

OS2: Geometric and probabilistic methods in flow dynamics

Organizer: Shane Ross (Virginia Tech, USA)

Several geometric and probabilistic methods for studying flow dynamics have been developed and fruitfully applied to diverse areas from orbital mechanics and geophysical flows to biomechanics and even beyond to non-mechanical systems, such as financial, psychological, or population dynamics. Many systems can be modeled as having an underlying skeleton of the flow in an abstract, perhaps high dimensional, space which organizes how all possible behaviors are related. For systems known analytically with simple time dependence, this skeleton consists of well-known mathematical structures such as invariant sets and sets which asymptotically approach or depart from such sets. Increasingly though, systems of interest are determined not by analytically defined model systems, but by data from experiments or large-scale simulations. This emphasis on real-world systems sharpens our focus on those features of flow dynamics in finite-time systems which seem to be robust, leading to the consideration of not only invariant manifolds and invariant manifold-like objects, but also their connection with concepts such as symbolic dynamics, braids, and almost-invariant sets.

The list of confirmed speakers is:

George Haller, McGill Univ, Canada
Susumu Goto, Osaka Univ, Japan
Ana Mancho, Instituto de Ciencias Matemáticas, Spain
Ronald Peikert, ETH Zurich, Switzerland
Takashi Sakajo, Hokkaido Univ, Japan
Gary Froyland, Univ. of New South Wales, Australia
Irina Rypina, Woods Hole, USA
Tomohiro Yanao, Waseda Univ, Japan
Kevin Mitchell, UC Merced, USA
John Mahoney, UC Merced, USA
Kayo Ide, Univ. of Maryland, USA
Shane Ross, Virginia Tech, USA
Scott Kelly, UNC, Charlotte, USA
Lennaert van Veen, Univ. of Ontario Inst. of Tech., Canada
Makoto Iima, Hiroshima Univ, Japan
Guy Metcalge, CSIRO, Australia
Piyush Grover, Mitsubishi Elec. Res. Lab, USA/Japan
Marko Budisic, UC Santa Barbara, USA

We have 19 speakers representing 4 continents.

OS2: Geometric and Probabilistic Methods in Flow Dynamics

SEIUN (THURSDAY)

September 20, 2012

- OS2-1
10:40-11:40 **Geodesic Theory of Transport Barriers in Two-Dimensional Flows (*Invited*)**
George Haller (McGill University, Canada), Francisco J. Beron-Vera (University of Miami, USA)
- OS2-2
11:40-12:10 **Ridge Surface Methods for the Visualization of Lagrangian Coherent Structures**
Ronald Peikert, Benjamin Schindler and Robert Carnecky (ETH Zurich, Switzerland)
- OS2-3
13:10-13:40 **An Analytic Framework for Finite-time Coherent Sets in Time-dependent Flows**
Gary Froyland (University of New South Wales, Australia)
- OS2-4
13:40-14:10 **Topological Chaos and Braiding of Almost-cyclic Sets**
Piyush Grover (Mitsubishi Electric Research Laboratories, USA), Shane D. Ross, Mark Stremler and Pankaj Kumar
- OS2-5
14:10-14:40 **Identifying Coherence in Flows using Lagrangian Averages**
Marko Budisic, Igor Mezic (University of California - Santa Barbara, USA)
- OS2-6
14:50-15:20 **Lagrangian Data Assimilation in Geophysical Flows**
Kayo Ide (University of Maryland, USA)
- OS2-7
15:20-15:50 **On the Performance of Lagrangian Descriptors in 2D and 3D Flows**
Ana M Mancho (CSIC, Spain), Jazabel Curbelo (CSIC, Spain / Universidad Autónoma de Madrid, Spain), Stephen Wiggins (University of Bristol, UK) and Carolina Mendoza (Universidad Politécnica de Madrid, Spain)
- OS2-8
15:50-16:20 **Short-term Dispersal of Fukushima-derived Radionuclides Off Japan: Modeling Efforts and Model-data Intercomparison**
Irina I. Rypina (Woods Hole Oceanographic Institution, USA), Steven R. Jayne, Ken O. Buesseler, Sashiko Yoshida, Elizabeth M. Douglass, Alison M. Macdonald
- OS2-9
16:30-17:00 **Bifurcation Structures in Flapping Flight Problems**
Makoto Iima (Hiroshima University, Japan)
- OS2-10
17:00-17:30 **Symmetries and Constraints in Aquatic Propulsion via Vortex Shedding** Scott David Kelly, Phanindra Tallapragada (University of North Carolina at Charlotte, USA)
- 17:30-17:45 Discussion

SEIUN (FRIDAY)

September 21, 2012

- OS2-11 **Atmospheric Coherent Structures and Biological Invasions**
9:00-9:30 Shane Ross, David G. Schmale III, Binbin Lin, Amir E. BozorgMagham,
Aaron J. Prussin II, Shibabrat Naik (Virginia Tech, USA), Phanindra
Tallapragada (University of North Carolina at Charlotte, USA)
- OS2-12 **Invariant Manifolds and the Geometry of Front Propagation in**
9:30-10:00 **Fluid Flows**
Kevin Mitchell, John Mahoney (University of California, USA), Tom
Solomon (Bucknell University, USA)
- OS2-13 **Classification of Streamline Topologies for Structurally Stable**
10:00-10:30 **Vortex Flows in Multiply Connected Domains**
Takashi Sakajo, Tomoo Yokoyama (Hokkaido University, Japan / JST
CREST, Japan)
- OS2-14 **Tubes, Bubbles and Flux: Scalar Transport Around Coherent**
10:40-11:10 **Structures in Laminar Flow**
Guy Metcalfe (CSIRO, Australia)
- OS2-15 **Global Bifurcations and the Onset of Turbulence in Shear Flows**
11:10-11:40 Lennaert van Veen (University of Ontario Institute of Technology,
Canada), Genta Kawahara (Osaka University, Japan)
- OS2-16 **Intramolecular Energy Flow and the Mechanisms for Collective**
11:40-12:10 **Motions of Complex Molecular Systems**
Tomohiro Yanao (Waseda University, Japan), Yurie Oka (Waseda
University, Japan) and Wang Sang Koon (California Institute of
Technology, USA)
- OS2-17 **Coherent Structures in Homogeneous Turbulence Sustained by**
13:10-13:40 **Steady Force**
Susumu Goto, Genta Kawahara and Tatsuya Yasuda (Osaka University,
Japan)
- OS2-18 **Lobe Dynamics for Propagating Fronts in Fluid Flows**
13:40-14:10 John Mahoney, Kevin Mitchell (University of California, USA)
- 14:10-14:25 Discussion