768	73543	41.8	IEEE	30768	41.8	ACM-Assoc Comput Mach	16768	22.8
6	Intel Corporation	29902	62578	47.8	IEEE	29902	47.8	3GPP General Partnership Project Standards Body	6393	10.2
7	Broadcom Ltd	28142	46613	60.4	IEEE	28142	60.4	International Telecommunication Union	1261	2.7
8	AT&T Inc	22624	43179	52.4	IEEE	22624	52.4	ACM-Assoc Comput Mach	3618	8.4
9	Marvell Technology Group Lt	21799	27809	78.4	IEEE	21799	78.4	3GPP General Partnership Project Standards Body	3109	11.2
10	Nokia Corp	18299	49060	37.3	IEEE	18299	37.3	3GPP General Partnership Project Standards Body	9021	18.4
11	Google Inc.	16248	47481	34.2	IEEE	16248	34.2	ACM-Assoc Comput Mach	10950	23.1
12	Semiconductor Energy Labora	16176	165536	9.8	SID-Society for Information Display	50635	30.6	American Institute of Physics	30648	18.5
13	Samsung Electronics Co Ltd	13781	42877	32.1	IEEE	13781	32.1	3GPP General Partnership Project Standards Body	8404	19.6
14	Ericsson	12761	41535	30.7	3GPP General Partnership Project Standards Bo	14918	35.9	IEEE	12761	30.7
15	Cisco Systems Inc.	12315	39529	31.2	IEEE	12315	31.2	Internet Soc/IETF-Internet Eng Task Force	6463	16.4
16	Sony Corp	11842	27291	43.4	IEEE	11842	43.4	ACM-Assoc Comput Mach	2347	8.6
17	Siemens Aktiengesellschaft	11838	28636	41.3	IEEE	11838	41.3	RELX Group (Elsevier)	2243	7.8
18	Massachusetts Institute of Tec	11822	45057	26.2	IEEE	11822	26.2	RELX Group (Elsevier)	5482	12.2
19	InterDigital Inc	11580	45244	25.6	3GPP General Partnership Project Standards Bo	28372	62.7	IEEE	11580	25.6
20	Oracle Corporation	11556	42144	27.4	ACM-Assoc Comput Mach	13031	30.9	IEEE	11556	27.4
21	ParkerVision Inc	11381	22492	50.6	IEEE	11381	50.6	IET/IEE	5318	23.6
22	Western Digital Corp.	11288	21910	51.5	IEEE	11288	51.5	American Institute of Physics	2210	10.1
23	Texas Instruments Inc	11133	17477	63.7	IEEE	11133	63.7	American Institute of Physics	650	3.7
24	Medtronic Inc	10709	128581	8.3	RELX Group (Elsevier)	22038	17.1	Lippincott Williams & Wilkins Ltd.	15685	12.2
25	Panasonic Corporation	9899	30123	32.9	IEEE	9899	32.9	3GPP General Partnership Project Standards Body	4471	14.8
26	MONOLITHIC 3D INC	9841	17242	57.1	IEEE	9841	57.1	IEEE/JPN Soc App Phys	1843	10.7
27	Personalized Media Communi	8958	55738	16.1	Society of Motion Picture and Television Engin	16366	29.4	IEEE	8958	16.1
28	Fujitsu Limited	8829	23630	37.4	IEEE	8829	37.4	3GPP General Partnership Project Standards Body	2678	11.3
29	LG Electronics Inc.	8736	39768	22.0	3GPP General Partnership Project Standards Bo	20908	52.6	IEEE	8736	22.0
30	Taiwan Semiconductor Manuf	8728	23975	36.4	IEEE	8728	36.4	American Institute of Physics	6905	28.8
31	Toshiba Corp	8177	20161	40.6	IEEE	8177	40.6	American Institute of Physics	1547	7.7
32	Xperi Corporation (Formerly	8101	15026	53.9	IEEE	8101	53.9	SPIE-Int Soc Opt Engineering	872	5.8
33	HP Inc	7986	25861	30.9	IEEE	7986	30.9	ACM-Assoc Comput Mach	3858	14.9
34	NXP Semiconductors NV	7514	12308	61.0	IEEE	7514	61.0	American Institute of Physics	897	7.3
35	Rambus Inc.	7326	11052	66.3	IEEE	7326	66.3	IEEE/JPN Soc App Phys	515	4.7
36	NEC Corp	7267	20797	34.9	IEEE	7267	34.9	3GPP General Partnership Project Standards Body	3839	18.5
37	STMicroelectronics	7252	11977	60.5	IEEE	7252	60.5	RELX Group (Elsevier)	849	7.1
38	Huawei Technologies Compan	7224	27439	26.3	3GPP General Partnership Project Standards Bo	10835	39.5	IEEE	7224	26.3
39	Macronix International Co. Lt	7200	13286	54.2	IEEE	7200	54.2	IEEE/JPN Soc App Phys	2485	18.7
40	Honeywell International Inc.	6945	17508	39.7	IEEE	6945	39.7	RELX Group (Elsevier)	1768	10.1

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
41	Koninklijke Philips N.V.	6920	25735	26.9	IEEE	6920	26.9	RELX Group (Elsevier)	2672	10.4
42	General Electric Company	6855	30595	22.4	IEEE	6855	22.4	RELX Group (Elsevier)	3700	12.1
43	Partners HealthCare Systems I	6665	91414	7.3	Optical Society of America	29420	32.2	RELX Group (Elsevier)	13191	14.4
44	Blackberry Ltd.	6468	23147	27.9	3GPP General Partnership Project Standards Bo	8707	37.6	IEEE	6468	27.9
45	Tela Innovations inc	6151	19106	32.2	SPIE-Int Soc Opt Engineering	6435	33.7	IEEE	6151	32.2
46	Irobot Corp	6132	10728	57.2	IEEE	6132	57.2	SPIE-Int Soc Opt Engineering	1518	14.1
47	Conversant Intellectual Proper	6058	9625	62.9	IEEE	6058	62.9	IEEE/JPN Soc App Phys	251	2.6
48	University of California	5907	48657	12.1	RELX Group (Elsevier)	6616	13.6	IEEE	5907	12.1
49	Cadence Design Systems Inc	5860	13507	43.4	IEEE	5860	43.4	Joint IEEE and ACM	4304	31.9
50	Infineon Technologies AG	5809	10213	56.9	IEEE	5809	56.9	American Institute of Physics	878	8.6
51	Xerox Corp	5715	19933	28.7	IEEE	5715	28.7	ACM-Assoc Comput Mach	3498	17.5
52	Murata Manufacturing Co. Lt	5632	7535	74.7	IEEE	5632	74.7	RELX Group (Elsevier)	209	2.8
53	Canon Inc	5434	19677	27.6	IEEE	5434	27.6	American Institute of Physics	1888	9.6
54	Columbia University	5293	17845	29.7	IEEE	5293	29.7	American Institute of Physics	1737	9.7
55	Ricoh Co. Ltd.	5198	11829	43.9	IEEE	5198	43.9	ACM-Assoc Comput Mach	1801	15.2
56	Synopsys Inc.	5180	15121	34.3	IEEE	5180	34.3	SPIE-Int Soc Opt Engineering	3163	20.9
57	Mitsubishi Electric Corp	5178	11438	45.3	IEEE	5178	45.3	3GPP General Partnership Project Standards Body	1076	9.4
58	Raytheon Co.	5148	10930	47.1	IEEE	5148	47.1	SPIE-Int Soc Opt Engineering	606	5.5
59	Fractus SA	5122	8615	59.5	IEEE	5122	59.5	IET/IEE	1265	14.7
60	California Institute of Technol	5103	28298	18.0	IEEE	5103	18.0	RELX Group (Elsevier)	4072	14.4
61	Hitachi Ltd	5017	18038	27.8	IEEE	5017	27.8	ACM-Assoc Comput Mach	1371	7.6
62	Nippon Telegraph & Telephon	4963	15407	32.2	IEEE	4963	32.2	3GPP General Partnership Project Standards Body	4182	27.1
63	Motorola Solutions Inc.	4895	10289	47.6	IEEE	4895	47.6	American Institute of Physics	1016	9.9
64	RPX Corp	4777	11637	41.1	IEEE	4777	41.1	Internet Soc/IETF-Internet Eng Task Force	913	7.8
65	Innovative Network Corporati	4765	7946	60.0	IEEE	4765	60.0	IEEE/JPN Soc App Phys	485	6.1
66	Intuitive Surgical Inc.	4721	9295	50.8	IEEE	4721	50.8	SAGES-Society of American Gastrointestinal and Endoscopic Su	531	5.7
67	Boston Scientific Corp.	4715	71033	6.6	RELX Group (Elsevier)	19673	27.7	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	7235	10.2
68	Immersion Corp.	4708	12402	38.0	IEEE	4708	38.0	ACM-Assoc Comput Mach	1418	11.4
69	Verizon Communications Inc	4690	17374	27.0	IEEE	4690	27.0	ACM-Assoc Comput Mach	2943	16.9
70	Cypress Semiconductor Corp.	4664	6852	68.1	IEEE	4664	68.1	Joint IEEE and ACM	464	6.8
71	Qorvo	4642	5576	83.2	IEEE	4642	83.2	American Institute of Physics	309	5.5
72	HRL Laboratories LLC	4616	9227	50.0	IEEE	4616	50.0	American Institute of Physics	572	6.2
73	Adaptix	4605	6695	68.8	IEEE	4605	68.8	European Telecom Standards Institute (ETSI)	730	10.9
74	Advanced Micro Devices Inc	4555	10160	44.8	IEEE	4555	44.8	Joint IEEE and ACM	855	8.4
75	Electronics and Telecommunic	4485	8878	50.5	IEEE	4485	50.5	3GPP General Partnership Project Standards Body	732	8.2
76	Digimarc Corp.	4387	10852	40.4	IEEE	4387	40.4	SPIE-Int Soc Opt Engineering	1315	12.1
77	University of Minnesota (The	4380	9059	48.3	IEEE	4380	48.3	RELX Group (Elsevier)	894	9.9
78	Industrial Technology Research	4373	8450	51.8	IEEE	4373	51.8	RELX Group (Elsevier)	739	8.7
79	Applied Materials Inc.	4353	17657	24.7	IEEE	4353	24.7	American Institute of Physics	3403	19.3
80	Abbott Laboratories	4339	99045	4.4	RELX Group (Elsevier)	23415	23.6	ACS-Am Chem Soc	12341	12.5



## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
81	Hon Hai Precision Industry Co	4325	21392	20.2	3GPP General Partnership Project Standards Bo	4687	21.9	IEEE	4325	20.2
82	Adobe Systems Inc.	4319	11264	38.3	IEEE	4319	38.3	ACM-Assoc Comput Mach	3772	33.5
83	Cree Inc.	4270	11521	37.1	IEEE	4270	37.1	American Institute of Physics	2578	22.4
84	Dexcom Inc	4258	66453	6.4	RELX Group (Elsevier)	16904	25.4	American Diabetes Association	6926	10.4
85	ZENO SEMICONDUCTOR I	4097	5259	77.9	IEEE	4097	77.9	IEEE/JPN Soc App Phys	996	18.9
86	Technicolor SA	4038	7816	51.7	IEEE	4038	51.7	ACM-Assoc Comput Mach	387	5.0
87	University of Illinois	4002	34604	11.6	American Institute of Physics	6590	19.0	ACS-Am Chem Soc	4779	13.8
88	Xilinx Inc.	3856	5535	69.7	IEEE	3856	69.7	Joint IEEE and ACM	519	9.4
89	Thermo Fisher Scientific Inc	3821	25933	14.7	RELX Group (Elsevier)	7378	28.5	IEEE	3821	14.7
90	Dolby Laboratories Inc	3737	8262	45.2	IEEE	3737	45.2	International Telecommunication Union	850	10.3
91	Analog Devices Inc.	3649	5528	66.0	IEEE	3649	66.0	Reed Business	437	7.9
92	SolarEdge Technologies Inc	3646	4176	87.3	IEEE	3646	87.3	WIP-Renewable Energies	289	6.9
93	Witricity Corp	3582	6011	59.6	IEEE	3582	59.6	American Institute of Physics	528	8.8
94	On Semiconductor Corporatio	3507	4795	73.1	IEEE	3507	73.1	RELX Group (Elsevier)	280	5.8
95	REARDEN LLC	3397	3862	88.0	IEEE	3397	88.0	IET/IEEE	123	3.2
96	Dell Technologies Inc	3387	13576	24.9	ACM-Assoc Comput Mach	5098	37.6	IEEE	3387	24.9
97	Softbank Corp	3381	10075	33.6	IEEE	3381	33.6	International Telecommunication Union	1870	18.6
98	Commscope Inc.	3377	5598	60.3	IEEE	3377	60.3	3GPP General Partnership Project Standards Body	475	8.5
99	The Invention Science Fund I	3360	23916	14.0	IEEE	3360	14.0	RELX Group (Elsevier)	2648	11.1
100	Sap SE	3348	14768	22.7	ACM-Assoc Comput Mach	5106	34.6	IEEE	3348	22.7
101	Fraunhofer Gesellschaft	3312	6988	47.4	IEEE	3312	47.4	RELX Group (Elsevier)	468	6.7
102	Lockheed Martin Corp.	3311	16906	19.6	IEEE	3311	19.6	RELX Group (Elsevier)	2222	13.1
103	Boeing Co. (The)	3140	10241	30.7	IEEE	3140	30.7	RELX Group (Elsevier)	1066	10.4
104	CPG TECHNOLOGIES LLC	3112	3919	79.4	IEEE	3112	79.4	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AVE	203	5.2
105	Amazon.com Inc.	3078	11698	26.3	ACM-Assoc Comput Mach	3295	28.2	IEEE	3078	26.3
106	Commvault Systems Inc.	3057	4672	65.4	IEEE	3057	65.4	ACM-Assoc Comput Mach	735	15.7
107	Cirrus Logic Inc.	3053	3728	81.9	IEEE	3053	81.9	Audio Eng Soc	86	2.3
108	ABB Ltd	2992	4768	62.8	IEEE	2992	62.8	IVI Foundation/SCPI Consortium	202	4.2
109	Seagate Technology Plc	2984	7239	41.2	IEEE	2984	41.2	American Institute of Physics	1362	18.8
110	Chipbond Technology Corp	2941	3684	79.8	IEEE	2941	79.8	RELX Group (Elsevier)	272	7.4
111	Comcast Corp	2918	7837	37.2	IEEE	2918	37.2	3GPP General Partnership Project Standards Body	2663	34.0
112	Tabula Inc	2903	7804	37.2	IEEE	2903	37.2	ACM-Assoc Comput Mach	2878	36.9
113	MicroUnity Systems Engineeri	2802	4582	61.2	IEEE	2802	61.2	Joint IEEE and ACM	408	8.9
114	Magna International Inc.	2717	4871	55.8	IEEE	2717	55.8	SAE-Society of Automobile Engineers	346	7.1
115	TiVo Corp	2686	9873	27.2	IEEE	2686	27.2	ACM-Assoc Comput Mach	941	9.5
116	Corning Inc.	2675	9068	29.5	IEEE	2675	29.5	Optical Society of America	1209	13.3
117	Harris Corp.	2618	4808	54.5	IEEE	2618	54.5	Internet Soc/IETF-Internet Eng Task Force	318	6.6
118	Seiko Epson Corporation	2618	7362	35.6	IEEE	2618	35.6	ACM-Assoc Comput Mach	631	8.6
119	Commissariat A L'Energie Ato	2601	9962	26.1	IEEE	2601	26.1	RELX Group (Elsevier)	1859	18.7
120	Pelican Imaging Corporation	2597	5408	48.0	IEEE	2597	48.0	SPIE-Int Soc Opt Engineering	874	16.2

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
121	United States Navy	2589	8743	29.6	IEEE	2589	29.6	RELX Group (Elsevier)	973	11.1
122	Silicon Laboratories Inc	2488	3171	78.5	IEEE	2488	78.5	Reed Business	121	3.8
123	INDIVIDUAL PATENTER	2484	15560	16.0	IEEE	2484	16.0	RELX Group (Elsevier)	2424	15.6
124	NVIDIA Corp.	2408	6211	38.8	IEEE	2408	38.8	ACM-Assoc Comput Mach	1764	28.4
125	Stanford University	2408	20891	11.5	RELX Group (Elsevier)	2551	12.2	IEEE	2408	11.5
126	Finisar Corp	2346	6230	37.7	IEEE	2346	37.7	IET/IEE	847	13.6
127	Amberwave Inc	2337	6843	34.2	IEEE	2337	34.2	American Institute of Physics	2045	29.9
128	Johnson & Johnson	2293	42793	5.4	RELX Group (Elsevier)	8488	19.8	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	3940	9.2
129	DIRECTV Group Inc. (The)	2203	3458	63.7	IEEE	2203	63.7	Elettronica e Telecomunicazioni	161	4.7
130	PACT XPP TECHNOLOGIE	2165	3709	58.4	IEEE	2165	58.4	ACM-Assoc Comput Mach	358	9.7
131	Rockwell Automation Inc	2131	3092	68.9	IEEE	2131	68.9	RELX Group (Elsevier)	166	5.4
132	Global Foundries Inc	2128	4391	48.5	IEEE	2128	48.5	American Institute of Physics	467	10.6
133	Georgia Institute of Technolog	2115	6367	33.2	IEEE	2115	33.2	RELX Group (Elsevier)	741	11.6
134	ConvergeOne Inc	2104	6348	33.1	IEEE	2104	33.1	Joint IEEE and ACM	891	14.0
135	Juniper Networks Inc.	2093	6066	34.5	IEEE	2093	34.5	Network Working Group RFC	1316	21.7
136	University of Michigan	2090	11732	17.8	IEEE	2090	17.8	RELX Group (Elsevier)	2007	17.1
137	Cognex Corp.	2075	4631	44.8	IEEE	2075	44.8	RELX Group (Elsevier)	780	16.8
138	SIPCO LLC	2043	3454	59.1	IEEE	2043	59.1	ACM-Assoc Comput Mach	265	7.7
139	Innovative Silicon SA	2033	2515	80.8	IEEE	2033	80.8	RELX Group (Elsevier)	108	4.3
140	Bosch (Robert) GmbH	2022	8696	23.3	IEEE	2022	23.3	RELX Group (Elsevier)	755	8.7
141	Intellectual Ventures Manage	2007	4154	48.3	IEEE	2007	48.3	ACM-Assoc Comput Mach	610	14.7
142	University of Texas	1929	14377	13.4	RELX Group (Elsevier)	2339	16.3	IEEE	1929	13.4
143	BT Group PLC	1922	4239	45.3	IEEE	1922	45.3	ACM-Assoc Comput Mach	337	7.9
144	Lenovo Group Ltd	1921	5170	37.2	3GPP General Partnership Project Standards Bo	1977	38.2	IEEE	1921	37.2
145	ARRIS Group Inc	1864	3438	54.2	IEEE	1864	54.2	International Telecommunication Union	150	4.4
146	Honda Motor Co. Ltd.(Honda	1854	4455	41.6	IEEE	1854	41.6	RELX Group (Elsevier)	624	14.0
147	Flex Ltd (Formerly Flextronics	1830	2476	73.9	IEEE	1830	73.9	CBS Interactive	254	10.3
148	Fuji Film Holdings Corp	1821	7890	23.1	IEEE	1821	23.1	ACM-Assoc Comput Mach	1161	14.7
149	Sanken Electric Co. Ltd.	1813	2306	78.6	IEEE	1813	78.6	RELX Group (Elsevier)	279	12.1
150	Interuniversity MicroElectroni	1812	4028	45.0	IEEE	1812	45.0	American Institute of Physics	369	9.2
151	Netapp Inc	1812	9444	19.2	ACM-Assoc Comput Mach	3984	42.2	IEEE	1812	19.2
152	FormFactor Inc	1807	3485	51.9	IEEE	1807	51.9	MacMillan Publishing Company	648	18.6
153	Arizona State University	1783	5292	33.7	IEEE	1783	33.7	RELX Group (Elsevier)	632	11.9
154	Accenture Ltd.	1759	5324	33.0	IEEE	1759	33.0	ACM-Assoc Comput Mach	993	18.7
155	Emerson Electric Co.	1752	6565	26.7	IEEE	1752	26.7	RELX Group (Elsevier)	719	11.0
156	University of Washington	1722	10989	15.7	IEEE	1722	15.7	RELX Group (Elsevier)	1697	15.4
157	SRI International	1716	4869	35.2	IEEE	1716	35.2	SPIE-Int Soc Opt Engineering	462	9.5
158	CenturyLink Inc	1712	5476	31.3	IEEE	1712	31.3	ACM-Assoc Comput Mach	959	17.5
159	Mediatek Inc.	1696	2869	59.1	IEEE	1696	59.1	3GPP General Partnership Project Standards Body	731	25.5
160	Nuance Communications Inc	1691	4879	34.7	IEEE	1691	34.7	ACM-Assoc Comput Mach	751	15.4

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
161	Texas A&M University	1678	3442	48.8	IEEE	1678	48.8	RELX Group (Elsevier)	257	7.5
162	Quarterhill Inc	1636	2447	66.9	IEEE	1636	66.9	3GPP General Partnership Project Standards Body	119	4.9
163	PDF Solutions	1612	2158	74.7	IEEE	1612	74.7	SPIE-Int Soc Opt Engineering	394	18.3
164	Wisteria Trading Inc	1573	3054	51.5	IEEE	1573	51.5	SPIE-Int Soc Opt Engineering	351	11.5
165	Citrix Systems Inc	1542	4706	32.8	IEEE	1542	32.8	ACM-Assoc Comput Mach	818	17.4
166	L-3 Communications Holdings	1499	2151	69.7	IEEE	1499	69.7	SPIE-Int Soc Opt Engineering	105	4.9
167	TDK Corporation	1495	4275	35.0	IEEE	1495	35.0	American Institute of Physics	769	18.0
168	Intertrust Technologies Corp	1488	9627	15.5	ACM-Assoc Comput Mach	1752	18.2	IEEE	1488	15.5
169	Microsemi Corp	1473	2353	62.6	IEEE	1473	62.6	Reed Business	122	5.2
170	University of Southern Califor	1458	7721	18.9	IEEE	1458	18.9	ACS-Am Chem Soc	1024	13.3
171	Infinera Corporation	1456	2891	50.4	IEEE	1456	50.4	IET/IEE	391	13.5
172	Hewlett Packard Enterprises	1434	3948	36.3	IEEE	1434	36.3	ACM-Assoc Comput Mach	902	22.8
173	BAE Systems Plc.	1402	2498	56.1	IEEE	1402	56.1	SPIE-Int Soc Opt Engineering	144	5.8
174	Walt Disney Co.	1396	5359	26.0	ACM-Assoc Comput Mach	2614	48.8	IEEE	1396	26.0
175	Solarflare Communications In	1387	8098	17.1	ACM-Assoc Comput Mach	4618	57.0	Joint IEEE and ACM	1607	19.8
176	INTOUCH HEALTH INC	1380	2916	47.3	IEEE	1380	47.3	Springer/Sp. Wien/Springer-Verlag/KluwAcad	145	5.0
177	Northrop Grumman Corp	1369	2963	46.2	IEEE	1369	46.2	American Institute of Physics	222	7.5
178	Facebook Inc	1360	4819	28.2	IEEE	1360	28.2	ACM-Assoc Comput Mach	1321	27.4
179	Orange	1342	2584	51.9	IEEE	1342	51.9	Internet Soc/IETF-Internet Eng Task Force	142	5.5
180	United Technologies Corp	1334	5804	23.0	IEEE	1334	23.0	NASA-National Aeronautics and Space Admin	540	9.3
181	LibertyMedia	1333	2340	57.0	IEEE	1333	57.0	ACM-Assoc Comput Mach	161	6.9
182	Transphorm Inc	1332	2586	51.5	IEEE	1332	51.5	American Institute of Physics	482	18.6
183	QST Holdings Llc	1315	2255	58.3	IEEE	1315	58.3	Joint IEEE and ACM	249	11.0
184	University of Wisconsin	1309	8925	14.7	IEEE	1309	14.7	ACS-Am Chem Soc	1163	13.0
185	IP RESERVOIR LLC	1306	2409	54.2	IEEE	1306	54.2	ACM-Assoc Comput Mach	407	16.9
186	Toyota Motor Corp	1294	4395	29.4	IEEE	1294	29.4	RELX Group (Elsevier)	902	20.5
187	Brain Corporation	1283	2958	43.4	IEEE	1283	43.4	MIT Press	519	17.5
188	Eastman Kodak Company	1270	5421	23.4	IEEE	1270	23.4	RELX Group (Elsevier)	512	9.4
189	Maxim Integrated Products Inc	1244	1458	85.3	IEEE	1244	85.3	Joint IEEE and ACM	20	1.4
190	Microchip Technology Inc.	1231	1800	68.4	IEEE	1231	68.4	ACM-Assoc Comput Mach	97	5.4
191	Agilent Technologies Inc	1230	4305	28.6	IEEE	1230	28.6	RELX Group (Elsevier)	512	11.9
192	NUVOTRONICS INC	1223	1461	83.7	IEEE	1223	83.7	IET/IEE	63	4.3
193	Imagination Technologies Gro	1220	3608	33.8	IEEE	1220	33.8	ACM-Assoc Comput Mach	810	22.5
194	Purdue University	1209	8206	14.7	RELX Group (Elsevier)	1419	17.3	IEEE	1209	14.7
195	PHOENIX SOLUTIONS INC	1206	3611	33.4	IEEE	1206	33.4	ISCA (International Speech Communication Association)	478	13.2
196	Synaptics Inc.	1203	2196	54.8	IEEE	1203	54.8	ACM-Assoc Comput Mach	122	5.6
197	Schneider Electric S.A.	1197	6302	19.0	IEEE	1197	19.0	ISA - Instrumentation, Systems & Automation Society	680	10.8
198	Ignis Innovation Inc	1195	1533	78.0	IEEE	1195	78.0	SID-Society for Information Display	163	10.6
199	SK Hynix Inc	1186	2167	54.7	IEEE	1186	54.7	American Institute of Physics	133	6.1
200	Velatia Group	1182	1571	75.2	IEEE	1182	75.2	Echelon Corp	113	7.2

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
201	Hong Kong University of Scie	1174	2403	48.9	IEEE	1174	48.9	American Institute of Physics	272	11.3
202	United States of America Depa	1151	6463	17.8	RELX Group (Elsevier)	1239	19.2	IEEE	1151	17.8
203	United Microelectronics Corp	1145	2189	52.3	IEEE	1145	52.3	American Institute of Physics	336	15.3
204	United States Army	1133	4531	25.0	IEEE	1133	25.0	American Institute of Physics	478	10.5
205	Kyocera Corp.	1117	3274	34.1	3GPP General Partnership Project Standards Bo	1145	35.0	IEEE	1117	34.1
206	Total SA	1115	1607	69.4	IEEE	1115	69.4	RELX Group (Elsevier)	98	6.1
207	Extreme Networks Inc	1111	2406	46.2	IEEE	1111	46.2	ACM-Assoc Comput Mach	261	10.8
208	Enphase Energy Inc	1107	1376	80.5	IEEE	1107	80.5	WIP-Renewable Energies	61	4.4
209	National Instruments Corp.	1102	1955	56.4	IEEE	1102	56.4	ACM-Assoc Comput Mach	197	10.1
210	Stryker Corp.	1098	6961	15.8	RELX Group (Elsevier)	1131	16.2	IEEE	1098	15.8
211	University of South Florida	1093	4376	25.0	IEEE	1093	25.0	RELX Group (Elsevier)	690	15.8
212	Illumina Inc.	1091	5366	20.3	IEEE	1091	20.3	RELX Group (Elsevier)	622	11.6
213	Avaya Inc	1083	3902	27.8	IEEE	1083	27.8	Internet Soc/IETF-Internet Eng Task Force	637	16.3
214	MagnaCom Ltd	1072	1133	94.6	IEEE	1072	94.6	AMER TELEPHONE TELEGRAPH CO, 550 MADISON AVE	61	5.4
215	Elwha LLC	1069	3345	32.0	IEEE	1069	32.0	RELX Group (Elsevier)	225	6.7
216	McAfee Inc	1063	4126	25.8	IEEE	1063	25.8	ACM-Assoc Comput Mach	860	20.8
217	Symantec Corp.	1052	3980	26.4	IEEE	1052	26.4	ACM-Assoc Comput Mach	968	24.3
218	Washington University in St. L	1045	5570	18.8	IEEE	1045	18.8	RELX Group (Elsevier)	760	13.6
219	Battelle Memorial Institute	1038	5452	19.0	RELX Group (Elsevier)	1040	19.1	IEEE	1038	19.0
220	IDC Llc	1038	2898	35.8	IEEE	1038	35.8	SID-Society for Information Display	391	13.5
221	Verance Corp	1032	1924	53.6	IEEE	1032	53.6	SPIE-Int Soc Opt Engineering	244	12.7
222	eBay Inc	1030	5489	18.8	IEEE	1030	18.8	ACM-Assoc Comput Mach	753	13.7
223	Thales	1030	1958	52.6	IEEE	1030	52.6	RELX Group (Elsevier)	118	6.0
224	SUN PATENT TRUST	1017	4207	24.2	3GPP General Partnership Project Standards Bo	1592	37.8	IEEE	1017	24.2
225	SRC Computers Inc.	1015	1149	88.3	IEEE	1015	88.3	ACM-Assoc Comput Mach	41	3.6
226	Crossbar Inc	1012	3599	28.1	IEEE	1012	28.1	American Institute of Physics	518	14.4
227	Energous Corporation	1012	1276	79.3	IEEE	1012	79.3	Rajagiri School of Engineering & Technology, Cochin, Kerala, I	128	10.0
228	Kandou	1012	1106	91.5	IEEE	1012	91.5	IET/IEE	69	6.2
229	Smith & Nephew Plc.	1009	13619	7.4	RELX Group (Elsevier)	2876	21.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1223	9.0
230	Agency for Science Technolog	1004	3149	31.9	IEEE	1004	31.9	RELX Group (Elsevier)	452	14.4
231	Viasat	999	1522	65.6	IEEE	999	65.6	RELX Group (Elsevier)	60	3.9
232	General Motors Corp	997	3823	26.1	IEEE	997	26.1	RELX Group (Elsevier)	925	24.2
233	GUIDED THERAPY SYSTE	995	2698	36.9	IEEE	995	36.9	RELX Group (Elsevier)	387	14.3
234	Math Works Inc (The)	965	2186	44.1	IEEE	965	44.1	ACM-Assoc Comput Mach	463	21.2
235	Carnegie Mellon University	962	3683	26.1	IEEE	962	26.1	RELX Group (Elsevier)	398	10.8
236	REALTIME DATA LLC	962	3408	28.2	IEEE	962	28.2	IBM Corp.	439	12.9
237	FireEye Inc	960	2274	42.2	IEEE	960	42.2	ACM-Assoc Comput Mach	452	19.9
238	New Jersey Institute of Techno	949	2401	39.5	IEEE	949	39.5	RELX Group (Elsevier)	543	22.6
239	ATTOPSEMI TECHNOLOG	944	1205	78.3	IEEE	944	78.3	IEEE/IPN Soc App Phys	174	14.4
240	Michigan State University	942	10876	8.7	Optical Society of America	2115	19.4	American Institute of Physics	1534	14.1

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
241	University of North Carolina	922	5342	17.3	IEEE	922	17.3	RELX Group (Elsevier)	685	12.8
242	Mellanox Technologies Ltd	917	2404	38.1	IEEE	917	38.1	Joint IEEE and ACM	302	12.6
243	LivaNova Plc	915	12737	7.2	RELX Group (Elsevier)	2555	20.1	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	1748	13.7
244	Nielsen Holdings Plc	912	6317	14.4	RELX Group (Elsevier)	1014	16.1	IEEE	912	14.4
245	ASM International N.V.	910	7238	12.6	American Institute of Physics	1697	23.4	RELX Group (Elsevier)	1503	20.8
246	TRILLIANT NETWORKS I	905	1391	65.1	IEEE	905	65.1	Internet Soc/IETF-Internet Eng Task Force	93	6.7
247	Schlumberger Ltd.	893	12578	7.1	Society of Petroleum Engineers	2732	21.7	RELX Group (Elsevier)	1396	11.1
248	SYNQOR INC	892	1023	87.2	IEEE	892	87.2	Penton Media, Inc.	45	4.4
249	ORIGIN WIRELESS INC	884	1096	80.7	IEEE	884	80.7	American Institute of Physics	41	3.7
250	YFY Inc	882	10033	8.8	SID-Society for Information Display	3767	37.5	National Symposium on Information Display	1129	11.3
251	Nantero Inc	881	11164	7.9	ACS-Am Chem Soc	3296	29.5	American Institute of Physics	2335	20.9
252	Sonos Inc	877	2032	43.2	IEEE	877	43.2	SPIE-Int Soc Opt Engineering	321	15.8
253	Ford Motor Co.	873	2555	34.2	IEEE	873	34.2	SAE-Society of Automobile Engineers	427	16.7
254	Mevion Medical Systems Inc	873	2960	29.5	IEEE	873	29.5	RELX Group (Elsevier)	581	19.6
255	University of Florida	871	4030	21.6	IEEE	871	21.6	RELX Group (Elsevier)	649	16.1
256	HTC Corporation	861	3536	24.3	3GPP General Partnership Project Standards Bo	1896	53.6	IEEE	861	24.3
257	Midtronics Inc.	859	2047	42.0	IEEE	859	42.0	RELX Group (Elsevier)	357	17.4
258	BIOSENSORS INTERNATI	851	2627	32.4	IEEE	851	32.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	372	14.2
259	Masimo Corp	849	2165	39.2	IEEE	849	39.2	Lippincott Williams & Wilkins Ltd.	205	9.5
260	Teledyne Technologies Incorp	849	1719	49.4	IEEE	849	49.4	SPIE-Int Soc Opt Engineering	154	9.0
261	Johns Hopkins University	846	5784	14.6	RELX Group (Elsevier)	989	17.1	IEEE	846	14.6
262	III HOLDINGS 1 LLC	842	1320	63.8	IEEE	842	63.8	ACM-Assoc Comput Mach	151	11.4
263	Vanderbilt University	835	4480	18.6	IEEE	835	18.6	RELX Group (Elsevier)	677	15.1
264	Cornell University	823	5970	13.8	RELX Group (Elsevier)	830	13.9	IEEE	823	13.8
265	3M Co	822	11686	7.0	RELX Group (Elsevier)	1826	15.6	ACS-Am Chem Soc	1273	10.9
266	Integrated Device Technology	820	1127	72.8	IEEE	820	72.8	Joint IEEE and ACM	30	2.7
267	Deutsche Telekom AG	818	2130	38.4	IEEE	818	38.4	3GPP General Partnership Project Standards Body	202	9.5
268	Nikon Corp.	811	4935	16.4	SPIE-Int Soc Opt Engineering	2012	40.8	IEEE	811	16.4
269	X ONE INC	806	1770	45.5	IEEE	806	45.5	ACM-Assoc Comput Mach	343	19.4
270	Fortinet Inc	803	1388	57.9	IEEE	803	57.9	ACM-Assoc Comput Mach	188	13.5
271	Skyworks Solutions Inc	800	1079	74.1	IEEE	800	74.1	Summit Technical Media	52	4.8
272	Lam Research Corp.	786	4242	18.5	American Institute of Physics	1162	27.4	IEEE	786	18.5
273	Technion - Israel Institute of T	786	2232	35.2	IEEE	786	35.2	RELX Group (Elsevier)	252	11.3
274	Round Rock Research LLC	776	2395	32.4	IEEE	776	32.4	RELX Group (Elsevier)	342	14.3
275	CA Inc	775	2170	35.7	IEEE	775	35.7	ACM-Assoc Comput Mach	426	19.6
276	Knowles Corp	773	1502	51.5	IEEE	773	51.5	RELX Group (Elsevier)	172	11.5
277	Airbus SE	767	1829	41.9	IEEE	767	41.9	RELX Group (Elsevier)	202	11.0
278	University of Nebraska	765	3536	21.6	IEEE	765	21.6	Springer/Sp. Wien/Springer-Verlag/KluwAcad	416	11.8
279	Viavi Solutions Inc	758	2533	29.9	IEEE	758	29.9	American Institute of Physics	397	15.7
280	Cleveland Clinic (and Foundat	755	4053	18.6	RELX Group (Elsevier)	786	19.4	IEEE	755	18.6

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
281	PixelWorks Inc	753	1143	65.9	IEEE	753	65.9	SPIE-Int Soc Opt Engineering	109	9.5
282	BUTTERFLY NETWORKS I	744	814	91.4	IEEE	744	91.4	Acoustical Society of America	32	3.9
283	Voxer Llc	741	1224	60.5	IEEE	741	60.5	Internet Soc/IETF-Internet Eng Task Force	90	7.4
284	KLA-Tencor Corp.	737	6290	11.7	SPIE-Int Soc Opt Engineering	1902	30.2	American Institute of Physics	978	15.5
285	Synergy Microwave Corp	734	896	81.9	IEEE	734	81.9	Horizon House Publications	66	7.4
286	Northwestern University	732	11071	6.6	ACS-Am Chem Soc	2460	22.2	RELX Group (Elsevier)	1390	12.6
287	Cortica Ltd	730	974	74.9	IEEE	730	74.9	ACM-Assoc Comput Mach	95	9.8
288	VIVAQUANT LLC	729	1169	62.4	IEEE	729	62.4	RELX Group (Elsevier)	91	7.8
289	Power Integrations Inc.	725	1099	66.0	IEEE	725	66.0	Penton Media, Inc.	68	6.2
290	M/A-COM Technology Soluti	723	1499	48.2	IEEE	723	48.2	American Institute of Physics	190	12.7
291	Duke University	718	4794	15.0	IEEE	718	15.0	RELX Group (Elsevier)	628	13.1
292	Aisin Seiki Co. Ltd.	714	5062	14.1	Optical Society of America	1802	35.6	IEEE	714	14.1
293	NETWORK-1 TECHNOLOG	714	1617	44.2	IEEE	714	44.2	ACM-Assoc Comput Mach	451	27.9
294	Headwater Partners 1 LLC	710	1597	44.5	IEEE	710	44.5	ACM-Assoc Comput Mach	315	19.7
295	Avid Technology Inc.	709	1692	41.9	IEEE	709	41.9	ACM-Assoc Comput Mach	613	36.2
296	University of Maryland	708	3914	18.1	IEEE	708	18.1	RELX Group (Elsevier)	587	15.0
297	Nant Holdings IP Llc	706	1939	36.4	IEEE	706	36.4	ACM-Assoc Comput Mach	496	25.6
298	BANDSPEED INC	696	1046	66.5	IEEE	696	66.5	Bluetooth Special Interest Group	262	25.0
299	Princeton University	694	5901	11.8	American Institute of Physics	1314	22.3	ACS-Am Chem Soc	718	12.2
300	Silverbrook Pty Ltd	691	1966	35.1	IEEE	691	35.1	Springer/Sp. Wien/Springer-Verlag/KluwAcad	440	22.4
301	JPMorgan	682	5959	11.4	Source Media	1101	18.5	IEEE	682	11.4
302	Pioneer Corp.	682	1519	44.9	IEEE	682	44.9	SPIE-Int Soc Opt Engineering	273	18.0
303	General Dynamics Corp	669	1593	42.0	IEEE	669	42.0	American Physical Society	248	15.6
304	Advantest Corp.	666	939	70.9	IEEE	666	70.9	American Institute of Physics	41	4.4
305	Charles Stark Draper Laborato	666	2199	30.3	IEEE	666	30.3	RELX Group (Elsevier)	281	12.8
306	University of Pennsylvania	665	7192	9.2	RELX Group (Elsevier)	1081	15.0	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	745	10.4
307	Yageo Corporation	657	870	75.5	IEEE	657	75.5	IET/IEE	182	20.9
308	Align Technology Inc	656	2552	25.7	IEEE	656	25.7	RELX Group (Elsevier)	373	14.6
309	Harvard University	655	10885	6.0	ACS-Am Chem Soc	1428	13.1	RELX Group (Elsevier)	1326	12.2
310	Zebra Technologies Corp.	655	1366	48.0	IEEE	655	48.0	Optical Society of America	63	4.6
311	NOMADIX INC	647	2485	26.0	IEEE	647	26.0	Network Working Group RFC	410	16.5
312	NUMENTA INC	632	2492	25.4	Numenta Inc.	876	35.2	IEEE	632	25.4
313	Sulvolta Inc	620	1301	47.7	IEEE	620	47.7	American Institute of Physics	200	15.4
314	North Carolina State Universit	619	4027	15.4	American Institute of Physics	773	19.2	RELX Group (Elsevier)	628	15.6
315	BIONX MEDICAL TECHN	617	1262	48.9	IEEE	617	48.9	RELX Group (Elsevier)	207	16.4
316	EchoStar Corp	617	1118	55.2	IEEE	617	55.2	RELX Group (Elsevier)	78	7.0
317	State University of New York	615	3875	15.9	IEEE	615	15.9	RELX Group (Elsevier)	598	15.4
318	MOJO MOBILITY INC	614	784	78.3	IEEE	614	78.3	RELX Group (Elsevier)	54	6.9
319	ZTE Microelectronics Technol	614	2937	20.9	3GPP General Partnership Project Standards Bo	1578	53.7	IEEE	614	20.9
320	Ciena Corp	606	1880	32.2	IEEE	606	32.2	Optical Society of America	296	15.7

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
321	MULTI-TECH SYSTEMS IN	606	975	62.2	IEEE	606	62.2	International Telecommunication Union	52	5.3
322	Centre National De La Recher	604	5849	10.3	RELX Group (Elsevier)	1529	26.1	IEEE	604	10.3
323	ASML Holding NV	603	12444	4.8	SPIE-Int Soc Opt Engineering	4281	34.4	American Institute of Physics	2739	22.0
324	Fastback Networks Inc	596	836	71.3	IEEE	596	71.3	IET/IEE	57	6.8
325	Ecole Polytechnique Federale	590	2024	29.2	IEEE	590	29.2	RELX Group (Elsevier)	193	9.5
326	Johnson Controls International	586	1700	34.5	IEEE	586	34.5	RELX Group (Elsevier)	255	15.0
327	Tel Aviv University	585	3571	16.4	IEEE	585	16.4	RELX Group (Elsevier)	554	15.5
328	Unisantis Electronics Ltd	583	670	87.0	IEEE	583	87.0	RELX Group (Elsevier)	38	5.7
329	EXEGY INC	577	1112	51.9	IEEE	577	51.9	ACM-Assoc Comput Mach	173	15.6
330	Oki Electric Industry Co. Ltd.	577	1379	41.8	IEEE	577	41.8	IEICE-Inst Elec Info Comm Eng	153	11.1
331	VerintSys	577	4633	12.5	International Data Group	1318	28.4	ACM-Assoc Comput Mach	925	20.0
332	National Chiao Tung Universi	574	1109	51.8	IEEE	574	51.8	American Institute of Physics	99	8.9
333	Screen Holdings Co Ltd (Form	569	2138	26.6	IEEE	569	26.6	RELX Group (Elsevier)	315	14.7
334	Nintendo Co. Ltd.	568	3196	17.8	ACM-Assoc Comput Mach	741	23.2	IEEE	568	17.8
335	ACORN TECHNOLOGIES I	561	1596	35.2	IEEE	561	35.2	American Institute of Physics	437	27.4
336	3D Systems Corp.	556	1280	43.4	IEEE	556	43.4	ACM-Assoc Comput Mach	310	24.2
337	Denso Corp	555	1247	44.5	IEEE	555	44.5	RELX Group (Elsevier)	115	9.2
338	BTG Plc.	554	2155	25.7	IEEE	554	25.7	RELX Group (Elsevier)	273	12.7
339	Virgin Islands Microsystems	548	2251	24.3	IEEE	548	24.3	American Institute of Physics	461	20.5
340	Sotera Wireless	547	1093	50.0	IEEE	547	50.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	182	16.7
341	CREATIVE KINGDOMS LL	541	1635	33.1	IEEE	541	33.1	ACM-Assoc Comput Mach	447	27.3
342	Halliburton Co. (Holding)	540	9391	5.8	Society of Petroleum Engineers	3465	36.9	SPWLA-Society of Petrophysicists and Well Log Analysts	662	7.0
343	Soitec SA	536	2054	26.1	IEEE	536	26.1	American Institute of Physics	505	24.6
344	Schweitzer Engineering Labor	535	647	82.7	IEEE	535	82.7	IET/IEE	16	2.5
345	Fitbit Inc	532	1291	41.2	IEEE	532	41.2	Springer/Sp. Wien/Springer-Verlag/KluwAcad	190	14.7
346	Korea Advanced Institute for S	530	1662	31.9	IEEE	530	31.9	RELX Group (Elsevier)	181	10.9
347	Maxlinear Inc	528	726	72.7	IEEE	528	72.7	ACM-Assoc Comput Mach	41	5.6
348	Emcore Corp.	525	1185	44.3	IEEE	525	44.3	American Institute of Physics	165	13.9
349	Via Technologies Inc.	522	1109	47.1	IEEE	522	47.1	Joint IEEE and ACM	149	13.4
350	Micro Focus International PL	521	1522	34.2	IEEE	521	34.2	ACM-Assoc Comput Mach	410	26.9
351	Xtera Communications Inc.	521	1533	34.0	IEEE	521	34.0	IET/IEE	359	23.4
352	Hoya Corp	519	1776	29.2	IEEE	519	29.2	American Institute of Physics	343	19.3
353	Eaton Corp.	518	740	70.0	IEEE	518	70.0	RELX Group (Elsevier)	34	4.6
354	Pulse Link Inc	516	630	81.9	IEEE	516	81.9	Scientific American Inc.	24	3.8
355	SAS Institute	515	1500	34.3	IEEE	515	34.3	RELX Group (Elsevier)	215	14.3
356	The National Aeronautical and	515	2596	19.8	IEEE	515	19.8	AIAA-Am Inst Aero Astro	269	10.4
357	New York University	512	3011	17.0	IEEE	512	17.0	Optical Society of America	316	10.5
358	University of Pittsburgh	510	4132	12.3	RELX Group (Elsevier)	827	20.0	IEEE	510	12.3
359	Sumitomo Electric Industries	508	3519	14.4	IEEE	508	14.4	American Institute of Physics	476	13.5
360	AMPT LLC	503	637	79.0	IEEE	503	79.0	IET/IEE	34	5.3

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
361	VirnetX Holding Corp	503	8565	5.9	Network Working Group RFC	4279	50.0	Internet Soc/IETF-Internet Eng Task Force	1492	17.4
362	Olympus Corp.	500	2631	19.0	IEEE	500	19.0	RELX Group (Elsevier)	406	15.4
363	ST-Ericsson SA (Patents split	498	701	71.0	IEEE	498	71.0	3GPP General Partnership Project Standards Body	83	11.8
364	HMD Global	497	955	52.0	IEEE	497	52.0	3GPP General Partnership Project Standards Body	69	7.2
365	GoPro Inc	496	723	68.6	IEEE	496	68.6	ACM-Assoc Comput Mach	69	9.5
366	Comtech Telecommunications	494	1041	47.5	IEEE	494	47.5	3GPP General Partnership Project Standards Body	218	20.9
367	Assa Abloy AB	492	3079	16.0	IEEE	492	16.0	International Association for Cryptologic Research (IACR)	402	13.1
368	ECOLE DE TECHNOLOGIE	482	695	69.4	IEEE	482	69.4	3GPP General Partnership Project Standards Body	54	7.8
369	University of Central Florida	482	3814	12.6	RELX Group (Elsevier)	532	13.9	IEEE	482	12.6
370	HEMOSONICS LLC	480	779	61.6	IEEE	480	61.6	RELX Group (Elsevier)	70	9.0
371	Medispectra Inc	480	1291	37.2	IEEE	480	37.2	RELX Group (Elsevier)	146	11.3
372	ZENA TECHNOLOGIES IN	480	1821	26.4	IEEE	480	26.4	American Institute of Physics	392	21.5
373	MC10 Inc	479	5386	8.9	American Institute of Physics	1054	19.6	ACS-Am Chem Soc	796	14.8
374	Cheetah Omni LLC	478	1872	25.5	IEEE	478	25.5	Optical Society of America	445	23.8
375	Realtek Semiconductor Corp.	477	572	83.4	IEEE	477	83.4	IET/IEEE	15	2.6
376	Tellabs Inc.	476	1049	45.4	IEEE	476	45.4	Internet Soc/IETF-Internet Eng Task Force	172	16.4
377	ETA DEVICES INC	474	541	87.6	IEEE	474	87.6	IET/IEEE	20	3.7
378	Pennsylvania State University	474	3300	14.4	RELX Group (Elsevier)	607	18.4	IEEE	474	14.4
379	Qinetiq Group Ltd	474	1524	31.1	IEEE	474	31.1	American Institute of Physics	168	11.0
380	MIRAMAR LABS INC	471	1115	42.2	IEEE	471	42.2	IOP Publishing	105	9.4
381	Lattice Semiconductor Corp.	469	678	69.2	IEEE	469	69.2	Joint IEEE and ACM	39	5.8
382	Ligado Networks (formerly Li	468	874	53.5	IEEE	468	53.5	Baltzer Science Publishers B.V.	133	15.2
383	Soraa Inc	468	5513	8.5	American Institute of Physics	1835	33.3	Institute of Pure and Applied Physics	972	17.6
384	University of Colorado ( The	464	3225	14.4	Optical Society of America	764	23.7	IEEE	464	14.4
385	FARO Technologies Inc.	463	1200	38.6	IEEE	463	38.6	SPIE-Int Soc Opt Engineering	202	16.8
386	MegaChips Corp	462	704	65.6	IEEE	462	65.6	American Physical Society	43	6.1
387	Proteus Biomedical Inc	459	1980	23.2	IEEE	459	23.2	RELX Group (Elsevier)	367	18.5
388	Tokyo Electron Limited	459	3634	12.6	RELX Group (Elsevier)	520	14.3	American Institute of Physics	482	13.3
389	NCR Corp.	458	1525	30.0	IEEE	458	30.0	ACM-Assoc Comput Mach	330	21.6
390	MicroStrategy Inc.	457	1843	24.8	IEEE	457	24.8	United Business Media/UBM Tech	359	19.5
391	IDEMIA	456	1176	38.8	IEEE	456	38.8	SPIE-Int Soc Opt Engineering	80	6.8
392	University of Utah	453	2782	16.3	IEEE	453	16.3	RELX Group (Elsevier)	354	12.7
393	Oewaves Inc	447	1412	31.7	Optical Society of America	537	38.0	IEEE	447	31.7
394	ALOFT MEDIA LLC	446	654	68.2	IEEE	446	68.2	3GPP General Partnership Project Standards Body	105	16.1
395	Lumentum Holdings Inc	445	1489	29.9	IEEE	445	29.9	Optical Society of America	342	23.0
396	Global Tel Link Corp	443	624	71.0	IEEE	443	71.0	IEEE/Eurasip	32	5.1
397	Omnivision Technologies Inc	443	1121	39.5	IEEE	443	39.5	Optical Society of America	288	25.7
398	Red Hat Inc	439	1463	30.0	IEEE	439	30.0	ACM-Assoc Comput Mach	374	25.6
399	F5 Networks Inc	438	2382	18.4	IEEE	438	18.4	ACM-Assoc Comput Mach	374	15.7
400	Maui Diagnostic Imaging	437	553	79.0	IEEE	437	79.0	RELX Group (Elsevier)	34	6.1



## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
401	National Taiwan University	436	830	52.5	IEEE	436	52.5	American Institute of Physics	60	7.2
402	PLUSN LLC	436	600	72.7	IEEE	436	72.7	IET/IEE	57	9.5
403	University of Virginia (and Pat	433	2121	20.4	IEEE	433	20.4	RELX Group (Elsevier)	303	14.3
404	Aerospace Corp.	431	1112	38.8	IEEE	431	38.8	American Institute of Physics	157	14.1
405	Virginia Tech University	428	1424	30.1	IEEE	428	30.1	RELX Group (Elsevier)	171	12.0
406	ICOSYSTEM CORP	426	576	74.0	IEEE	426	74.0	RELX Group (Elsevier)	27	4.7
407	City University of Hong Kong	425	1036	41.0	IEEE	425	41.0	Optical Society of America	95	9.2
408	SAIC Inc	425	2618	16.2	SPIE-Int Soc Opt Engineering	572	21.8	IEEE	425	16.2
409	Vestas Wind Systems A/S	425	911	46.7	IEEE	425	46.7	AWEA-American Wind Energy Association	98	10.8
410	Fortive Corporation	424	1045	40.6	IEEE	424	40.6	RELX Group (Elsevier)	100	9.6
411	Commonwealth Scientific and	420	892	47.1	IEEE	420	47.1	RELX Group (Elsevier)	97	10.9
412	University of New Mexico	420	2131	19.7	IEEE	420	19.7	American Institute of Physics	247	11.6
413	Alstom	417	682	61.1	IEEE	417	61.1	ASME-Am Soc Mech Eng	55	8.1
414	MACAU UNIVERSITY OF S	415	506	82.0	IEEE	415	82.0	ACM-Assoc Comput Mach	24	4.7
415	Densbits Technologies Ltd	414	767	54.0	IEEE	414	54.0	Springer/Sp. Wien/Springer-Verlag/KluwAcad	119	15.5
416	Tigo Energy Inc	413	580	71.2	IEEE	413	71.2	WIP-Renewable Energies	125	21.6
417	TRACBEAM LLC	413	789	52.3	IEEE	413	52.3	ACM-Assoc Comput Mach	108	13.7
418	IPCO LLC	411	732	56.1	IEEE	411	56.1	ACM-Assoc Comput Mach	54	7.4
419	Asahi Kasei Corp.	409	4934	8.3	RELX Group (Elsevier)	1109	22.5	Lippincott Williams & Wilkins Ltd.	662	13.4
420	Dassault Systemes SA	407	3208	12.7	RELX Group (Elsevier)	665	20.7	ACS-Am Chem Soc	466	14.5
421	ACACIA MEDIA TECHNOL	406	736	55.2	IEEE	406	55.2	ACM-Assoc Comput Mach	66	9.0
422	Ohio State University	405	2408	16.8	IEEE	405	16.8	RELX Group (Elsevier)	405	16.8
423	Palantir Technologies Inc	402	1455	27.6	ACM-Assoc Comput Mach	423	29.1	IEEE	402	27.6
424	Telecom Italia SPA	402	1024	39.3	IEEE	402	39.3	3GPP General Partnership Project Standards Body	144	14.1
425	Ygomi LLC	401	439	91.3	IEEE	401	91.3	SPIE-Int Soc Opt Engineering	15	3.4
426	Autodesk Inc.	399	2657	15.0	ACM-Assoc Comput Mach	1625	61.2	IEEE	399	15.0
427	Coherent Inc.	397	2773	14.3	Optical Society of America	563	20.3	American Institute of Physics	502	18.1
428	EDGE 3 TECHNOLOGIES I	392	606	64.7	IEEE	392	64.7	International Association for Pattern Recognition (IAPR)	43	7.1
429	TANGIS CORP	392	559	70.1	IEEE	392	70.1	ACM-Assoc Comput Mach	94	16.8
430	AVISTAR COMMUNICATI	390	777	50.2	IEEE	390	50.2	ACM-Assoc Comput Mach	228	29.3
431	ITT Corp	390	854	45.7	IEEE	390	45.7	Internet Soc/IETF-Internet Eng Task Force	63	7.4
432	ON-RAMP WIRELESS INC	389	569	68.4	IEEE	389	68.4	IET/IEE	48	8.4
433	YANICKLO TECHNOLOG	389	2402	16.2	ACM-Assoc Comput Mach	854	35.6	IEEE	389	16.2
434	Communications Research Ce	388	601	64.6	IEEE	388	64.6	IET/IEE	43	7.2
435	Fuji Electric Holdings Co. Ltd.	388	820	47.3	IEEE	388	47.3	American Institute of Physics	116	14.1
436	IWALK INC	384	1017	37.8	IEEE	384	37.8	RELX Group (Elsevier)	207	20.4
437	BIO CONTROL MEDICAL (	383	1409	27.2	IEEE	383	27.2	Lippincott Williams & Wilkins Ltd.	221	15.7
438	Furukawa Electric Co. Ltd.	382	1856	20.6	Optical Society of America	429	23.1	IEEE	382	20.6
439	United States of America Depa	382	1837	20.8	IEEE	382	20.8	American Institute of Physics	332	18.1
440	Becton Dickinson and Co.	381	20744	1.8	RELX Group (Elsevier)	3484	16.8	Wolters Kluwer	2791	13.5

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
441	Carl-Zeiss Stiftung	381	8308	4.6	SPIE-Int Soc Opt Engineering	1612	19.4	Optical Society of America	1296	15.6
442	Genesys Telecommunications	378	869	43.5	IEEE	378	43.5	ACM-Assoc Comput Mach	145	16.7
443	Jiangsu ChangJiang Electronic	378	479	78.9	IEEE	378	78.9	International Microelectronics And Packaging Society	49	10.2
444	Avigilon Corp	377	576	65.5	IEEE	377	65.5	ACM-Assoc Comput Mach	41	7.1
445	Catholic University Leuven	377	965	39.1	IEEE	377	39.1	American Institute of Physics	121	12.5
446	DowDuPont	377	7915	4.8	RELX Group (Elsevier)	1793	22.7	ACS-Am Chem Soc	1133	14.3
447	Teradyne Inc.	375	743	50.5	IEEE	375	50.5	ASME-Am Soc Mech Eng	95	12.8
448	Voicebox Technologies Inc	375	499	75.2	IEEE	375	75.2	ACM-Assoc Comput Mach	77	15.4
449	TE Connectivity Ltd	374	984	38.0	IEEE	374	38.0	Optical Society of America	114	11.6
450	University of Connecticut	374	1991	18.8	IEEE	374	18.8	RELX Group (Elsevier)	357	17.9
451	Caterpillar Inc.	373	1113	33.5	IEEE	373	33.5	SAE-Society of Automobile Engineers	158	14.2
452	Concornis Inc	373	10832	3.4	Springer/Sp. Wien/Springer-Verlag/KluwAcad	1716	15.8	RELX Group (Elsevier)	1401	12.9
453	University of Alabama	372	3037	12.2	RELX Group (Elsevier)	707	23.3	IEEE	372	12.2
454	Delphi Automotive PLC	371	850	43.6	IEEE	371	43.6	RELX Group (Elsevier)	114	13.4
455	Drexel University	371	3484	10.6	RELX Group (Elsevier)	829	23.8	American Institute of Physics	713	20.5
456	INTERVAL RESEARCH CO	371	899	41.3	IEEE	371	41.3	ACM-Assoc Comput Mach	235	26.1
457	NXGEN PARTNERS IP LLC	370	818	45.2	IEEE	370	45.2	Optical Society of America	225	27.5
458	Hologic Inc	368	4352	8.5	RELX Group (Elsevier)	835	19.2	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	631	14.5
459	Novartis AG	368	8478	4.3	RELX Group (Elsevier)	2492	29.4	Association for Research in Vision and Ophthalmology	583	6.9
460	THE FLORIDA INTERNATI	368	832	44.2	IEEE	368	44.2	RELX Group (Elsevier)	102	12.3
461	Kofax Inc	365	895	40.8	IEEE	365	40.8	ACM-Assoc Comput Mach	142	15.9
462	Sigma Corp	365	483	75.6	IEEE	365	75.6	SPIE-Int Soc Opt Engineering	70	14.5
463	Rohm Co. Ltd.	364	3172	11.5	American Institute of Physics	894	28.2	RELX Group (Elsevier)	434	13.7
464	United States Air Force	364	1509	24.1	IEEE	364	24.1	American Institute of Physics	167	11.1
465	William Marsh Rice Universit	364	3776	9.6	ACS-Am Chem Soc	746	19.8	RELX Group (Elsevier)	507	13.4
466	ZF Friedrichshafen AG (Germ	364	941	38.7	IEEE	364	38.7	American Institute of Physics	81	8.6
467	Avalanche Technology Inc	358	1591	22.5	American Institute of Physics	499	31.4	IEEE	358	22.5
468	UT-Battelle LLC	358	3559	10.1	RELX Group (Elsevier)	645	18.1	American Institute of Physics	494	13.9
469	Eagleview Technologies Inc	357	1078	33.1	IEEE	357	33.1	ACM-Assoc Comput Mach	192	17.8
470	Council of Scientific and Indus	353	1316	26.8	IEEE	353	26.8	RELX Group (Elsevier)	279	21.2
471	Atos SE	352	873	40.3	IEEE	352	40.3	Internet Soc/IETF-Internet Eng Task Force	121	13.9
472	Quest Software Inc	351	908	38.7	IEEE	351	38.7	ACM-Assoc Comput Mach	278	30.6
473	SYNTROPY SYSTEMS LLC	351	392	89.5	IEEE	351	89.5	Springer/Sp. Wien/Springer-Verlag/KluwAcad	18	4.6
474	Dialog Semiconductor Plc.	350	413	84.7	IEEE	350	84.7	ONLINE INC	18	4.4
475	Japan Science and Technology	348	3978	8.7	American Institute of Physics	1069	26.9	RELX Group (Elsevier)	540	13.6
476	SHARED SPECTRUM CO	347	389	89.2	IEEE	347	89.2	Defense Advanced Research Projects Agency (DARPA)	18	4.6
477	Fluidigm Corp	346	2854	12.1	RELX Group (Elsevier)	422	14.8	ACS-Am Chem Soc	421	14.8
478	University Health Network	346	991	34.9	IEEE	346	34.9	RELX Group (Elsevier)	142	14.3
479	CIRREX SYSTEMS LLC	341	1421	24.0	IEEE	341	24.0	Optical Society of America	223	15.7
480	COLLABORATION PROPE	341	506	67.4	IEEE	341	67.4	ACM-Assoc Comput Mach	68	13.4

## Appendix C: Top Organizations from All Categories Combined

rank	assignee	# IEEE Refs	Total Science Refs	% IEEE Refs	Top Referenced Organization	# Refs	% Refs	2nd Most Referenced Organization	# Refs	% Refs
481	National University of Singap	341	1320	25.8	IEEE	341	25.8	American Institute of Physics	164	12.4
482	Tensorcomm Inc	337	378	89.2	IEEE	337	89.2	IET/IEE	13	3.4
483	VASCULAR IMAGING CO	337	696	48.4	IEEE	337	48.4	IET/IEE	200	28.7
484	Los Alamos National Security	335	3453	9.7	RELX Group (Elsevier)	670	19.4	John Wiley & Sons/Wiley-Verlag/Wiley-Liss	482	14.0
485	PerkinElmer Inc.	335	4653	7.2	ACS-Am Chem Soc	1142	24.5	RELX Group (Elsevier)	678	14.6
486	Security First Corp	335	1057	31.7	IEEE	335	31.7	ACM-Assoc Comput Mach	309	29.2
487	Silicon Genesis Corporation	335	1617	20.7	IEEE	335	20.7	RELX Group (Elsevier)	328	20.3
488	Hexagon AB	334	1059	31.5	IEEE	334	31.5	ACM-Assoc Comput Mach	119	11.2
489	Plantronics Inc.	334	506	66.0	IEEE	334	66.0	International Telecommunication Union	57	11.3
490	Sanan Optoelectronics Techno	334	1378	24.2	American Institute of Physics	637	46.2	IEEE	334	24.2
491	University of Tennessee	333	1694	19.7	IEEE	333	19.7	RELX Group (Elsevier)	282	16.6
492	CONSTELLATION DESIGN	330	352	93.8	IEEE	330	93.8	IET/IEE	8	2.3
493	Seoul National University	330	1290	25.6	IEEE	330	25.6	ACS-Am Chem Soc	155	12.0
494	Vishay Intertechnology Inc.	330	511	64.6	IEEE	330	64.6	RELX Group (Elsevier)	30	5.9
495	Seoul Semiconductor Co Ltd	326	2374	13.7	American Institute of Physics	922	38.8	IEEE	326	13.7
496	AMS AG	323	600	53.8	IEEE	323	53.8	RELX Group (Elsevier)	69	11.5
497	Continental AG (Germany Fed	323	654	49.4	IEEE	323	49.4	RELX Group (Elsevier)	48	7.3
498	Ossur hf	323	1063	30.4	IEEE	323	30.4	RELX Group (Elsevier)	247	23.2
499	University of Arizona	323	1632	19.8	Optical Society of America	328	20.1	IEEE	323	19.8
500	BLUERISC INC	322	923	34.9	IEEE	322	34.9	Joint IEEE and ACM	242	26.2