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Attorneys for Samsung Electronics Co., Ltd.,
Samsung Electronics America, Inc., and Samsung
Telecommunications America LLC

UNITED STATES DISTRICT COURT

NORTHERN DISTRICT OF CALIFORNIA, SAN JOSE DIVISION

APPLE INC., a California corporation,

Plaintiff,

vs.

SAMSUNG ELECTRONICS CO., LTD., a Korean business entity; SAMSUNG ELECTRONICS AMERICA, INC., a New York corporation; SAMSUNG TELECOMMUNICATIONS AMERICA, LLC, a Delaware limited liability company,

Defendants.

CASE NO. 11-cv-01846-LHK

DECLARATION OF RICHARD WESEL IN SUPPORT OF SAMSUNG'S PROPOSED CLAIM CONSTRUCTION FOR U.S. PATENT NO. 7,200,792

Date: January 20, 2012
Time: 10:00 am
Courtroom 4, 5th Floor
Judge: Hon. Lucy H. Koh

02198.51855/4458776.1

I, Richard Wesel, declare:

1. I am a professor at the University of California, Los Angeles, in the field of Electrical Engineering, specializing in communications. I have been asked to provide an expert declaration on behalf of Samsung Electronics Co. Ltd., Samsung Electronics America, Inc., and Samsung Telecommunications America, LLC (collectively "Samsung") as to the meaning of the term "symbol" in claims 11 and 14 of U.S. Patent No. 7,200,792, as it would have been understood by persons of ordinary skill in the art at the time of the invention (on or around December 2001). If called upon as a witness, I could competently testify to the truth of each statement herein.

2. I am being compensated for my work in this matter at the rate of $450 per hour. My compensation does not depend in any way on the outcome of this investigation or the particular testimony or opinions I provide.

3. In preparing this declaration, I have considered my own experiences in the field, the items discussed herein, and the items listed below:

A. U.S. Patent No. 7,200,792 (" '792 patent").

B. U.S. Patent No. 7,200,792 prosecution history.

C. Declaration of Prof. Richard D. Gitlin in Support of Apple's Proposed Claim Construction for U.S. Patent No. 7,200,792, dated November 14, 2011 ("Gitlin Decl.").

D. Gitlin, Hayes and Weinstein, DATA COMMUNICATIONS PRINCIPLES, Kluwer Academic/Plenum Publishers (1992) ("Gitlin, et. al., DATA COMMUNICATIONS PRINCIPLES").

E. Apple's PLR 4-2 disclosure, dated Oct. 31, 2011, for the term "symbol," *i.e.,* Apple's PLR 4-2 disclosure at 12-17.

F. Samsung's PLR 4-2 disclosure, dated Oct. 31, 2011, for the term "symbol," *i.e.,* Samsung's PLR 4-2 disclosure, Exhibit A at 46.

4. I reserve the right to supplement or amend this declaration based on any new information received that is relevant to my opinions.

I. PROFESSIONAL BACKGROUND

5. I have a bachelor's and master's degrees in electrical engineering from the Massachusetts Institute of Technology and a doctorate in electrical engineering from Stanford University.

6. I am currently a Professor in the Electrical Engineering Department and Associate Dean of Academic and Student Affairs for the Henry Samueli School of Engineering and Applied Science (HSSEAS) at the University of California, Los Angeles.

7. I have been an electrical engineering professor at UCLA since 1996 teaching courses in error control coding and communication systems among other topics. I received the HSSEAS TRW Excellence in Teaching Award in 2000.

8. I have authored or co-authored over 130 conference and journal publications on communications and signal processing.

9. I have received the National Science Foundation CAREER Award and an Okawa Foundation Award for Excellence in Telecommunications Research.

10. Attached as Exhibit A is a copy of my curriculum vitae setting forth my qualifications and publications.

II. PERSON OF ORDINARY SKILL IN THE ART

11. I understand that to determine the ordinary and customary meaning of a claim term, one looks to the meaning that a person of ordinary skill in the art would have given the term at the time of the invention, which in this case is at least as early as December 2001. Based on my experiences and the materials I have reviewed, it is my opinion that one of ordinary skill in the field of the '792 patent is a person in the field of electrical engineering specializing in communications, with either a Bachelor's degree and approximately three years of experience or a Master's degree with approximately one year of experience.

III. MEANING OF "SYMBOL" – PLAIN AND ORDINARY MEANING

12. I have been asked to provide my opinion about the meaning of the word "symbol" as used in claims 11 and 14 of the '792 patent. I understand that the meaning of a term is considered in the context of the patent as a whole, including the claim language and the specification, as well as the patent's prosecution history – collectively described as intrinsic evidence. I also understand that claim construction may take into account extrinsic evidence, such as dictionaries and treatises; however, such evidence is considered less reliable than intrinsic evidence, and is examined in the context of the available intrinsic evidence.

13. I am informed and understand that district courts are not required to construe every limitation present in a patent's claim. In particular, a district court is not obligated to construe terms with ordinary meanings, lest trial courts be inundated with requests to parse the meaning of every word in the asserted claims. However, a determination that a claim term "needs no construction" or can be understood according to its "plain and ordinary meaning" may be inadequate when a term has more than one ordinary meaning or when reliance on a term's ordinary meaning does not resolve the parties' dispute.

14. The '792 patent is directed to the field of communications, specifically to data transmission in a communication system. In that field, "symbol" is such a ubiquitous and well-understood term in data communications that some data communications textbooks use it without any definition. *See* Gitlin, et. al., DATA COMMUNICATIONS PRINCIPLES. In my opinion, it would be immediately apparent to a person of ordinary skill in the art that the '792 patent uses "symbol" in a manner similar to other books, documents, and writings in the communications field. Thus, a person of ordinary skill in the art would recognize that Claims 11 and 14 of the '792 patent are properly understood using the plain and ordinary meaning of "symbol." Because "symbol" is being used in this ordinary and customary sense, no construction of this term is necessary.

15. The plain and ordinary meaning is clear in the context of data transmission and reception. In that context, "symbol" is widely understood to describe a modulated signal representing a number of bits of information. The signal is "modulated" in the sense that one or

more of its properties, such as phase, frequency, or amplitude, are altered to convey the information. The selected modulation technique specifies the number of bits that a symbol represents. Therefore, if the Court decides a construction of the term "symbol" is necessary, it should be given its plain and ordinary meaning: **"a modulated signal representing a number of bits specified according to the modulation technique."** Apple's and Samsung's proposed constructions are summarized in the table below.

Claim No.	Disputed Term	Apple's Proposed Construction	Samsung's Proposed Construction
11 and 14	"symbol"	"a modulated pattern in a sequence of such patterns that represents a plurality of bits"	Plain and ordinary meaning If the Court decides a construction is necessary: "a modulated signal representing a number of bits specified according to the modulation technique"

a.) <u>"a modulated signal" v. "a modulated pattern"</u>

1.) Intrinsic Evidence – "a modulated <u>signal</u>"

16. A "symbol" is a "modulated <u>signal</u>," and not a "modulated <u>pattern</u>." The language of the claims indicates that symbol is used in this plain and ordinary sense. Claims 11 and 14 both claim a "received symbol." In order for a "symbol" to be "received," it must have been transmitted by a source. The transmission and reception of a symbol indicate the "symbol" is a signal.

17. Moreover, Claims 11 and 14 include the language "demodulating a received symbol into a plurality of systematic bits and parity bits." The ordinary meaning of "demodulating" requires a demodulator to receive a modulated signal. The understanding of "symbol" in its ordinary sense as a "signal" is fully consistent with the use of "demodulating" in the claim language.

18. The specification further confirms that a "received symbol" refers to a "signal." Columns 21-24 of the specification teach the functionality of the receivers that is described in

Claims 11 and 14. Near the beginning of that section, entitled "Receiver According to Invention," the specification states, "Since a **received signal** is in the form of a **symbol modulated** by a modulator in the transmitter, **the received signal is first demodulated** by a demodulator and then provided to a deinterleaver." '792 patent at 21:48-51 (emphasis added). The specification describes a "received signal" as a "symbol" because "symbol" refers to a type of signal under its ordinary meaning.

19. Indeed, the phrase "received signal" in the specification is used in a parallel manner to the term "received symbol" in Claims 11 and 14. The specification language cited above (21:48-51) closely tracks the language of Claims 11 and 14. Both the specification and the claim language describe receiving information in the form of a signal/symbol, demodulating that information, and then deinterleaving that information. Thus, a person of ordinary skill in the art would have recognized that this specification language describes "symbol" as used in Claims 11 and 14. Below is a side-by-side comparison of the specification language and the claim language that highlights the parallel use of "signal" and "symbol" in the specification and the claims of the '792 patent.

'792 Patent, 21:48-51	Claim 11	Claim 14
"Since a **received signal** is in the form of a symbol modulated in the transmitter, the received signal is first **demodulated** by a demodulator and then provided to a **deinterleaver**."	"An apparatus for receiving data in a communication system comprising: a demodulator for **demodulating** a **received symbol** into a plurality of systematic bits and parity bits; a first **deinterleaver** …"	"A method for receiving data in a communication system, comprising: **demodulating** a **received symbol** into a plurality of systematic bits and parity bits; writing the plurality of systematic bits on a column by column basis in a first **deinterleaver**…"

2.) Extrinsic Evidence – "a modulated <u>signal</u>"

20. As mentioned above in ¶14, Dr. Gitlin's book does not even define "symbol," which is not surprising because "symbol" is a widely understood term. However, Dr. Gitlin implicitly uses "symbol" in its plain and ordinary sense to mean a "modulated signal," by using

"signal" and "symbol" interchangeably in his textbook. *See generally* Gitlin, et. al., DATA COMMUNICATIONS PRINCIPLES. For example, in Chapter 2 ("Theoretical Foundations of Digital Communications"), pages 72-78, Dr. Gitlin repeatedly alternates between "transmitted signal" and "transmitted symbol."[1] On the other hand, the book never uses the word "pattern" in this excerpt. Dr. Gitlin's own book confirms that in its plain and ordinary meaning, a symbol is a "modulated signal," and not a "modulated pattern."

21. Dr. Gitlin's declaration also acknowledges that the plain meaning of "symbol" refers to "signals." His declaration explains that Quadrature Amplitude Modulation is represented by a "signal constellation of symbols." Gitlin Decl. at ¶57. A signal constellation is a set of points in the two-dimensional plane. Each point represents a symbol. The magnitude and angle of each point identifies the symbol by specifying, respectively, the amplitude and phase of a sinusoidal signal. Thus in Dr. Gitlin's statement, "symbol" is used in its plain and ordinary sense to refer to a type of modulated signal. This usage is the same usage of "symbol" in the '792 patent, and is the same plain and ordinary usage of "symbol" by one of ordinary skill in the art.

3.) Apple's construction, "a modulated pattern," is incorrect

22. Apple's use of "modulated pattern" is incorrect, because "pattern," as used in the '792 patent, refers to a pattern of systematic and parity bits. These bits are then encoded by the mapper to produce a signal. Under the plain and ordinary meaning of "symbol" in the claims, a symbol may **represent** a pattern of systematic and parity bits, but a symbol itself is not a pattern. A symbol is a signal. The plain language of the claims does not suggest that a "symbol" is the same as a "pattern."

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[1] See, for example, page 75 where the book manipulates an equation regarding the probability of error. Equation (2.6b) presents a criterion for a decision rule governing when to "choose s_1 as the transmitted **symbol**." Equation (2.7b) presents the corresponding criterion for the case of a discrete observation space for a decision rule governing when to "choose s_1 as the transmitted **signal**." In both cases, $\mathbf{s}_1$ is being chosen as both the transmitted signal and the transmitted symbol.

23. The plain language of the claims is contrary to the idea that a "symbol" is a "pattern." In Claims 11 and 14, the received symbol is demodulated into "systematic bits and parity bits." Here, the demodulator is acting in an ordinary fashion to convert a received signal into bits. Only **after** demodulation does the system generate a "pattern" of bits. Thus, the plain language of the claims confirms that a "symbol" is not itself a "pattern."

24. The specification confirms that a "symbol" is distinct from a "pattern." It states, "if the size of the buffer (buffer size={the number of systematic bits}+{the number of parity bits}) is minimized, a **symbol pattern** for the 64QAM cannot be optimally mapped." '792 patent at 10:53-56. Here, "symbol pattern" describes the pattern of systematic and parity bits that will be mapped onto a symbol, and not the symbol itself. Thus, the specification further confirms that a "symbol" is not a "pattern." *See also id.* at 20:13 (describing "symbol pattern" as a pattern of bits in a modulator).

25. Similarly, the patent Abstract distinguishes "symbol" from the pattern of bits, stating, "A modulator alternatively collects the permutated bits on a column by column basis from the first and second interleavers, and maps collected bits from the first and second interleavers onto **one modulation symbol**." Again, a "symbol" may represent a pattern of bits, but the symbol is itself a modulated signal.

b.) <u>"representing a number of bits specified according to the modulation technique" v. "that represents a plurality of bits"</u>

26. Under plain and ordinary meaning, a symbol represents a number of bits specified according to the modulation technique. In customary usage, "symbol" encompasses a wide variety of modulated signals that represent various numbers of bits. The modulation scheme fixes the number of bits. For example, BPSK (Binary Phase-Shift Keying) uses only two distinct symbols, and each symbol represents a single bit. QPSK (Quadrature Phase-Shift Keying) uses 4 distinct symbols to represent 2 bits. 64QAM (64-ary Quadrature Amplitude Modulation) uses 64 distinct symbols to represent 6 bits. While the number of bits varies, the modulation technique

determines the number of bits that the symbol represents. This understanding is included in the plain and ordinary meaning of "symbol."

1.) Intrinsic Evidence - "representing a number of bits specified according to the modulation technique"

27. The '792 patent claims confirm that the number of bits is specified by the modulation technique. For instance, Claim 5 states, "[Claim 1], wherein if the modulation scheme is 16QAM (16-ary Quadrature Amplitude Modulation), mapping onto one modulation symbol 2 bits from the first interleaver and 2 bits from the second interleaver." *See also* '792 patent, Claim 10. Claims 5 and 10 implicitly acknowledge that the number of bits is specified according to the modulation technique. Systems using the 16QAM modulation technique produce symbols representing 4 bits (in this particular case, 2 each from the first and second interleaver). Again, a person of ordinary skill would be aware of this plain meaning.

28. The specification also explains that the number of bits represented by a symbol is specified by the modulation technique. For instance, it states, "The DEMUX demultiplexes as many input bits as a prescribed number according to a modulation technique…." '792 patent at 22:11-13, *see also id.* at 9:33-37 (describing that symbols are "commonly" mapped "according to … a modulation technique."). The specification provides specific examples of this relationship, such as: "if the modulation technique is 16QAM, 4 coded bits are mapped to one symbol." *Id.* at 13:49-53. The figures confirm that the number of bits is specified by the modulation technique, with 16QAM generating symbols representing 4 bits, and 64QAM generating symbols representing 6 bits.

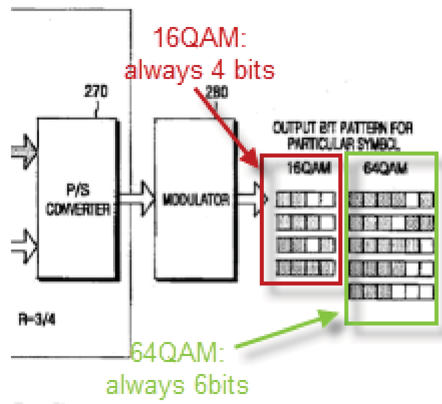

FIG.5

('792 patent, Fig. 5, annotations added)

29. The specification identifies other modulation techniques as well. The specification states, "The interleaved coded bits are subject to symbol mapping in a modulator **according to a modulation technique** of QPSK (Quadrature Phase Shift Keying), 8PSK (8-ary Phase Shift Keying), 16QAM (16-ary Quadrature Amplitude Modulation) or 64QAM." *Id.* at 2:40-44. Thus, the specification encompasses a wide range of symbols that are generated "according to a modulation technique." This relationship between the modulation technique and the number of bits represented by a symbol is basic, foundational knowledge for one of ordinary skill in the art.

2.) Extrinsic Evidence - "representing a number of bits specified according to the modulation technique"

30. Dr. Gitlin agrees that a "symbol" represents a number of bits specified according to the modulation technique. For example, Dr. Gitlin states, "in 16QAM, there are sixteen unique symbols and each symbol represents 4 bits." Gitlin Decl. at ¶58. Furthermore, "Some forms of modulation, e.g., binary phase-shift keying (BPSK), use only two distinct symbols and each symbol represents a single bit." Gitlin Decl. at ¶53. In both these examples, the number of bits is specified according to the modulation technique.

3.) Apple's construction, "that represents a plurality of bits" is incorrect

31. As discussed above in ¶¶27-30, a person of ordinary skill would know that the number of bits represented by a symbol varies according to the modulation technique used. Thus, a "symbol" might represent only one bit using the BPSK modulation technique, six bits using

64QAM, or some other number of bits. While the number of bits may vary, the number can be one and it is specified according to the modulation technique that is used. The plain and ordinary meaning of "symbol" encompasses signals generated by all these modulation techniques. Thus, no construction is needed.

32. Indeed, Dr. Gitlin himself acknowledges that "symbol" ordinarily refers to symbols that may represent only one bit. As he states, "Some forms of modulation, e.g., binary phase-shift keying (BPSK), use only two distinct symbols and each symbol represents a single bit. In other words, **one of ordinary skill in the field of the '792 patent would be aware of symbols that do not represent a plurality of bits**." Gitlin Decl. ¶53 (emphasis added).

33. Dr. Gitlin proceeds to argue that "symbol" as used in the '792 patent deviates from ordinary meaning because it refers only to signals with "a plurality of bits." *See* Gitlin Decl. ¶53. However, Dr. Gitlin's definition needlessly limits the meaning of "symbol" within the context of Claims 11 and 14. The term "symbol" need not be limited to symbols representing two or more bits; instead, Claims 11 and 14 themselves contain explicit limitations. Claim 11 reads, "… a demodulator for demodulating a received symbol into a **plurality** of systematic bits and parity bits." If "symbol" inherently meant signals representing "a plurality of bits," then the use of "plurality" in Claim 11 would be redundant. In other words, "symbol" is used according to its plain and ordinary meaning in Claims 11 and 14, while the claim itself contains explicit limitations with respect to "a plurality of systematic bits and parity bits."

C.) <u>"representing a number of bits specified according to the modulation technique" v. "in a sequence"</u>

1.) Intrinsic Evidence – "in a sequence" is incorrect

34. Apple's interpretation that a symbol must exist "in a sequence" is inconsistent with the plain and ordinary meaning of "symbol." While a symbol may appear in a sequence of symbols, it does not necessarily do so. A symbol can exist by itself. Although as a matter of practice, data communications systems nearly always transmit symbols in a sequence, there is no

reason to define "symbol" this way. As an analogy, a word normally appears in a sequence of words, as in a sentence or a paragraph. However, a word standing alone is still a word.

35. I agree with Dr. Gitlin when he says, "Digital communication systems of the type disclosed in the '792 patent communicate by transmitting a sequence of symbols." Gitlin Decl. at ¶58. As Dr. Gitlin states, "[I]n a communication system of the type disclosed in the '792 patent, any one symbol would be part of a larger sequence of symbols that carry the transmitted bits." *Id.* at ¶59. The specification clearly teaches that the deinterleaver described by Claims 11 and 14 respectively do operate on sequences of symbols, because the deinterleaving process only makes sense in the context of a sequence of symbols. However, I disagree that this aspect of the invention should be imported into the construction of the term "symbol."

2.) Extrinsic Evidence – "in a sequence" is incorrect

36. Dr. Gitlin's own hypothetical confirms that signals do not necessarily exist in a sequence. Dr. Gitlin states, "For example, in 16QAM, there are sixteen unique symbols and each symbol represents four bits. To transmit 40 bits, a 16QAM based system would need to transmit ten symbols (i.e. ten symbols of four bits each results in communicating forty bits)." Gitlin Declaration at ¶58. By extension, to transmit 4 bits, a 16QAM system would need to transmit **only one symbol**. Under Apple's definition, however, a symbol representing four bits, if isolated, would suddenly cease to be a "symbol" because it is by itself, and not "in a sequence." Such an interpretation defies ordinary common sense.

37. Moreover, Dr. Gitlin himself uses "symbol" to refer to a single bit that is not in a sequence of bits. *See* Gitlin, et. al., DATA COMMUNICATIONS PRINCIPLES at 72-78 (discussing the probability of error of a single symbol). Dr. Gitlin is simply using "symbol" in its plain and ordinary sense, which does not require a sequence of symbols.

38. Dr. Gitlin appears to be concerned about the ability to distinguish a single symbol from a sequence of symbols. *See* Gitlin Decl. ¶ 74. Specifically, Dr. Gitlin suggests that a sequence of symbols might incorrectly be construed as one giant "super-symbol" with many bits. However, Apple's proposed definition, requiring "a sequence" of symbols does not solve Dr.

Gitlin's concern. Under Apple's proposed construction, multiple symbols could still be combined into a "super-symbol" within a sequence of such "super-symbols." Thus, "in a sequence" is extraneous language that does not solve the alleged ambiguity identified by Dr. Gitlin in his declaration.

3.) Plain and ordinary meaning is correct

39. In contrast, Samsung's plain meaning definition, "representing a number of bits specified according to the modulation technique," addresses Dr. Gitlin's concern, because the length of a symbol is "specified according to the modulation technique." Modulation techniques are discussed in the '792 patent claims and specification, and these techniques would have been known by one of ordinary skill in the art. Dr. Gitlin raises an ambiguity that simply does not exist under the plain and ordinary meaning of "symbol." No construction of "symbol" is necessary to alter this plain meaning.

I declare under penalty of perjury under the laws of the United States of America that the foregoing is true and correct.

Executed on November 28, 2011, at Los Angeles, California.

Richard Wesel

EXHIBIT A

TO DECLARATION OF RICHARD WESEL IN SUPPORT OF SAMSUNG'S PROPOSED CLAIM CONSTRUCTION FOR U.S. PATENT NO. 7,200,792

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RICHARD DALE WESEL

EDUCATION

1991 – 1996 **Stanford University**, Stanford, CA
Ph.D. in Electrical Engineering
Dissertation: *Trellis Code Design for Correlated Fading and Achievable Rates for Tomlinson-Harashima Precoding.*

1984 – 1989 **Massachusetts Institute of Tech.**, Cambridge, MA
S. M. and S. B. in Electrical Engineering
Dissertation: *Adaptive Equalization for Modem Constellation Identification.*

EMPLOYMENT

1996 – present **University of California, Los Angeles**, Los Angeles, CA

Associate Dean of Academic and Student Affairs for the Henry Samueli School of Engineering and Applied Science since July 2007

Professor of Electrical Engineering since July 2006

Associate Professor of Electrical Engineering 2002-2006

Assistant Professor of Electrical Engineering 1996-2001

1992-present **Various Firms**, CA
Consultant to various firms including Xerox PARC, Elantec, Metricom, Townsend and Townsend and Crew, Clarity Wireless (now part of Cisco), Kyocera Wireless Corporation, Latham & Watkins, Aktino Corporation, Fulbright & Jaworski, McAndrews, Held, & Malloy, Weil Gotshcal & Manges, Kirkland & Ellis, Townsend and Townsend and Crew, Kilpatrick Townsend & Stockton.

1991 – 1996 **Stanford University**, Stanford, CA
Research Assistant and Teaching Assistant.

1989 – 1991 **AT&T Bell Laboratories**, Holmdel, NJ

Member of Technical Staff. 1989-1991. Also at AT&T as MTS during summer 1994 and an intern 1986-1989.

TEACHING RESPONSIBILITIES

Courses taught: EE131A Probability, EE132A Communications Systems, EE231A Information Theory, EE232A Stochastic Processes, and EE231E Channel Coding
Winner 2000 TRW Excellence in Teaching Award

AWARDS

- Selected for the National Academy of Engineering Frontiers of Engineering Program
- TRW Excellence in Teaching Award (UCLA School of Engineering)
- Okawa Foundation Award for Excellence in Telecomm. Research
- National Science Foundation CAREER Award
- AT&T Foundation Ph.D. Fellow.
- IEEE Senior Member, Tau Beta Pi MIT chapter president 1987-1988, Etta Kappa Nu, Sigma Xi, National Merit Scholar.

GRADUATED PH.D. STUDENTS

1. Christina Fragouli, Ph.D. Sept. 2000, Dissertation: *Turbo Code Design for High Spectral Efficiency,* 2000-2001 UCLA EE Dept**. Ph.D. Student of the Year Award.** FNS Assistant Professor at EPFL.
2. Christos Komninakis, Ph.D. Dec. 2000, Dissertation: *Joint Channel Estimation and Decoding for Wireless Channels*, AWR Corp., El Segundo, CA.
3. Xueting Liu, Ph.D. Dec. 2000, Dissertation: *Trellis Code Design for Periodic Erasures and Adaptive Coded, Modulation Schemes for Time-Varying Channels*, Nokia, San Diego, CA.
4. Wei Shi, Ph.D. Dec. 2000, Dissertation: *New Results in Wireless Communications*, Qualcomm, San Diego, CA.
5. Tom Sun, Ph.D. Dec. 2002, Dissertation: *Error Protection Techniques for Source and Channel Coding*, Qualcomm, San Diego, CA.
6. Chris Jones, Ph.D. Dec. 2003, Dissertation: *Constructions, applications, and implementations of low-density parity-check codes,* Jet Propulsion Laboratory, Pasadena, CA
7. Adina Matache, Ph. D. June 2004, Dissertation: *Coding Techniques for High Data Rates in Wireless Multiple-Input Multiple-Output Communications*, Marvell, San Jose, CA
8. Cenk Kose,Ph.D. Dec. 2004, Dissertation*: Universal trellis codes and concatenated trellis-coded modulations for the compound linear vector Gaussian channel,* Conexant, San Diego, CA
9. Aditya Ramamoorthy, June 2005, *Generalized ACE Codes and Theoretic Results in Network Coding*, Assistant Profesor at Iowa State University starting Fall 2006
10. Jun Shi, Ph.D. Sept. 2005, Dissertation: *Universal Channel Codes and Trellis State-Diagram Reduction*

11. Wen-Yen Weng, Ph.D. March 2007, Dissertation: *Universal Serially Concatenated Trellis Coded Modulations and Rate-Compatible High-Rate LDPC Codes*
12. Esteban Valles (Primary Advisor John Villasenor), Ph.D. March 2007, Dissertation: *Timing Recovery Using Soft Information Feedback and Efficiency of Array Codes*
13. Andres Vila Casado, Ph.D. December 2007, Dissertation: *Improving LDPC Decoders: Informed Dynamic Message-Passing Scheduling and Multiple-Rate Code Design*
14. Herwin Chan (Primary Advisor Ingrid Verbauwhede), Ph.D. December 2007, Dissertation: *Accelerating Applications Through Cross-Layer Co-Design*
15. Miguel Griot, Ph.D. Sept. 2008, Dissertation: *Nonlinear Codes for Multiple Access to Binary Channels and Higher-Order Modulations over the AWGN Channel*
16. Bike Xie, Ph.D. June 2010, Dissertation: *Encoding for Degraded Broadcast Channels and Resource Allocation for content Distribution in Peer-To-Peer Networks*

PROFESSIONAL ACTIVITIES

- **Associate Editor***, IEEE Transactions on Communications* 1999-2005.
- **Technical Program Committee Member,** regularly for *Globecom* and *ICC*.
- **Technical Program Chair**, *Communication Theory Symposium at Globecom 2002*.
- **Organizer and Session Chair** for Special Session on Concatenated codes and iterative decoding at the *2001 Asilomar Conf. on Signals, Systems, and Computers*.
- **Organizer and Session Chair** for Special Session on Communication over Time Varying Channels at the *1999 Asilomar Conf. on Signals, Systems, and Computers*.
- **Session Organizer and Chair** for Communication Theory Symposium at the 2001 International Conference on Communications.
- **Panel member** for three National Science Foundation Proposal Review Panels.
- **Organizer and lecturer** for UCLA Extension course on Error Control Coding (annually since 2000). Received an award for being among the top 10% of UCLA extension lecturers.
- **Instructor** for 1997 UCLA Extension course on wireless multimedia communications.
- **Invited speaker** 1998 and 2000 *IEEE Communication Theory Workshops*.
- **Invited speaker** Office of Naval Research, Naval Research Labs 1998 Turbo Codes Workshop.
- **Invited speaker** 1998 DARPA GloMo workshop on emerging technologies for hand-held wireless devices in military communication.
- **Invited speaker** at various universities and companies including Stanford, Berkeley, U.C. San Diego, the Ohio State University, University of Arizona, the Johns Hopkins University, Cornell, Telia Research, Lulea, Sweden, Lucent, Boeing, Xetron, Texas Instruments, Conexant, and Microsoft Research.
- **Reviewer** for various IEEE conferences and journals. Regularly reviewing submissions to Trans. on Information Theory, Trans. On Communications, Journal on Selected Areas of Communications, Communications Letters, Globecom, and International Conference on Communications, 1994-present.

ACADEMIC SERVICE

- **Member of the Executive Enrollment Management Group**
  October 2011-present
- **Member of the Undergraduate Non-Resident Implementation Task Force**
  August 2010 – July 2011
- **Member of UCLA Undergraduate Council** July 2006- July 2008.
- **Member of the Committee on Undergraduate Admissions and Relations with Schools** July 2006- July 2008
- **Electrical Engineering Department Vice Chair for Undergraduate Affairs** July 2005 – July 2007. Successfully managed the 2006 ABET Accreditation visit.
- **Member of the School of Engineering Faculty Executive Committee** 2003-2006.
- **Chair of the Electrical Engineering Department Courses and Curriculum Committee** 2003-2005.
- **Chair of the Communications Major Field** in the Electrical Engineering Department at the University of California, Los Angeles, 1999-2004.
- **Chair of the Cubicle Allocation Committee** for the Electrical Engineering Department at UCLA, managing the allocation of 150 student cubicles among approximately 20 professors who share this space, 1998-2005.
- **Chair of 2002 Annual Research Review** (annual departmental research symposium). Also Vice Chair of 2001 Annual Research Review.
- **Member of 2001 UCLA EE Annual Report Committee.**
- **Elected Member of the Legislative Assembly** of the UCLA Academic Senate, 1997-2001.
- **Chair for quarterly Seminar Series** in Signals and Systems. Established this seminar series in spring 1997. Recruit a professor each quarter to organize speakers for the series. Personally organized speakers for four of these quarters.
- **Local Exhibits Chair,** 1997 UCLA EE Research Symposium

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