Curriculum Vitae-Thomas Kailath

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Fields of Interest: Information Theory, Communication, Computation, Control, Linear Systems, Statistical Signal Processing, VLSI Systems, Semiconductor Manufacturing and Lithography, Probability, Statistics, Linear Algebra, Matrix and Operator Theory.

Born in Poona (now Pune), India, June 7, 1935.
In the US since 1957; naturalized: June 8, 1976

B.E. (Telecom.), College of Engineering, Pune, India, June 1956
S.M. (Elec. Eng.), Massachusetts Institute of Technology, June, 1959
Thesis: *Sampling Models for Time-Variant Filters*
Sc.D. (Elec. Eng.), Massachusetts Institute of Technology, June 1961
Thesis: *Communication via Randomly Varying Channels*

Positions

Sep 1957- Jun 1961 : Research Assistant, Research Laboratory for Electronics, MIT
Oct 1961- Dec 1962 : Communications Research Group, Jet Propulsion Labs, Pasadena, CA; also Visiting Asst. Professor at Caltech
Jan 1963- Aug 1964 : Acting Assoc. Prof. of Elec. Eng., Stanford University (on paid leave at UC Berkeley, Jan-Aug, 1963)
Sep 1964- Jan 1968 : Associate Professor of Elec. Eng.
Jan 1968- Feb 1968 : Full Professor of Elec. Eng.
Feb 1988- Jun 2001 : First holder of the Hitachi America Professorship in Engineering
July 2001- Present : Hitachi America Professorship in Engineering, Emeritus; recalled to active duty to continue his research and writing activities.

He has also held shorter-term appointments at several institutions around the world: UC Berkeley (1963), Indian Statistical Institute (1966), Bell Labs (1969), Indian Institute of Science (1969-70, 1976, 1993, 1994, 2000, 2002), Cambridge University (1977), K. U. Leuven (1977), T.U. Delft (1981), Weizmann Institute (1984), Imperial College (1989), MIT (1991), UCLA (2001),T. U. Munich(2003).

At Stanford, Kailath served as Director of the Information Systems Laboratory during a decade of rapid growth from 1971 to 1981, and built it into a world-leading center for communications, control and signal processing research.
He served on the Executive Committee of the department from 1971 to 1987 and as Associate Chair from 1981 to 1987. He was also twice elected to the Senate of the University.

Brief Research Summary

J.F. Gibbons, Stanford Dean of Engineering at Stanford from 1984-1998, wrote to Kailath at his 60th birthday conference in 1995:
"Your career has been an extraordinary success many times over, and for a different set of reasons each decade. I have never seen anything like it in over 40 years of service at Stanford."

Kailath's research during the 1960s led to prize-winning papers on an algorithm for exploiting the availability of noiseless feedback and major new results and techniques in signal-detection theory. In the 1970s, his work resulted in the influential textbook, Linear Systems (1980), and extensive contributions to estimation and control resulted in another major textbook, Linear Estimation (2000).

In the 1980s, his research groups focused on multiple antenna signal processing, the design of VLSI arrays for signal processing, and the development and application of the concept of displacement structure to the design of fast algorithms for many problems in engineering and mathematics.

In the 1990s, they made notable contributions to smart antenna technology for wireless communications and to resolution enhancement techniques for optical lithography in semiconductor manufacturing. Over this period, he also made well-recognized contributions to stochastic processes, operator theory, and linear algebra. Kailath appeared in the ISI (Institute of Scientific Information) list of Highly Cited Authors in the categories of Engineering, of Mathematics and of Computer Science.

Kailath's entry into different fields was aided by his success in attracting a brilliant array of nearly a hundred doctoral and postdoctoral students from around the world, about half of whom are already IEEE Fellows. About a third went to academia, others to industry (a dozen to Bell Labs alone), and several went on to found companies, about 20 already. Kailath himself joined them in four successful ventures.

The most recent Stanford Dean, James Plummer, is quoted in an article on Kailath's winning the IEEE Medal of Honor as saying: *"Many of us have met individuals who have made deep contributions in specific technical fields, or had a major impact on industry, or had a major impact on their academic discipline or educated the leaders of the future. Tom is essentially unique in that he has done all of these things at the very highest levels."*

A summary of Kailath's career is provided by the citation for his National Medal of Science:

"for transformative contributions to the fields of information and system science, for distinctive and sustained mentoring of young scholars, and of translation of scientific ideas into entrepreneurial ventures that have had a significant impact on industry."

Academy Memberships

US National Academy of Engineering, 1984: *"for contributions to prediction and filtering and for leadership in engineering."*

American Academy of Arts and Sciences, 1994

US National Academy of Sciences, 2000

TWAS (Academy of Sciences of the Developing World), 1991-Foreign Associate

Indian National Academy of Engineering, 1997- Foreign Associate

Royal Spanish Academy of Engineering, 2003- Foreign Member

National Academy of Sciences, India, 2009-Foreign Member

Royal Society of London, 2009-Foreign Member

Indian Academy of Sciences, 2013-Foreign Member

Indian National Science Academy, 2014-Foreign Member

Honorary Degrees

1990: Linköping University, Linköping, Sweden

1992: Strathclyde University, Glasgow, United Kingdom

1999: University of Carlos III, Madrid, Spain

2003: University of Bordeaux I, Bordeaux, France

2004: Shanghai Jiao Tung University, Shanghai, China (Honorary Professor)

2009: Visvesaraya Technological University, Bangalore, India

2011: Technion-The Israel Institute of Technology, Haifa, Israel

Major Fellowships

Guggenheim Fellowship: held at Indian Institute of Science, Bangalore, 1970

Churchill Fellowship: held at Cambridge University, 1977

Michael Visiting Chair in Mathematics, Weizmann Institute, Israel, 1984

Royal Society Guest Research Fellowship, Imperial College, London, 1989

Senior Vinton Hayes Fellowship: MIT, 1991

Senior Humboldt Fellowship: held at Technical University of Munich, 2003

Professional Society Fellowships

IEEE, 1970: *"for creative contributions to, and inspired teaching of, information, communication and control theory"*

Institute of Mathematical Statistics, 1975

SIAM (Society of Industrial and Applied Mathematics), 2009: *"for contributions to linear algebra, systems and control and their applications in engineering."*

IEEE Awards

IEEE Medal of Honor, 2007: "*for exceptional contributions to the development of powerful algorithms for communications, control, computing and signal processing*."

IEEE Jack S. Kilby Signal Processing Medal, 2006: "*for seminal contributions to the theory and applications of statistical signal processing*."

IEEE Education Medal, 1995: "*for leadership in graduate engineering education through a classic textbook in linear systems and creative interdisciplinary research*."

IEEE Information Theory Society: Claude Shannon Award, 2000*: "for consistent and profound contributions to Information Theory."*

IEEE Circuits and Systems Society Golden Jubilee Medal, 2000

IEEE Millennium Medal, 2000

IEEE Donald G. Fink Prize Paper Award, 1996: *for the survey paper "A state-space approach to adaptive filtering",* IEEE Signal Processing Magazine *11(3):*18-60, July 1995- the first such award for any IEEE Magazine paper.

IEEE Circuits and Systems Society: Education Award, 1993*: "for outstanding contributions to all facets of education in the fields of signal processing, linear system theory and VLSI design."*

IEEE Signal Processing Society: Society Award, 1990: *"for outstanding leadership and fundamental contributions to signal processing, including array processing and algorithms."*

IEEE Signal Processing Society: Technical Achievement Award, 1988: *"for contributions to a broad range of areas in signal processing including statistical spectral estimation, sensor array processing, and the design of VLSI array architectures."*

IEEE Information Theory Society: President, 1975. Leader of the IEEE delegation to the First IEEE-USSR Workshop in Information Theory, Moscow, Dec. 1975.

IEEE Fellow**,** 1970: *"for creative contributions to, and inspired teaching of, information, communication and control theory."*

Major Non-IEEE Awards

US National Medal of Science, 2012: *" for transformative contributions to the fields of information and system science, for distinctive and sustained mentoring of young scholars, and for translation of scientific ideas into entrepreneurial ventures that have had a significant impact on industry."*

Athanasios Papoulis Award, European Signal Processing Society, 2012:"*for outstanding lifelong contributions to signal processing research and teaching."*

Vladimir Karapetoff Outstanding Technical Achievement Award, IEEE Eta Kappa Nu Society, 2011: *"for outstanding research and teaching in the fields of telecommunications, information theory, signal processing, and linear systems."*

BBVA Foundation Frontiers of Knowledge Award, 2010: "*for contributions to creating knowledge with transformative impact on the information and communication technologies that permeate everyday life.*"

Padma Bhushan, 2009: third highest civilian honor of the Government of India: "*for distinguished service to the nation in the field of science and engineering.*"

Blaise Pascal Medal, European Academy of Sciences, 2009: *"for contributions to information and communication sciences.*"

College of Engineering, Pune: First inductee of the COEP Alumni Hall of Fame, 2009

Silicon Valley Engineering Hall of Fame, 2006

TiE (The Indus Entrepreneurs): Lifetime Achievement Award, 2005: *"In recognition of your extraordinary lifetime achievements and contribution to scientific knowledge and for inspiring generations of engineers, entrepreneurs and academic leaders."*

American University of Beirut, Lebanon, 2002: Distinguished Scholar Award

Inaugural Simon Stevin Medal and Lecture: *"Research Universities: Looking Before and After",* Delft University, the Netherlands, 1996

American Control Council: John R. Ragazzini Education Award, 1988: *"in recognition of outstanding contributions and distinguished leadership in automatic control education."*

Inst. of Electronics and Telecommunication Engineers, India: Honorary Fellow, 1986

National Federation of Asian Indian Organizations in the US: Engineering Achievement Award, 1986

Churchill College, Cambridge: Life Fellow, 1977-

AMS (American Mathematics Society) and SIAM: Centennial Lecturer in Applied Mathematics, 1988

J. Linear Algebra and its Applications, Distinguished Editors Board, 2001-

J. Integral Equations and Operator Theory, Honorary Editors Board, 2001-

Outstanding Paper Prizes

Outstanding Paper Prize for 1965-1966 of IEEE Information Theory Society

Outstanding Paper Prize for 1983 of IEEE Signal Processing Society

International Federation of Automatic Control (IFAC), Citation for Outstanding Contribution, 1987.

Golden Jubilee Paper Award, 1998 of IEEE Information Theory Society

Outstanding Paper Prize, IEEE Transactions on Semiconductor Manufacturing, 1993

Outstanding Paper Prize, European Signal Processing Society, 1994

Companies co-founded with students

In 1980: **Integrated Systems, Inc.**, pioneered software for computer-aided control systems design and later for embedded software. The company went public in 1990 and merged with Wind River Systems in 1999; acquired by Intel in 2009.

In 1995: Numerical Technologies, Inc., developed resolution enhancementtechnologies for sub-wavelength optical lithography, breaking the apparent 100nm barrier for optical lithography. It went public in April 2000; acquired by Synopsys, Inc., in 2003.

In 1998: Excess Bandwidth Corporation, chipset deisgn for DSL (Digital Subscriber Line) systems; acquired in 2003 by Virata (of Cambridge, UK).

In 2004: Clearshape Technologies, Inc., Design for Manufacturing (DFM) solutions for 65nm and 45nm chip designs; acquired by Cadence in 2007.

The Annual Kailath Lectures and Colloquia

In 2005, to celebrate his 70th birthday, several past students endowed an Annual Kailath Lecture and Colloquium-see http://isl.stanford.edu/kailathlecture. The lecturers so far have been:

2005: Prof. Robert Gallager, MIT

2006: Prof. Jacob Ziv, Technion

2007: Prof. David Forney, MIT

2008: Prof. Rudolf Kalman, ETH

2009: Dr. Andrew Viterbi, Viterbi Group

2010: Prof. Leonard Kleinrock, UCLA

2011: Dr Irwin Jacobs, Qualcomm

2012: Prof. Elwyn Berlekamp, UC Berkeley

2014: Prof. Donald Knuth, Stanford

2015: Prof. Stanley Osher, UCLA

2016: Prof. Christos Papadimitriou, UC Berkeley

Some Recent Named Lectures (not including numerous keynote and plenary invited addresses)

American Math Society/SIAM Centennial Lecture in Applied Mathematics, 1988*: A Century of Signal Processing*

Otto Toeplitz Memorial Lectures, Dept. of Mathematics, Tel Aviv University, Israel, 1980 and 1990

Issai Schur Memorial Lectures, Dept. of Mathematics, Tel Aviv University, Israel, 1990

Charles Edison Lecture, University of Notre Dame, 1991: *Do Real Engineers use Theory?*

Inaugural Simon Stevin Lecture, Technical University of Delft, The Netherlands, 1996: *Research Universities: Looking Before and After*.

25th Homi J. Bhabha Memorial Lecture, Institute of Electronics and Telecom Engineers, India, 2000: *Challenges in Telecommunications.*

Rustagi Memorial Lecture, Dept of Statistics, Ohio State University, 2001: *The Structure of Likelihood Ratios.*

Annual Linear Algebra and Applications Lecture, Dept of Mathematics, Univ. of Wisconsin, Madison, 2002: *Displacement Structure: Theory and Applications*.

Dean Lytle Endowed Lectures, University of Washington, Seattle, 2010

Prof. I. G. Sarma Memorial Lecture, Indian Inst. of Science, 2012: *From Wiener and Shannon to Fast Algorithms for Cell Phones.*

ICT Global Lecture Series, KAIST, Korea, 2014: *Displacement Structure of Matrices and some Applications (4 Lectures).*

IISc Centenary Lecture, 2015: *The Process of Making Breakthroughs in Engineering.*

Prof. P. V. Indiresan Memorial Lecture, IIT Delhi, 2016: *The Process of Research in Engineering.*

Inaugural Prof. WH Kwon lecture, Seoul National University, 2016

Distinguished Lecture, City University of Hong Kong, 2016

Prof. Jack Keil Wolf Memorial lecture, University of Pennsylvania, 2016

OTHER PROFESSIONAL ACTIVITIES

1963-2003: Editor, Prentice-Hall Series on Information Sciences & System

1967-1971: Communication Theory Technical Committee, IEEE Communications Society

1971-1977: Board of Governors, IEEE Control Systems Society

1972-1978: Board of Governors, IEEE Information Theory Society

1972-1980: IEEE Press Board

1975 : President, IEEE Information Theory Society

1982-1985: IEEE Honorary Member Awards Committee

1986-1988: Air Force Office of Scientific Research Mathematics Advisory Board

1987-1988: Office of Naval Research Electronics Review Panel

1988-1990: National Science Foundation, Advisory Board, Microelectronics Systems Program

1988-2001: Technical Advisory Panel, Hitachi America Ltd.

1990-1993: Peer Review Committee, National Academy of Engineering

1990-1995: VLSI Signal Processing Committee, IEEE Signal Processing Society

1990-1997: DARPA Defense Sciences Research Council

1993-1995: Chairman, Wiener Prize Committee, American Mathematical Society

2002 : Class Membership Committee, National Academy of Sciences

1962- : Service on numerous editorial boards of journals in engineering, mathematics and statistics.

1962- : Keynote and Plenary Lectures at numerous conferences

1962- : Consultant over the years to several industries, including: Melpar, Sylvania, Ampex, General Electric, Lincoln Labs, Bell Labs, Mobil, Rockwell, IBM, Lockheed, Hitachi.

1962- : Consultant to several universities and research centers - in India, Australia, Israel, Kuwait, Holland.

1970-1972: Consultant to the Government of India on troposcatter communications