

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 Theory, Mathematical Statistics, Linear Algebra, Matrix and Operator Theory.

Home page: www.stanford.edu/~tkailath

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. He also held a part-time teaching appointment at Caltech

Jan 1963- Aug 1964 : Acting Associate Professor of Elec. Eng., Stanford University (on 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-June 2001 : First holder of the Hitachi America Professorship in Engineering

July 2001- : 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.

His research and teaching at Stanford was remarkably wide-ranging.

J.F. Gibbons, Stanford Dean of Engineering at Stanford from 1984-1998, wrote of Kailath in 1995, "His career has been an extraordinary success many times over, and for a different set of reasons each decade".

His research during the 1960s led to prize-winning papers on an algorithm for exploiting the availability of noiseless feedback and new techniques in signal-detection theory. In the 1970s, his work resulted in the influential textbook, *Linear Systems* (1980), and major contributions to estimation and control resulted in another major textbook, *Linear Estimation* (2000). In the 1980s, his 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 design 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. It is noteworthy that Kailath appears 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, briefly noted later.

A nice summary of his career is provided by the current Stanford Dean, James Plummer, who 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."

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

Royal Society of London, 2009-Foreign Member

Royal Spanish Academy of Engineering, 2003- Foreign Member

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

Indian National Academy of Engineering, 1997- Foreign Member

National Academy of Sciences, India, 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

Academic Fellowships

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

Churchill Fellowship: held at Cambridge University, 1977

Churchill College, Cambridge: Life Fellow, 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: Fellow, 1970: *"for creative contributions to, and inspired teaching of, information, communication and control theory"*

Institute of Mathematical Statistics: Fellow, 1975

Inst. of Electronics and Telecommunication Engineers, India:

Honorary Fellow, 1986

SIAM (Society of Industrial and Applied Mathematics): Fellow, 2009:

"for contributions to linear algebra, systems and control and their applications in engineering."

Major Medals and Awards-IEEE

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

IEEE Information Theory Society: President, 1975. Led the IEEE delegation to the First IEEE-USSR Joint Workshop in Infm. Theory, Moscow, Dec.1975.

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

: 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 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 Circuits and Systems Society Golden Jubilee Medal, 2000

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

Major Medals and Awards-non IEEE

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

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

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

Silicon Valley Engineering Hall of Fame, 2006

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

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

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

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

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."*

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

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
Outstanding Paper Prize, IEEE Transactions on Semiconductor Manufacturing, 1993
Outstanding Paper Prize, European Signal Processing Society, 1994
IEEE Information Theory Society Golden Jubilee Paper Award, 1998.
International Federation of Automatic Control, Citation for Outstanding Contribution, 1987

Companies co-founded with students

In **1980** (well before it became a fashion): **Integrated Systems, Inc.**, a pioneer in software for computer-aided control. systems and later of 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., developing resolution enhancement technologies for sub-wavelength optical lithography. It went public in April 2000; acquired by Synopsys, Inc., in 2003.

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

In 2004: Clearshape Technologies, Inc., DFM (design for manufacturing) 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

2013: Prof. Elwyn Berlekamp, UC Berkeley

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*

Charles Edison Lecture, University of Notre Dame, USA, 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*.

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

OTHER PROFESSIONAL ACTIVITIES

1963-2000 : Editor, Prentice-Hall Series on Information Sciences & Systems

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