Curriculum Vitae

October 18, 2007.

Name: IGOR MEZIĆ

Positions held:

- *July 1995 - present:* Assistant Professor, Associate Professor and Professor,
  Department of Mechanical Engineering and Department of Mathematics
  University of California, Santa Barbara, USA.
- *January 2000 - August 2001*: Associate Professor,
  Division of Engineering and Applied Science, Harvard University, Cambridge, USA.
- *June 1994 - June 1995*: Postdoctoral Research Fellow,
  Mathematics Institute, University of Warwick, UK.

Education:

- Ph.D. in *Applied Mechanics*, California Institute of Technology, Pasadena, CA, USA. (1994).
  Thesis advisor: Professor Stephen Wiggins.
  Thesis: "On Geometrical and Statistical Properties of Dynamical Systems: Theory and Applications"
  .
- Dipl. Ing. in *Mechanical Engineering*, Technical School of Rijeka (TSR), University of Rijeka, Croatia. (1990) Thesis advisors: Professor Luka Sopta and Professor Zoran Mrša.
  Senior Thesis: "On Numerical Solution of Viscous Fluid Flow Using the Finite Elements Method".

Selected honors and awards:

- National Science Foundation CAREER Award for research on *"Nonlinear Dynamics and Control from Microscale to Macroscale"* (1999).
- Sloan Fellowship in *Mathematics* (1999).
- Axelby Outstanding Paper Award (IEEE Transactions on Automatic Control) for the paper on *"Control of Mixing: a Maximum Entropy Approach"* (2000).
- Invited Plenary Lecturer, *Dynamics Days Europe,* Palma de Mallorca, Spain (2003).
- Invited Plenary Lecturer, *SIAM Control Theory Meeting*, New Orleans, USA (2005).
- Invited Plenary Lecturer, *The Second International Conference on Dynamics,Vibration and Control,* Beijing, China (2006).
- Opening Lecturer, *First Lab on a Chip World Congress,* Edinburgh, Scotland (2007).
- United Technologies Senior Vice President's Special Award (2007)

Current research interests:

- Science and technology of energy efficiency dynamics; including building systems, micropower generation and power grids.
- Mixing and separation in fluids across the scales with applications ranging from microfluidic phenomena to oceanographic flows.
- Nano and micro-scale particle dynamics induced by dielectrophoresis and other electrokinetic phenomena, with applications to biotechnology.
- Dynamical systems theory of complex systems, including large-scale networked systems.

Journal articles:

1. I. Mezić and S. Wiggins, "On the integrability and perturbations of three-dimensional fluid flows with symmetry". *Journal of Nonlinear Science* **4**, 157-194 (1994).
2. I. Mezić and S. Wiggins, "On the dynamical origin of asymptotic t^2 dispersion of a non-diffusive tracer in incompressible laminar flows". *Physics of Fluids*, **6**, 2227-2229 (1994).
3. I. Mezić and S. Wiggins, "Nonergodicity, accelerator modes, and asymptotic quadratic-in-time diffusion in a class of volume-preserving maps". *Physical Review E*, **52**, 3215-3217 (1995).
4. I. Mezić, J. F. Brady and S. Wiggins,"Maximal effective diffusivity for time periodic incompressible fluid flows". *SIAM Journal of Applied Mathematics*, **56**, 40-56 (1996).
5. I. Min, I. Mezić and A. Leonard, "Lévy stable distributions for velocity and velocity difference in systems of vortex elements". *Physics of Fluids*, **8**, 1169-1180 (1996).
6. I. Mezić, "FKG inequalities in cellular automata and coupled map lattices." *Physica D*, **103**, 491-504 (1997).
7. M.J. Keeling, I. Mezić, R. Hendry, J. McGlade, and D.A. Rand, "Characteristic length scales of spatial models in ecology via fluctuation analysis". *Philosophical Transactions of the Royal Society*, **B 352**, 1589-1601 (1997).
8. G. Haller and I. Mezić, "Reduction of three-dimensional, volume-preserving flows with symmetry". *Nonlinearity*, **11**, 319-339 (1998).
9. I. Mezić, A. Leonard and S. Wiggins, "Regular and chaotic particle motion near a helical vortex filament". *Physica D*, **111**, 179-201 (1998).
10. A.N. Yannacopoulos, I. Mezić, G. Rowlands, and G.P. King, "Eulerian diagnostics for lagrangian chaos in three dimensional Navier-Stokes flows". *Physical Review E*, **57**, 482-490 (1998).
11. M.A. Bees, I. Mezić and J. McGlade, "Planktonic interactions and chaotic advection in Langmuir circulations". *Mathematics and Computers in Simulation*, Vol. **44**, 527-544 (1998).
12. A. Majumdar and I. Mezić, "Stability regimes of thin liquid films". *Microscale Thermophysical Engineering*, **2**, 203-213 (1998).
13. N. Malhotra, I. Mezić and S. Wiggins, "Patchiness: A new diagnostic for Lagrangian trajectory analysis in fluid flows". *Journal of Bifurcations and Chaos*, **8**, 1053-1094 (1998).

14. I. Mezić and S. Wiggins, "A method for visualization of invariant sets of dynamical systems based on ergodic partition". *Chaos*, **9**, 213-218 (1999).

15. I. Mezić and S. Wiggins, "Residence-time distributions for chaotic flows in pipes". *Chaos*, **9**, 173-182 (1999).

16. A. Banaszuk, H. A. Hauksson and I. Mezić, "A backstepping controller for a nonlinear partial differential equation model of compression system instabilities". *SIAM Journal on Control and Optimization*, **37**, 1503-1537 (1999).

17. A.C. Poje, G. Haller and I. Mezić, "The geometry and statistics of mixing in aperiodic flows". *Physics of Fluids*, **11**, 2963-2968 (1999).

18. D. D'Alessandro, M. Dahleh and I. Mezić, "Control of mixing in fluid flows: a maximum entropy approach". *IEEE Transactions on Automatic Control,* **44**, 1852-1864 (1999).

19. M. Ashhab, M.V. Salapaka, M. Dahleh and I Mezić, "Dynamical analysis and control of micro-cantilevers". *Automatica*, **35**, 1663-1670 (1999).

20. M. Ashhab, M.V. Salapaka, M. Dahleh and I Mezić, "Melnikov-based dynamical analysis of microcantilevers in scanning probe microscopy". *Journal of Nonlinear Dynamics*, **20**, 197-220 (1999).

21. A. Majumdar and I. Mezić, "Instability of ultra-thin water films and the mechanism of droplet formation on hydrophilic surfaces," *Journal of Heat Transfer -Transactions ASME*, **121**, 964-971 (1999).

22. M. Basso, L. Giarre, M. Dahleh, I. Mezić "Complex dynamics in a harmonically excited Lennard-Jones oscillator: Microcantilever-sample interaction in scanning probe microscopes". *Journal of Dynamical Systems-Transactions ASME*, **122**, 240-245 (2000).

23. G.O. Fountain, D.V. Khakhar, I. Mezic, and J.M. Ottino, "Chaotic mixing in a bounded three-dimensional flow". *Journal of Fluid Mechanics*, **417**, 265-301 (2000).

24. I. Mezić, "Chaotic advection in three-dimensional bounded Navier-Stokes flows". *Journal of Fluid Mechanics*, **431**, 347-370 (2001).

25. V. Salapaka, M. Dahleh and I Mezić, "On the dynamics of a harmonic oscillator undergoing impacts with a vibrating platform". *Journal of Nonlinear Dynamics*, **24**, 333-358 (2001).

26. I. Mezić, "Break-up of invariant surfaces in action-angle-angle maps and flows". *Physica D*, **154**, 51-67 (2001).

27. D. D'Alessandro, I. Mezić and M. Dahleh, "Statistical properties of controlled fluid flows with applications to control of mixing". *Systems and Control Letters*, **45,** 249-256 (2002).

28. I. Mezić and F. Sotiropoulos, "Ergodic Theory and Experimental Visualization of Chaos", *Physics of Fluids*, **14**, 2235-2243 (2002).

29. A. D. Stroock, S. K. W. Dertinger, A. Ajdari, I. Mezić, H. A. Stone, G. M. Whitesides, "Chaotic mixer for microchannels". *Science*, **295**, 647-651 (2002).

30. P. K. Newton and I. Mezić, "Non-equilibrium statistical mechanics for a vortex gas". *Journal of Turbulence*, **3**, Article number 052 (2002).

31. I. Mezić, "An extension of Prandtl-Batchelor theory and consequences for chaotic advection". *Physics of Fluids*, **14**, 61-64 (2002).

32. A. X. C. N Valente, N. H. McClamroch and I. Mezić, "Hybrid dynamics of two coupled oscillators that can impact a fixed stop". *International Journal of Nonlinear Mechanics*, **38**, 677-689 (2003).

33. G. Hagen and I. Mezić, "Spillover stabilization in finite-dimensional control and observer design for dissipative evolution equations". *SIAM Journal on Control and Optimization*, **42**, 746-768 (2003).

34. I. Mezić, "Controllability, integrability and ergodicity". *Lecture Notes in Control and Information Sciences*, **289**, 213-229 (2003).

35. S. Balasuriya, I. Mezić and C. K. R. T. Jones, "Weak finite-time Melnikov theory and 3D viscous perturbations of Euler flows". *Physica D*, **176**, 82-106 (2003).

36. T. H. Solomon and I. Mezić "Uniform, resonant chaotic mixing in fluid flows". *Nature*, **425**, 376-380 (2003).

37. G. Hagen I. Mezić and B. Bamieh "Distributed control design for parabolic evolution equations: Application to compressor stall control, ". *IEEE Transactions on Automatic Control*, **49**, 1247-1258 (2004).

38. I. Mezić and A. Banaszuk "Comparison of systems with complex behavior". *Physica D*, **197**, 101-133 (2004).

39. D. E. Chang, S. Loire and I. Mezić "Closed-form solutions in the electrical field analysis for dielectrophoretic and travelling wave inter-digitated electrode arrays". *Journal of Physics D-Applied Physics*, **36**, 3073-3078 (2004).

40. U. Vaidya and I. Mezić "Controllability for a class of area-preserving twist maps". *Physica D*, **189**, 234-246 (2004).

41. D. Vainchtein and I. Mezić "Optimal control of a co-rotating vortex pair: averaging and impulsive control". *Physica D*, **192**, 63-82 (2004).

42. F. Bottausci, I. Mezić, C. Cardonne and C. Meinhart "Mixing in the shear superposition micromixer: three-dimensional analysis". *Philosophical Transactions of the Royal Society: Mathematical, Physical and Engineering Sciences theme issue 'Transport and mixing at the microscale'*, **362**, 1001-1018 (2004).

43. D. Vainchtein and I. Mezić "Capture into resonance: A method for efficient control,". *Physical Review Letters*, **93**, Art. No. 084301 (2004).

44. B. R. Noack, I. Mezić, G. Tadmor and A. Banaszuk "Optimal mixing in recirculation zones". *Physics of Fluids*, **16**, 867-888 (2004).

45. S. D, Muller, I. Mezić, J. H. Walther and P. Koumoutsakos "Transverse momentum micromixer optimization with evolution strategies,". *Computers and Fluids*, **33**, 521-531 (2004).

46. I. Mezić "Spectral properties of dynamical systems, model reduction and decompositions". *Nonlinear Dynamics*, **41**, 309-325 (2005).

47. G. Mathew, I. Mezić and L. Petzold "A Multiscale Measure for Mixing". *Physica D*, **41**, 23-46 (2005).

48. I. Tuval, I. Mezić, F. Bottausci, Y. T. Zhang, N. C. MacDonald and O. Piro "Control of particles in microelectrode devices". *Physical Review Letters*, **95**, 236002 (2005).

49. I. Mezić, "On the dynamics of molecular conformation ". *Proceedings of the National Academy of Sciences of the USA*, **103**, 7542-7547 (2006).

50. D. Vainchtein and I. Mezić "Vortex-based control algorithms,". *Lecture Notes in Control and Information Sciences* , **330**, 189-212 (2006).

51. D. Vainchtein, A. I. Neishtadt and I. Mezić "Resonances and Mixing in Stokes Flows ,". *Chaos*, **16**, Art. No. 043123 (2006).

52. D. M. Gorman, J. Mezić, I. Mezić and P. J. Gruenewald "Agent-based modeling of drinking behavior: A preliminary model and potential applications to theory and practice." *American Journal of Public Health*, **96**, 2055-2060 (2006).

53. F. Bottausci, C. Cardonne, C. Meinhart and I. Mezić " An ultrashort mixing length micromixer,". *Lab on a Chip*, **7**, 396-398 (2007).

54. G. Mathew, I. Mezić, S. Grivopoulos, U. Vaidya and L. Petzold "Optimal control of mixing in Stokes fluid flows". *Journal of Fluid Mechanics*, **580**, 261-281 (2007).

Books:

- "Normally Hyperbolic Invariant Manifolds in Dynamical Systems" (with S. Wiggins and G. Haller) Springer-Verlag, New York (1994).
- "Control of Fluid Flow" (Editor, with P. Koumoutsakos) Springer-Verlag, New York (2006).

Professional activities:

Conference/Workshop/minisymposium organizer:

- Minisymposium: "Uncertainty Propagation in Large-scale Networked Dynamical Systems", at the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah, (2007).
- Workshop: "Coupled Nonlinear Oscillators and Applications in Nanosystems", Santa Barbara, CA, (with T. Hikihara, Kyoto University) 2007.
- A semester program in Dynamical Systems, Spring 2007, Mathematical Sciences Research Institute, Berkeley, CA. (with C. K. R. T. Jones (University of North Carolina), L.-S. Young (Courant Institute), A. Stewart (Warwick University) and J. Mattingley (Duke University)).
- Summer School and Workshop Analysis and Control of Mixing with an Application to Micro and Macro Flow Processes Sponsored by Marie Curie Program - EUA4X, CISM, Udine, Italy (with L. Cortelezzi, McGill University) (2005).
- Minisymposium: "Control of Hamiltonian Systems", at the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah (with J. Meiss (University of Colorado)), (2005).

- Invited Session: "Uncertainty Propagation - Theory and Tools", at the Conference on Decision and Control (with T. Kalmar-Nagy (United Technologies Research Center)), (2004).
- Pre-nominated session on Chaos in Fluid and Solid Mechanics, XXI International Congress of Theoretical and Applied Mechanics, Warsaw, Poland (session chair with G. Rega, Rome), (2004).
- Two Workshops on Uncertainty Analysis in the Design of Dynamical Systems, at CIMMS, Caltech and United Technologies Research Center (UTRC), Hartford, CT (with J. E. Marsden (Caltech), M. Myers (UTRC) and A. Banaszuk (UTRC)), (2003/2004).
- Minisymposium: "Transport by Chaotic Advection in Three Dimensional Flows and Maps", at the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah (with J. Meiss (University of Colorado)), (2003).
- Minisymposium: "Dimensional Reduction for Nonlinear Systems" , at the SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah (with R. Kupferman (University of California, Berkeley)), (2003).
- The First International Symposium on Turbulence and Shear Flow Phenomena (Member of the Executive Committee) (1999).
- Workshop on Dynamical Systems and Statistical Mechanics Methods for Coherent Structures in Turbulent Flows (with M. Farge, ENS, Paris) (1997).

Journal Editorial Boards:

- Physica D (2001-) Editor.
- Dynamics and Stability of Systems (2000-2002) Member of the Editorial Board.
- Journal of Applied Mechanics (2003-) Associate Editor.
- SIAM Journal on Control and Optimization (2005-) Associate Editor.

Invited colloquium presentations (since 1999):

- 1999 "A Large-scale Theory of Axial Compression System Dynamics", Institute for Fluid Mechanics, ETH Zurich.
- 1999 "A Large-scale Theory of Axial Compression System Dynamics", University of Illinois, Urbana-Champaign.
- 1999 "Three-Dimensional Chaotic Advection", Division of Engineering and Applied Sciences, Harvard University.
- 1999 "Chaotic Advection in Three-Dimensional, Bounded flows", Department of Mechanical Engineering, Massachusetts Institute of Technology.
- 2000 "Ergodic Theory and Control of Mixing", Laboratory for Information and Decision Systems, Massachusetts Institute of Technology.
- 2000 "Control of Mixing", Department of Mathematics, Boston University.
- 2000 "Ergodic Theory in Fluid Mechanics", Isaac Newton Institute for Mathematical Sciences, Cambridge University.

- 2001 "A Large-scale Theory of Axial Compression System Dynamics", Division of Applied Mathematics, Brown University.
- 2001 "Control of Mixing", Center for Nonlinear Science, Georgia Institute of Technology.
- 2002 "Modeling of Complex Systems", Center for Integrative Multiscale Modeling and Simulation (CIMMS), Caltech.
- 2002 "Comparison of Dynamical Systems Based on the Spectral Properties of the Koopman Operator", Department of Mathematics, UC Berkeley.
- 2002 "Micromixing", Department of Aerospace and Mechanical Engineering, University of Southern California.
- 2002 "Comparison of Dynamical Systems Based on the Spectral Properties of the Koopman Operator", Center for Nonlinear Science, Georgia Institute of Technology.
- 2002 "Chaotic Advection in Three-Dimensional Flows: Geometry and Physics", Applied Mathematics Department, Columbia University.
- 2002 "Chaotic Advection in Three-Dimensional Flows: Geometry and Physics", Courant Institute for Mathematical Sciences, New York University.
- 2002 "Comparison of Dynamical Systems Based on the Spectral Properties of the Koopman Operator", Program in Computational and Applied Mathematics, Princeton University.
- 2003 "Ergodic Theory and Control Theory", IGERT (Interdisciplinary Seminars in Nonlinear Science) Research Colloquium, Northwestern University.
- 2003 "Control of Mixing and Application in Microfluidic Devices", Computations in Science Seminar, University of Chicago.
- 2003 "Mixed Orthogonal Decomposition", Statistical and Applied Mathematical Sciences Institute, North Carolina.
- 2003 "Control and Mixing of Bioparticles", California Nanoscience Institute, University of California, Santa Barbara.
- 2003 "Ergodic Theory Methods for Controllability", Institute for Pure and Applied Mathematics, University of California, Los Angeles.
- 2003 "Mixing and Control of Particles in Microchannels", United Technologies Research Center, Hartford, Connecticut.
- 2003 "Nonlinear Dynamics of Atomic Force Microscopes", VEECO Inc.
- 2004 "Control of Mixing and Application in Microfluidic Devices", Mathematics Department, McMaster University.
- 2004 "Control of Mixing and Application in Microfluidic Devices", Mechanical Engineering Department, Stanford University.
- 2004 "Uncertainty in Analysis & Design: a Dynamical Systems Perspective", Center for Nonlinear Science, Georgia Institute of Technology Mixing and control of particles in microchannels, GALCIT, Caltech
- 2005 "Two topics in coupling probabilistic and dynamical systems approaches for complex systems", National Center for Atmospheric Research
- 2005 "Spectral Theory for Nonlinear Dynamical Systems", LIDS, MIT
- 2005 "Control of Mixing: Ergodic Theory and Biosensors ", University of Illinois at Urbana-Champaign.
- 2005 "Spectral Theory for Nonlinear Dynamical Systems", CIMMS, Caltech.
- 2006 "Spectral Theory for Nonlinear Dynamical Systems", University of Southern California.

- 2006 "Utilizing Nominal Dynamics in Control: A Theory for Hamiltonian Systems and Nanoscale Applications", Institut de Mathmatiques, Univ. Bordeaux.
- 2006 "Biomolecules as Nonlinear Oscillators: Life-Enabling Dynamics", Kyoto University.
- 2006 "Biomolecules as Nonlinear Oscillators: Life-Enabling Dynamics, Tokyo University
- 2007 "Physical Structure, Graph Structure and Uncertainty in Complex Systems", UCSB
- 2007 "Theory and Practice of Active Microfluidic Devices", MIT
- 2007 "Theory and Practice of Active Microfluidic Devices", Univeristy of Wisconsin, Madison
- 2007 "Characterization of mixing and hyperbolicity in flows", Ecole Normale Superieure, Paris
- 2007 "Active, Universal Particle Micromanipulators: CPUs for Microfluidics", LLNL, Livermore, CA
- 2007 "Physical Structure, Graph Structure and Uncertainty in Complex Systems", LLNL, Livermore, CA
- 2007 "Physical Structure, Graph Structure and Uncertainty in Complex Systems", Courant Institute of Mathematical Sciences, New York University, NY.
- 2007 "Modeling for Design of Energy Efficient Buildings", LBNL, Berkeley, CA

Selected conference presentations (since 1999):

- 1999 "Transport and Mixing in Three-Dimensional Perturbations of Two-Dimensional Flows", American Physical Society Meeting, New Orleans. (Contributed).
- 1999 "Chaotic Advection in Three-Dimensional, Bounded flows", NSF-KDI/IGPP Workshop, San Diego, CA. (Invited Speaker).
- 1999 "Chaotic Advection in Three-Dimensional, Bounded flows", Integrating integrability into mathematics and science: Conference in honor of V. Zakharov's 60th Birthday. University of Arizona. (Invited).
- 1999 "Control of Mixing", NSF Workshop on Control of Fluids, UCSD. (Invited Speaker).
- 1999 "Dynamics and Transport in 3-D, Volume Preserving Maps and Flows", SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah. (Contributed).
- 2000 "Instabilities in Rotating Flows With Body Forces: Turning Navier-Stokes into a Reaction-Diffusion Equation", American Physical Society Meeting, Washington DC. (Contributed).
- 2000 "Chaotic Advection in Bounded Navier-Stokes Flows", ICTAM 2000, Chicago. (Contributed).
- 2000 "Overview of Some Theoretical and Experimental Results on Modeling and Control of Shear Flows", Conference on Decision and Control, Sydney. (Contributed).
- 2000 "Comparison of Systems with Complex Behavior", Conference on Decision and Control, Sydney. (Contributed).
- 2001 "Control of Nonlocal Reaction-Diffusion Equations; Application to Control of Instabilities in Axial Compressors", SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah. (Contributed).
- 2001 "Control of Mixing", SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah. (Contributed).
- 2001 "Controlled Group Translations and Controllability of Nonlinear Systems", NOLCOS 01, St. Petersburg, Russia. (Contributed).
- 2001 "An Extension of Prandtl-Batchelor Theory and Consequences for Chaotic Advection", American Physical Society Fluid Dynamics Meeting, San Diego, CA. (Contributed).

- 2002 "Ergodic Theory and Control Theory", Mohammed Dahleh Symposium, UCSB. (Invited Speaker).
- 2002 "Modeling and Numerical Analysis of Mixing in an Actively Controlled Micromixer", HEFAT01, South Africa. (Contributed).
- 2002 "Mixing in Three-Dimensional Flows", SIAM Annual Conference, Philadelphia, PA. (Invited).
- 2002 "Control of Fluid Particle Motion and (Anti)-KAM Theory", Workshop on Dynamical Systems Methods in Fluids, Mathematisches Forschungsinstitut Oberwolfach, Germany. (Invited Speaker).
- 2002 "Mixing, KAM, Anti-KAM and Controllability", AFOSR Contractors Meeting, Pasadena, CA. (Invited).
- 2002 "Mixing in Three-Dimensional Flows", Workshop on sediment transport, Monte Verita, Ascona, Switzerland. (Invited Speaker).
- 2002 "On Control of Vortex Dynamics", American Physical Society Fluid Dynamics Meeting, Dallas, Texas. (Contributed)
- 2003 "Mixed Orthogonal Decomposition", American Mathematical Society Meeting, Baltimore, MD. (Invited).
- 2003 "Control of Mixing and Application in Microfluidic Devices", Dynamics Days Europe, Palma de Mallorca, Spain. (Invited Plenary Speaker).
- 2003 "An Actively Controlled Micromixer: 3-D Theory", American Physical Society Fluid Dynamics Meeting, New Jersey. (Contributed).
- 2003 "A Multiscale Measure of Mixing and its Applications", Conference on Decision and Control, Maui, Hawaii. (Invited).
- 2003 "Uncertainty Analysis: a Dynamical Systems Approach", Workshop on Uncertainty Analysis, Pasadena, CA. (Contributed).
- 2004 "Uncertainty Analysis: a Dynamical Systems Approach, DARPA Workshop on Uncertainty Analysis, United Technologies Research Center, Hartford, CT. (Contributed)
- 2004 Mathematical aspects of mixing theory and application in m icrofluidic mixing AIMS Dynamical Systems and Differential Equations Conference, Pomona, CA . (Invited).
- 2004 "Spectral properties of dynamical systems and model reduction AIMS Dynamical Systems and Differential Eq uations Conference, Pomona, CA. (Invited)
- 2004 "Nonlinear dynamics of multicomponenmt dynamical systems", ICTAM, Warsaw, Poland. (Contributed).
- 2004 "High Efficiency Mixing in the Shear Superposition Micromixer" APS DFD Meeting, Seattle, Washington. (Contributed)
- 2004 "Mixing and control of particles in microchannels" NOLTA 2004, Fukuoka, Japan (2004).(Invited)
- 2004 "Collaborations with UTRC 1997-2004" Conference on Decision and Control (CDC). (Invited)
- 2004 "Coupled Nonlinear Dynamical Systems: Asymptotic Behavior and Uncertainty Propagation" Conference on Decision and Control (CDC) (2004). (Contributed)
- 2005 "Coupled Nonlinear Dynamical Systems: Asymptotic Behavior and Uncertainty Propagation" SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah . (Contributed).
- 2005 "Dynamics and Control of Macromolecules" SIAM Conference on Applications of Dynamical Systems, Snowbird, Utah (2005). (Contributed)
- 2005 "Uncertain, High-Dimensional Dynamical Systems" Workshop on Geophysical Dynamics, IPAM, UCLA (2005). (Invited)

- 2005 "Utilizing Nominal Dynamics in Control: A Theory for Hamiltonian Systems and Nanoscale Applications" Plenary Lecture at the 2005 SIAM Control Theory Meeting, New Orleans. (Invited)
- 2006 "Complex Systems Architectures: Rules, Interfaces, Modules, Dynamics", DARPA Microsystems Technology Office Complex Systems Architectures Workshop Arlington, VA. (Invited)
- 2006 "Biomolecules as Nonlinear Oscillators: Life-Enabling Dynamics", Plenary Lecture at the Second International Conference on Dynamics,Vibration and Control, Beijing, China. (Invited)
- 2006 "Biomolecules as Nonlinear Oscillators: Life-Enabling Dynamics", Keynote Lecture at the Nonlinear Dynamics of Nanosystems Workshop, TU-Chemnitz, Chemnitz, Germany (Invited)
- 2006 "Physical Structure, Graph Structure and Uncertainty in Complex Systems", Keynote Lecture at the Mathematics in the Science of Complex Systems Workshop Warwick University, UK
- 2006 "Optimal Control of Fluid Mixing" American Physical Society Division of Fluid Dynamics Meeting, Tampa, Florida (Contributed)
- 2007 "Robust Decision Making: Agent-Based Models and Dynamical Systems", Robust Decision Making Workshop, AFOSR, Arlington, Virginia (Invited)
- 2007 "Controllability, Integrability, Ergodicity", Mathematical Sciences Research Institute, Berkeley, CA (Invited)
- 2007 "Active, Universal Particle Micromanipulators: CPUs for Microfluidics", Lab-on-a-Chip World Congress, Edinburgh, Scotland (Invited)
- 2007 "Characterization of mixing and hyperbolicity in flows", International Congress on Industrial and Applied Mathematics, Zurich, Switzerland.

Reviewing and refereeing activity:

Air Force Office of Scientific Research, ASME, Automatica, IEEE Transactions on Automatic Control, Journal of Applied Mechanics, Journal of Computational Physics, Chaos, Control Systems Technology, International Journal of Robust and Nonlinear Control, European Physical Journal B, International Journal of Heat & Mass Transfer , Journal of Fluid Mechanics, Journal of Nonlinear Science, Journal of Physical Oceanography, Journal of Physics A, Mathematical Reviews, Nature, Physica D, Physical Review E, Physical Review Letters, Physics Letters A, Physics of Fluids, The Physical Review, Journal of Micromechanics and Microengineering, Lab on a Chip, Springer-Verlag, United Technologies Research Center, National Institute of Health, National Science Foundation.

Consulting activity:

Propulsion Research Institute (1996-1998), Honda R & D (2000-2001), Combustion Research and Flow Technology (2000-2001), Guidant (2002-), United Technologies Research Center (1998-), Codman (Johnson and Johnson) (2002-2003), Prevention Research Institute (2004-2007)

Other professional activities:

- 2006 Visiting Professor, Kyoto University , Japan.
- 2006 Visiting Professor, Institut de Mathmatiques, Univ. Bordeaux, France.
- 2005, Panelist, National Science Foundation panel on proposals in Dynamics (Engineering Directorate).

- 2005, Member, Panel of the Defense Sciences Research Council Workshop on Design Principles for Complex Biological Systems, Washington DC..
- 2004-, Member, Program Committee, Division of Fluid Dynamics of the American Physical Society.
- 2004, Panelist, National Science Foundation panel on proposals in Applied Dynamical Systems (Mathematics Directorate).
- 2003, Member, *Institute for Collaborative Biotechnologies*, University of California, Santa Barbara.
- 2002, Panelist, *Panel on proposals in Control Theory (Engineering Directorate)*, National Science Foundation.
- 2002, Member, *California NanoSystems Institute*, University of California, Santa Barbara.
- 2001, Participant, *National Science Foundation Workshop on "Frontiers of Mathematics in Geosciences", Institute for Mathematics and its Applications*, University of Minnesota.
- 2000, Participant, *Programme on "Geometry and Topology of Fluid Flows"*, Isaac Newton Institute for Mathematical Sciences (Cambridge, UK).
- 2000, Participant, *Meeting of the "Future Directions in Control and Dynamical Systems" panel*, Washington DC.
- 1999 Participant, *Programme on "Turbulence"*, Isaac Newton Institute for Mathematical Sciences (Cambridge, UK).
- 1999 ERCOFTAC Visiting Professor, Institut fur Flüiddynamik, ETH Zürich.
- 1996 Participant, *Programme on "Mathematical Modelling of Plankton Population Dynamics"*, Isaac Newton Institute for Mathematical Sciences (Cambridge, UK).

Grants and industrial gifts:

- 1997-2000 NATO "Chaos and Mixing in 3-Dimensional Maps and Flows" $4,591 Co-Principal Investigator (Co-PI).
- 1997-2000 AFOSR "Dynamics and Control of Instabilities and Mixing in Complex Fluid Flows; Applications to Jet Engines", $151,083, Principal Investigator (PI).
- 1997-2000 ONR "Transport and Mixing in Three-dimensional Oceanographic Flows" $120,000, PI.
- 1998-2001 NSF "Mathematical Methods of Chaotic Advection in Three-Dimensional Fluid Flows" $75,000, PI.
- 1998-99 Honda Research Initiation Grant "Control of Mixing and Applications in Three-Dimensional Fluid Flows" $25,000, PI.
- 1998-99 Propulsion Research Institute, Industrial gift. $12,000, PI.
- 1999 Ford Motor Company, Industrial gift. $10,000, PI.
- 1999-2003 "Nonlinear Dynamics and Control from Microscale to Macroscale", NSF CAREER $200,000, PI.

- 2000-03 AFOSR "Nonlinear Dynamics and Ergodic Theory Methods in Control of Fluid Flows: Theory and Applications" $380,000, PI.
- 2000- NSF ITR "Computational Infrastructure for Microfluidic Systems with Applications to Biotechnology" $2,900,000, Co-PI.
- 2000- Honda R&D Industrial gift. $40,000, PI.
- 2000- NSF IGERT "Development of a Graduate Education Program in Computational Science and Engineering with Emphasis on Multi-scale Problems in Fluids and Materials." $2,900,000, (co-PI).
- 2004 Institute for Collaborative Biotechnologies, "Modeling of microfluidics processes for improved sensitivity and accuracy of bio/chemical sensing devices". $50,000 (PI).
- 2003-2006 AFOSR "Nonlinear Dynamics and Ergodic Theory Methods in Control" $450,000 (PI).
- 2003-2004 DARPA seed funding for research on "Analytical systems engineering: methodology for design of complex systems subject to uncertainty". $750,000, (In collaboration with the United Technologies Research Center).
- 2004-2007 NSF-NIRT, "Titanium-Based Biomolecular Manipulation Tools", $1,000,000. (co-PI).
- 2005 -2008 NSF-DMS, "Design of attractors for enhanced sensitivity biosensing", $310,000 (PI).
- 2006-2008 AFOSR "Uncertainty Analysis and Control for Nonlinear, Multiscale, Interconnected Systems", $532,796 (PI).
- 2006-2009 DARPA Robust Uncertainty Management, $2,291,315 (PI)
- 2007-2010 ONR Drifter Motion Planning for Optimal Surveillance of the Ocean, $561,145 (PI)
- 2008-2009 DARPA Design of Microstructure for Shape-Adaptive and Reflectance-Adaptive Materials, $250,000 (PI)

Students and postdoctoral fellows:
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3. Gregory Hagen, Ph. D. (Senior Researcher, United Technologies Research Center).
4. David Betz, Ph. D. (Researcher, Boeing Phantom Works).
5. Umesh Vaidya, Ph. D. (Assistant Professor, Electrical Engineering, Iowa State University).
6. Zoran Levnajic, M. S. (Graduate Student, Ljubljana, Slovenia).

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Postdoctoral fellows:

1. Yueheng Lan 2007-
2. Alice Hubenko 2007-
3. George Mathew, 2006-2007
4. Symeon Griveopoulos 2006-
5. Kaixia Zhang 1997-1998 (General Electric Research),
6. Dmitri Vainchtein (Harvard, UCSB) 2000-2005,
7. Dong-Eui Chang (UCSB) 2002-2003,
8. Frederic Bottausci (UCSB) 2002-.