Universidad
Carlos III de Madrid

PROGRAM "AKADEMOS" (A)

HOMAGE

TO

PROF. THOMAS KAILATH

Dept. Teoría de la Señal y Comunicaciones
Universidad Carlos III de Madrid

With the cooperation of
Real Academia de Ingeniería
and
IEEE SP+COM Spain Chapter

and the sponsorship of
Cátedra Telefónica – UCIIIM
(Sección Sistemas de Ayuda a la Toma de Decisiones)

PRESENTATION

Prof. Thomas Kailath is an eminent researcher in Digital Signal Processing and Communications, as well as in many other related subjects. On the occasion of his 2009 BBVA Foundation "Frontiers of Knowledge" Award in the Information and Communication Technologies category, Program "Akademos" has prepared an homage that includes invited lectures by himself and other two friends and very relevant researchers, Prof. José M.F. Moura and Prof. H. Vincent Poor. New results in lines that were explored by Prof. Kailath will be presented, as well as relevant applications in the areas of cellular communications, large scale networks, security in data transmission, sensor networks, multimedia and small-world nets.

Date: Friday, June 25th, 2010

Place: Salón de Actos, Edificio Padre Soler
Campus de Leganés, UCIIIM
Avda. de la Universidad, 30 28911 Leganés

Program:

9:00 – 9:15 : Opening address

9:15 – 10:15 : From radiative transfer theory to fast algorithms – Prof. T. Kailath

10:15 – 10:45 : Coffee break

10:45 – 11:45 : Kalman filtering: Gossip and intermittency – Prof. J. M. F. Moura

11:45 - 12:45 : Information and inference in the wireless physical layer – Prof. H. V. Poor

Abstracts in next pages

Free entrance. **Confirmation required**

RSVP: mcal@tsc.uc3m.es

First Lecture

FROM RADIATIVE TRANSFER THEORY TO FAST ALGORITHMS FOR CELL PHONES

Prof. Thomas KAILATH
Stanford University

Abstract

We first describe how noticing analogies between studies of the Wiener-Hopf equation in the statistical theories of prediction and filtering and in the earlier researches of V.Ambartzumian and S. Chandrasekhar in radiative transfer theory led to fast implementations of the Kalman filter for constant parameter state space systems. Further exploration led to the concept of Displacement Structure and the development of fast algorithms (and efficient integrated circuit implementations thereof) for a host of problems in several fields, including communications, control, signal processing, linear algebra and operator theory.

Short biography

Thomas Kailath has been at Stanford University since 1963, where he is now Hitachi America Professor of Engineering, Emeritus. His research has ranged over several fields, including information theory, linear systems, estimation and control, signal processing, semiconductor manufacturing, probability and statistics, and matrix and operator theory. Major honors include the IEEE Education and Signal Processing Medals and the IEEE Medal of Honor, and several honorary degrees, including a Doctorate from University Carlos III, Madrid. He has been elected to the US National Academy of Engineering, the US National Academy of Sciences, the American Academy of Arts and Sciences, the Silicon Valley Engineering Hall of Fame, the Indian National Academy of Engineering and the Royal Spanish Academy of Engineering. His recent honors include a Padma Bhushan civilian award from the President of India, the Blaise Pascal Medal from the European Academy of Sciences, Foreign Membership of the Royal Society of London and the BBVA Frontiers of Knowledge Award for Information and Communication Technologies.

Second Lecture

KALMAN FILTERING: GOSSIP AND INTERMITTENCY [1]

Prof. José M. F. MOURA
Carnegie Mellon University

Abstract

In honoring Prof. Tom Kailath, it is fitting to return to a topic to which he so fundamentally contributed, namely, Kalman filtering. The year of 2010 also marks fifty years since the seminal March 1960 paper of Rudy Kalman. In this talk, we address some recent research results described in the PhD thesis of Soummya Kar (CMU, ECE, 2010). In particular, we describe the Gossip Interactive Kalman Filter (GIKF) that addresses three issues arising in estimation and inference in large scale networked systems: i) the distributed nature of the filter and of the underlying networked system; ii) the intermittency of the observations due for example to packet loss resulting from communication infrastructure failures; and iii) the random asynchronous nature, for example, gossip, of the underlying communications protocol. The GIKF associated Riccati equation is a random dynamical system (RDS). We characterize the asymptotic path properties of the GIKF and of the Riccati RDS: i) we establish the distributed detectability condition under which the distributed GIKF is equivalent to the centralized filter; ii) we show that the sample paths of the Riccati RDS converge in distribution to an invariant measure on the cone of positive definite matrices –this is the random equivalent of Kalman's asymptotic result that, under appropriate controllability and observability conditions, the Riccati equation converges to a fixed point–; and iii) we obtain a large deviation result that characterizes the optimal decay rate of the probability of rare events, i.e., events bounded away from the fixed point of the non random Riccati equation.

Short biography

José M. F. Moura is University Professor at Carnegie Mellon University (CMU) where he founded the Center for Sensed Critical Infrastructure Research and the Information and Communication Technologies Institute. He holds a D.Sc. in Electrical Engineering and Computer Science from the Massachusetts Institute of Technology (MIT). His interests are in algebraic and statistical signal/ image processing, with projects on distributed algorithms, large scale critical physical infrastructures, bioimaging and intelligent compilers for signal processing algorithms.

He was President of the IEEE Signal Processing Society, Editor in Chief for the IEEE Transactions on Signal Processing, and was on the Boards of the IEEE Proceedings and the ACM Sensors Journal. He is Fellow of the IEEE, Fellow of the AAAS, and corresponding member of the Academia das Ciências of Portugal. His awards include IEEE 3rd Millennium Medal, IEEE SPS Meritorious Service Award, IBM Faculty Award, CMU's College of Engineering Outstanding Research Award, CMU's Phillip Dowd Fellowship Award for excellence in Engineering Education.

[1] Work with Soummya Kar (CMU; starting July 1st, 2010, Princeton University)

Third Lecture

INFORMATION AND INFERENCE IN THE WIRELESS PHYSICAL LAYER

Prof. H. Vincent POOR
Princeton University

Abstract

Wireless networking applications continue to motivate challenging problems in information theory, signal processing, and other fields. A salient feature of wireless networks is the close interaction between the physical layer and the other networking layers. This phenomenon is a result of the principal distinguishing features of wireless, namely mobility and the importance of physical properties (diffusion, interference, fading and radio geometry) in determining link characteristics. For example, the applications layer interacts considerably with the physical layer, as is well known through the importance of quality-of-service in wireless network design. This talk will explore briefly four research areas, primarily involving information theoretic or inferential problems, each of which is motivated by an applications-layer issue. In particular, the four applications of file transfer, inference, real-time multimedia transmission, and social networking, will be used to motivate consideration of four respective research problems involving the physical layer: physical layer security in data networks, distributed inference in sensor networks, finite-blocklength capacity in multimedia networks, and connectivity in small-world networks. Recent progress in each of these four research areas will be reviewed.

Short biography

H. Vincent Poor is with Princeton University, where he is the Michael Henry Strater University Professor of Electrical Engineering and Dean of the School of Engineering and Applied Science. His current research interests are in the areas of stochastic analysis, statistical signal processing, and information theory, and their applications in wireless networking and related fields. His publications in these areas include the recent books MIMO Wireless Communications (Cambridge, 2007), Quickest Detection (Cambridge, 2009), and Information Theoretic Security (Now, 2009).

Dr. Poor is a Fellow of the IEEE, a member of the U. S. National Academy of Engineering, a Fellow of the American Academy of Arts & Sciences, and an International Fellow of the U. K. Royal Academy of Engineering. He has served as President of the IEEE Information Theory Society, as Editor-in-Chief of the IEEE Transactions on Information Theory, and as General Co-Chair of the 2009 IEEE International Symposium on Information Theory, held in Seoul, Korea. Recognition of his work includes the 2005 IEEE Education Medal, the 2007 Technical Achievement Award of the IEEE Signal Processing Society, and the 2009 Edwin Howard Armstrong Achievement Award of the IEEE Communications Society.