

An Analysis of the
Effect of IEEE
Publications on the
Apple Computer Inc.
Patent Portfolio

Prepared by IEEE for
Apple Computer Inc.

Based on a study conducted
by CHI Research, Inc.



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Executive Summary

Introduction – Today's Patents Cite Scientific Literature

In 2003, the IEEE commissioned CHI Research Inc., a worldwide leader in intellectual property consulting, to analyze how IEEE-published information influences patents in today's top technologies. According to the studies, patents issued by the U.S. Patent office are citing scientific literature, primarily IEEE information, more than ever before. CHI found that patents today are based on the fundamental source – scientific and technical literature, representing a shift from just 20 years ago when patents issued in information technology cited primarily previous patents. In the study, CHI also identified the top 25 patenting organizations in 2002. See Figure 1.

Figure 1: Top 25 Patenting Firms in 2002

Rank	Company Name	#US Patents	Rank	Company Name	#US Patents
1	IBM	3334	14	Toshiba Corporation	1352
2	Canon Inc	1937	15	Philips Electronic N.V.	1276
3	NEC Corporation	1920	16	Advanced Micro Devices	1152
4	Hitachi Ltd	1882	17	Intel Corp	1088
5	Micron Technology	1851	18	Fuji Photo Film Co Ltd	1010
6	Matsushita Electric	1712	19	Lucent Technologies	818
7	General Electric	1681	20	Robert Bosch GmbH	800
8	Sony Corporation	1601	21	Motorola Inc	778
9	Samsung Group	1563	22	Ericsson (LM) Telephone	767
10	Mitsubishi Electric	1474	23	Texas Instruments Inc.	744
11	Hewlett-Packard Co.	1391	24	Eastman Kodak Co	706
12	Fujitsu Limited	1368	25	Honda	703
13	Siemens AG	1357			

IEEE is the Science Base for the Top Patenting Organizations

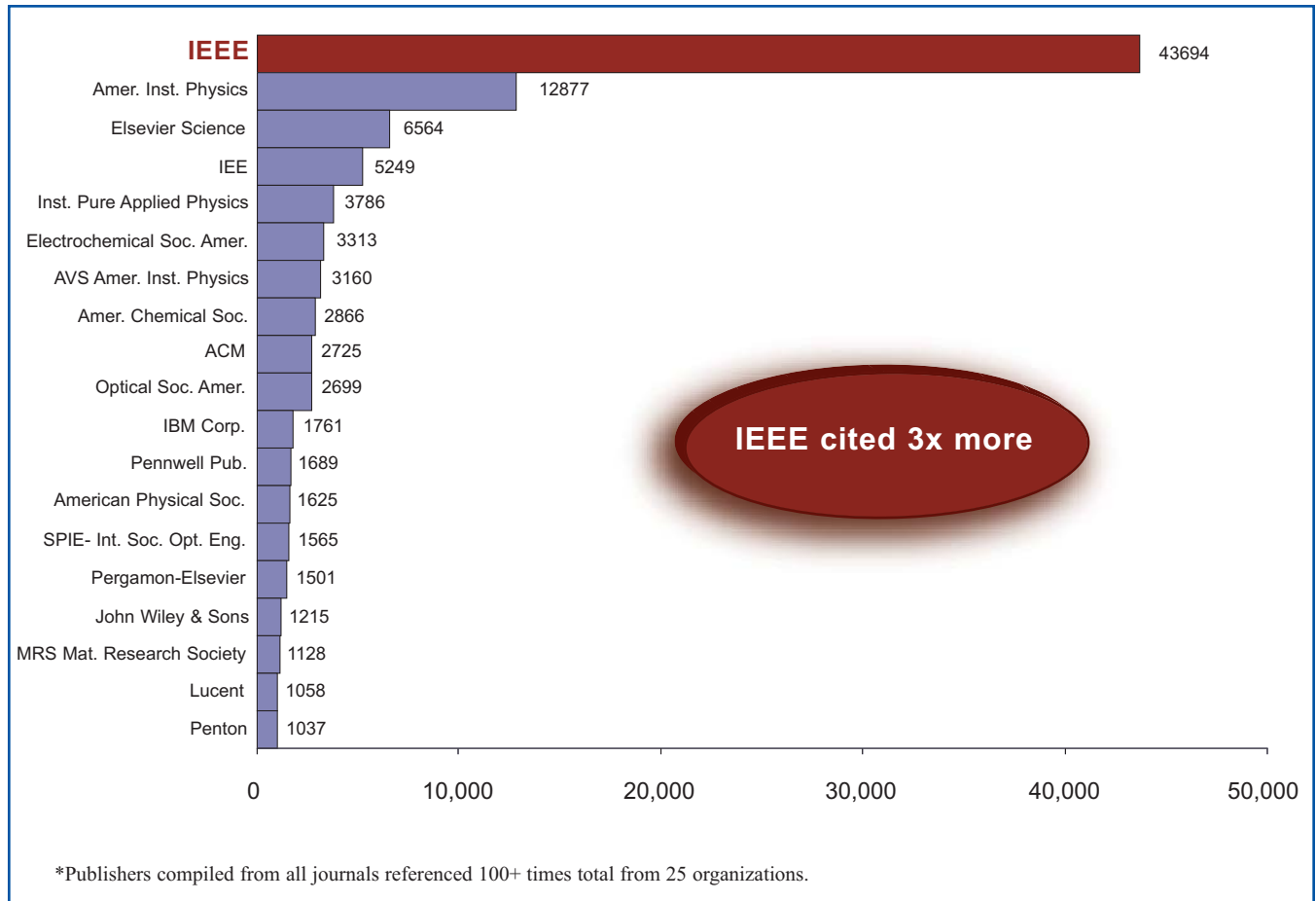
The analysis of the top 25 patenting organizations revealed that IEEE-published science was cited more often than that of other scholarly and commercial publishers:

- 38% of all science references from the patents of the top 25 patenting organizations go to articles that appear in IEEE journals. This is more than three times as many references to the second place publisher. See Figure 2.
- The results become even more impressive when we look at specific subcategories of patents.
 - Telecom: 58% of all science references come from IEEE
 - Computer hardware: 55% of all science references come from IEEE
 - Computer software: 45% of all science references come from IEEE
 - Semiconductors: 22% of all science references come from IEEE
 - Optics: 21% of all science references come from IEEE (see Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004)
- Referencing to IEEE articles in patents has increased 267% in the last decade.

Continued on page 2...

- CHI has documented that high patent citation rankings for an organization have been shown to be associated with increases in sales, profits, and stock price. Technology that builds upon IEEE science is likely to be of more value than peer technology not built on IEEE science. Patents that reference the IEEE are cited more often than patents that do not reference IEEE.
- The most highly cited patents build on IEEE science. There are more than 1,000 highly cited patents, which CHI calls "blockbuster" patents, that reference at least three IEEE articles (see Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004).

Figure 2: Number of Patent References from Top 25 Patenting Organizations to Top Publishers*



Apple is One of the Top 50 Patenting Firms That Cites IEEE Science

CHI Research also analyzed the top patenting organizations that reference IEEE most in several key technology categories. Apple was identified as one of the top 50 firms with patent citations to IEEE published science in the following technology area during the time period of 1983 to 2003:

Technology Category	Number of Apple Patent Science References to IEEE	Total Number of Apple Patent Science References	Percentage of Apple References to IEEE
Software	167	683	24%

Apple "Blockbuster" Patents Are Based on IEEE Science

The CHI report demonstrates that high citation rates are correlated with high impact patents. High patent citation rankings for an organization have been shown to be associated with increases in sales, profits, and stock price. There are more than 1000 highly cited patents that are based on IEEE science. The analysis finds that numerous Apple patents are both highly cited and extensively reference IEEE articles:

Apple Patent Name	Patent No.	IEEE Refs	Cites received	Expected citations	Citation index*
Programmable logic cell and array	05019736	9	78	10.92	7.14
Method and apparatus for fuzzy logic rule execution	05485550	3	61	14.94	4.08
Programmable, asynchronous logic cell and array	04700187	6	89	23.27	3.82
High speed lossless data compression system	05467087	4	32	8.76	3.65
Programmable logic cell and array	05155389	10	41	11.55	3.55

*Examples pulled from list of the top 1000 patents in terms of citation index among those with at least 4 citations and at least 3 references to IEEE papers. Citation index is the number of citations divided by the expected citations; expected citations are the average number of citations for all patents in the same technology class and age.

Conclusions

The data presented here demonstrates the value of IEEE information to technological innovation for the top patenting organizations. Patents today are citing scientific literature, primarily IEEE information, more than ever before. This new analysis of the top patenting organizations revealed that IEEE-published science was cited more often than that of other scholarly and commercial publishers and the most innovative "blockbuster" patents build on IEEE science, demonstrating that IEEE is the science base for the top patenting organizations.

About CHI Research Inc., the company BusinessWeek called "A Search Engine For Tech Prospectors"

CHI Research, Inc. is a highly focused research consultancy internationally recognized for its leadership in the development and analysis of technology and science indicators. Formed in 1968, CHI pioneered the development of science and technology citation analysis. Working with the U.S. National Science Foundation, CHI developed the first national-scale bibliometric indicators of scientific performance in the early 1970s. Since then, CHI has produced all the literature-to-literature, patent-to-literature and patent-to-patent citation indicators ever used in the congressionally mandated Science and Engineering Indicators reports published by the U.S. National Science Board.

About IEEE

The IEEE is the world's largest technical professional society with approximately 360,000 members in 170 countries. Through its members, the IEEE is a leading authority on areas ranging from aerospace, computers and telecommunications to biomedicine, electric power and consumer electronics. The IEEE produces 30 percent of the world's literature in the electrical and electronics engineering and computer science fields, and has developed more than 900 active industry standards. The organization also sponsors or cosponsors more than 300 international technical conferences each year. Additional information is available at www.ieee.org.

For more information,

- Read the enclosed CHI Studies:
 - Report A: "The Effect of IEEE Publications on Subsequent Patented Technology," 29 July, 2003.
 - Report B: "Analysis of References to IEEE Articles from Patents in 5 Technology Areas," 23 March, 2004.
- Contact Karen Hawkins, IEEE Senior Marketing Manager, at k.hawkins@ieee.org.

Top 50 Organizations That Cite IEEE in Software Patents

Organization	# IEEE Refs	# Total Science Refs	% IEEE Refs	Top Referenced Publisher	Second Most Referenced Publisher	# Refs	% Refs
1 IBM	1389	4593	30.2	IEEE	ACM	688	15.0
2 Lucent Technologies	784	1725	45.4	IEEE	ACM	150	8.7
3 Hewlett-Packard Company	631	2395	26.3	IEEE	ACM	346	14.4
4 Microsoft Corp	418	1670	25.0	IEEE	ACM	215	12.9
5 Hitachi Ltd	331	992	33.4	IEEE	ACM	107	10.8
6 Motorola Inc	310	505	61.4	IEEE	CMP MEDIA	22	4.4
7 NEC Corporation	277	539	51.4	IEEE	ACM	37	6.9
8 Intel Corp	248	538	46.1	IEEE	ACM	56	10.4
9 Sony Corporation	219	497	44.1	IEEE	LUCENT TECHNOLOGIES	36	7.2
10 Siemens AG	217	533	40.7	IEEE	ACM	42	7.9
11 Sun Microsystems Inc	204	1291	15.8	ACM	IEEE	204	15.8
12 Xerox Corporation	204	770	26.5	IEEE	ACM	141	18.3
13 Matsushita Electric Industrial Co Ltd	203	508	40.0	IEEE	ELSEVIER SCIENCE	38	7.5
14 Fujitsu Limited	197	529	37.2	IEEE	ACM	41	7.8
15 Toshiba Corporation	192	496	38.7	IEEE	ACM	60	12.1
16 MIT/Mass Inst of Technology	173	487	35.5	IEEE	ACM	78	16.0
17 Canon Inc	173	502	34.5	IEEE	ACM	43	8.6
18 Koninklijke Philips Electronics N.V.	170	415	41.0	IEEE	ACM	31	7.5
19 Apple Computer Inc.	167	683	24.5	IEEE	ACM	92	13.5
20 Mitsubishi Electric Corp	154	383	40.2	IEEE	ELSEVIER SCIENCE	21	5.5
21 Silicon Graphics Inc.	148	647	22.9	IEEE	ACM	60	9.3
22 Ricoh Company Ltd	144	271	53.1	IEEE	ACM	20	7.4
23 Verizon Communications	143	238	60.1	IEEE	ACM	11	4.6
24 Texas Instruments Incorporated	142	321	44.2	IEEE	ACM	21	6.5
25 E I DuPont de Nemours & Co	125	212	59.0	IEEE	AMER INST CHEMICAL ENGINEERS	15	7.1
26 Ericsson (LM) Telephone Co Inc	124	232	53.4	IEEE	ACM	11	4.7
27 A T & T Corp.	111	296	37.5	IEEE	ACM	31	10.5
28 Secure Computing Corp.	110	350	31.4	ACM	IEEE	110	31.4
29 Digimarc Corp	108	330	32.7	IEEE	CMP MEDIA	28	8.5
30 Digital Voice Systems, Inc.	107	119	89.9	IEEE	IEE	1	0.8
31 General Electric Co	104	267	39.0	IEEE	ELSEVIER SCIENCE	20	7.5
32 British Telecommunications PLC	95	294	32.3	IEEE	IEE	17	5.8
33 Nortel Networks Corp	94	178	52.8	IEEE	LUCENT TECHNOLOGIES	11	6.2
34 NCR Corporation	91	252	36.1	IEEE	ACM	51	20.2
35 Alcatel	84	216	38.9	IEEE	ELSEVIER SCIENCE	16	7.4
36 Micron Technology, Inc.	82	120	68.3	IEEE	IECE	11	9.2
37 Fuji Photo Film Co Ltd	82	207	39.6	IEEE	ACM	13	6.3
38 Cray Inc.	76	118	64.4	IEEE	ACM	9	7.6
39 SRI International	75	121	62.0	IEEE	ACM	8	6.6
40 Washington University	73	237	30.8	IEEE	AMER INST PHYSICS	23	9.7
41 Sharp Corporation	71	149	47.7	IEEE	ELSEVIER SCIENCE	7	4.7
42 Dolby Labs Licensing Corp.	67	133	50.4	IEEE	AUDIO ENGINEERING SOC	23	17.3
43 LSI Logic Corp.	67	119	56.3	IEEE	ELSEVIER SCIENCE	10	8.4
					ACOUSTICAL SOC AMER		
44 University of California	66	146	45.2	IEEE	AMER INST PHYSICS	13	8.9
45 Enterasys Networks Inc.	63	161	39.1	IEEE	MILLER FREEMAN	12	7.5
					ACOUSTICAL SOC AMER		
46 Lockheed Martin Corp.	63	151	41.7	IEEE	AMER INST PHYSICS	14	9.3
47 Unisys Corp	63	193	32.6	IEEE	ACM	60	31.1
48 STMicroelectronics N.V.	62	112	55.4	IEEE	IEE	8	7.1
49 EMC Corp	58	253	22.9	IEEE	ACM	37	14.6
50 Science Applications Int'l	58	192	30.2	IEEE	ACM	35	18.2

Note: The Table Above Represents Data Collected From 1983-2003



For more information:
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www.ieee.org/patentcitations

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