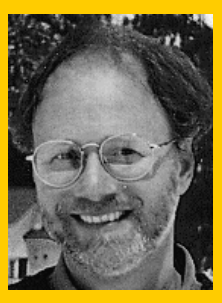
2007/08 IAM-PIMS-MITACS DISTINGUISHED COLLOQUIUM SERIES

The Institute of Applied Mathematics and the Pacific Institute for the Mathematical Sciences at the University of British Columbia, with support from The Mathematics of Information Technology and Complex Systems, are pleased to announce their Eleventh Annual Distinguished Colloquium Series. The talks are held on Monday or Wednesday afternoons in room 301 of the Leonard S. Klinck Building (6356 Agricultural Road, UBC). Refreshments are served in room 306 (IAM Lounge), about 15 minutes before the talks. Everyone is welcome to attend.



Howard Elman

Monday, 24 September 2007, 3:00-4:00 pm

HOWARD ELMAN – *Computer Science Department, University of Maryland at College Park*

Fast Iterative Solution of Models of Incompressible Flow

We discuss new efficient algorithms for computing the numerical solution of the incompressible Navier-Stokes equations. We show that preconditioning algorithms that take advantage of the structure of the linearized equations can be combined with Krylov subspace methods to produce algorithms that are optimal with respect to discretization mesh size, largely insensitive to Reynolds numbers, and easily adapted to handle both steady and evolutionary problems. We also show the relation between these approaches and traditional methods derived from operator splittings, and we demonstrate the performance of the new methods in some practical settings.

Richard G. Baraniuk

Monday, 14 January 2008, 3:00-4:00 pm

RICHARD G. BARANIUK – *Victor E. Cameron Professor of Electrical and Computer Engineering, Rice University*

Compressive Signal Processing

Sensors, signal processing hardware, and algorithms are under increasing pressure to accommodate larger and higher-dimensional data sets; faster capture, sampling, and processing rates; lower power consumption; communication over more difficult channels; and radically new sensing modalities. This talk overviews our recent research on "Compressive Sensing", an emerging field based on the revelation that a small number of linear projections of a compressible signal contain enough information for signal reconstruction and statistical signal processing. The implications of compressive sensing are promising for many applications and enable the design of new kinds of analog-to-digital converters, imaging systems and cameras, and radar systems.

Joseph Pedlosky

Monday, 25 February 2008, 3:00-4:00 pm

JOSEPH PEDLOSKY – *Department of Physical Oceanography, Woods Hole Oceanographic Institution*

Theories of the General Ocean Circulation

The general circulation of the ocean is a global phenomenon in which many geographically localized structures have long attracted scientific attention. This lecture will survey some of these and emphasize the connection between them. The connection between western boundary currents, such as the Gulf Stream, and the oceanic interior circulation will be discussed. The vertical density structure of the broad interior of the ocean, the thermocline, will be shown to be connected to the equatorial current system, in particular the Equatorial Undercurrent (EUC). The possibility that the strength of the global meridional overturning circulation (MOC), so important to the climate system, is related to the detailed boundary layer structure joining the base of the thermocline to the abyssal ocean will be reviewed.

Howard A. Stone

Monday, 10 March 2008, 3:00-4:00 pm

HOWARD A. STONE – *Vicky Joseph Professor of Engineering and Applied Mathematics, Harvard University*

Manipulating Thin-Film Flows: From Patterned Substrates to Evaporating Systems

Here we describe two variants of thin-film flows, one involving wetting and the other involving evaporation. First, we describe the spreading of mostly wetting liquid droplets on surfaces decorated with assemblies of micron-size cylindrical posts arranged in regular arrays. We obtain a variety of deterministic final shapes of the spreading droplets, including octagons, squares, hexagons and circles. Dynamic considerations provide a "shape" diagram and suggest rules for control. Second, we consider evaporation of volatile liquid drops. Using experiments and theory we show how the sense of the internal circulation depends on the ratio of the liquid and substrate conductivities and how it controls the deposition patterns.

Boris N. Kholodenko

Monday, 31 March 2008, 3:00-4:00 pm

BORIS N. KHOLODENKO – *Department of Pathology, Anatomy, and Cell Biology; Jefferson Medical College, Thomas Jefferson University*

Cell Signalling Dynamics in Time and Space

The specificity of cellular responses to receptor stimulation is encoded by the spatial and temporal dynamics of downstream signalling networks. Computational models provide insights into the intricate relationships between stimuli and responses and reveal mechanisms that enable networks to amplify signals, reduce noise and generate discontinuous bistable dynamics or oscillations. These temporal dynamics are coupled to precipitous spatial gradients of signalling activities, which guide pivotal intracellular processes. Trafficking of endosomes and kinase-scaffold complexes driven by molecular motors propagate signals from the plasma membrane to the nucleus. Rapid survival signals in neurons might be transmitted by waves of protein modification.

Yasumasa Nishiura

Monday, 07 April 2008, 3:00-4:00 pm

YASUMASA NISHIURA – *Laboratory of Nonlinear Studies and Computation, Research Institute for Electronic Science, Hokkaido University*

Particle Patterns in Dissipative Systems

Particle patterns mean any spatially localized structures sustained by the balance between inflow and outflow of energy/material, which arise in the form of chemical blobs, discharge patterns, morphological spots, or binary convection cells. These patterns are typically modeled by three-component reaction-diffusion systems or a couple of complex Ginzburg-Landau equations with a concentration field. The particles collide with each other, interact with defects and experience large deformation and/or basin-switching of dynamics in the form of merging, annihilation, rebound, and pinning to the defect created by heterogeneities. A new viewpoint based on a network of hidden saddles is presented to reveal the skeletal structure of such complex transient dynamics.

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