Curriculum Vitae

Rodolphe Chabreyrie

Carnegie Mellon University, Mechanical Engineering Department
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Objective

Assistant Professor of Mechanical Engineering

Employement

- **Postdoctoral Researcher**
  Since August 2010
  Mechanical Engineering Department
  Carnegie Mellon University
  Pittsburgh, PA, USA

Education

- **Ph.D., Mechanical Engineering**
  August 2010
  Thesis Title: Strategies for Controlling Chaotic Mixing in Microfluidic and Other Fluid Flow Devices
  Advisor: Nadine Aubry, Raymond J. Lane Distinguished Professor and Head
  Carnegie Mellon University

- **M.S., Physique Théorique et Mathématique, Physique des Particules et Astroparticules (Theoretical and Mathematical Physics, Particle and Astroparticle Physics)**
  May 2005
  Centre de Physique Théorique
  Campus de Luminy, Case 907
  13288 Marseille cedex 9, France

- **B.S., Physics**
  May 2003
  Université de la Méditerranée, Aix-Marseille II
  13288 Marseille, France

  Fall 2002 and Spring 2003
  Université de Montréal
  Student Exchange Program (CREPUQ)

Research Interests

Strategies to understand and control chaotic transport. I focus on chaos theory's mathematical and computational tools for controlling chaotic transport. More precisely, I investigate strategies or methods to activate, increase, reduce or eliminate chaotic behavior by slightly and ingeniously changing the system to be controlled. I consider applications for which controlling chaotic transport represents better efficiency and sustainability such as small to micro fluidic reactors, mechanical and electrical oscillations.

Teaching Philosophy

A well-made rather than a well-filled head. My philosophy is to teach students how to learn and think by themselves rather than teaching them pure textbook knowledge. Such an intellectual ability can be imparted to the students by stimulating questions, research activities and, communication. I am particularly interested in applying this teaching philosophy via conventional courses (e.g., fluid mechanics or vibrations, mathematics for engineers) and, unconventional courses or research activities on chaos theory.

Journal Publications

- Chabreyrie R and Aubry N, "Switching Chaos On/Off in Duffing Oscillator," in preparation.
- Chabreyrie R, Chandre C, Singh P, Aubry N, "Complete Chaotic Mixing in an Electro-osmotic Flow by Destabilization of Key Periodic Pathlines," submitted to Physics of Fluids.
- Chabreyrie R, Vainchtein D, Chandre C, Singh P, Aubry N, "Using Resonances to Control Chaotic Mixing within a Translating and Rotating Droplet," Communications in Nonlinear Science and Numerical Simulations 15, 2124, 2010.
- Chabreyrie R, Vainchtein D, Chandre C, Singh P, Aubry N, "Robustness of Tuned Mixing within a Droplet for Digital Microfluidics," Mechanics Research Communications 36, 130, 2009.
- Chabreyrie R, Vainchtein D, Chandre C, Singh P, Aubry N, "Tailored Mixing inside a Translating Drop," Physical Review E 77, 036314, 2008. (Selected for the April 7, 2008 issue of Virtual Journal of Nanoscale Science Technology).

Proceeding Publications

- Chabreyrie R, Chang D, Chandre C, Singh P, Aubry N, "Destabilizing Key Periodic Orbits for Complete Chaotic Mixing in an Electro-osmotic Mixer," US National Congress of Theoretical and Applied Mechanics 2010, USNCTAM2010-978, 2010.
- Chabreyrie R, Chandre C, Aubry N, "Switching Chaos On/Off in an Inverted Pendulum by Bi-chromic Forcing," US National Congress of Theoretical and Applied Mechanics 2010, USNCTAM2010-979, 2010.
- Chabreyrie R, Vainchtein D, Chandre C, Singh P, Aubry N, "Controlling Mixing inside a Droplet by Time Dependent Rigid-body Rotation," Proceedings of IMECE 2008, 68026, 2008.

Conference Presentations

- "Targeting Complete Chaotic Mixing by Destabilizing Key Periodic Orbits in an Electro-osmotic Mixer," American Physical Society 63rd Annual Meeting of the Division of Fluid Dynamics, Long Beach, CA, USA, November 2010.
- "Optimizing Chaotic Mixing in a Two-Inlet Microfluidic Channel by Out-of-Phase Pulsing," American Physical Society 63rd Annual Meeting of the Division of Fluid Dynamics, Long Beach, CA, USA, November 2010.
- "Destabilizing Key Periodic Orbits for Complete Chaotic Mixing in an Electro-osmotic Mixer," 16th US National Congress of Theoretical and Applied Mechanics, University Park, PA, USA, July 2010.
- "Switching Chaos On/Off in an Inverted Pendulum by Bi-chromic Forcing," 16th US National Congress of Theoretical and Applied Mechanics, University Park, PA, USA, July 2010.

- "Breaking Regular Islands for Improved Mixing in an Electro-osmotic Device," American Physical Society 62nd Annual Meeting of the Division of Fluid Dynamics, Minneapolis, MN, USA, November 2009.
- "Targeting Complete Chaotic Mixing in an Electro-osmotic Mixer," Bifurcations and Instabilities in Fluid Dynamics, Nottingham, UK, August 2009.
- "Controlling Mixing Inside a Droplet by Time Dependent Rigid-body Rotation," American Society of Mechanical Engineering International Mechanical Engineering Congress and Exposition, Boston, MA, USA, October 2008.
- "Tailoring Chaotic Mixing within a Translating Droplet by Oscillatory Rotation," International Congress of Theoretical and Applied Mechanics, Adelaide, South Australia, Australia, August 2008.
- "Robust Tailoring Chaotic Mixing within a Translating Droplet by Oscillatory Rotation and its Possible Experimental Application," Journées de Dynamique Non Linéaire, Marseille, France, May 2008.
- "Tailoring Chaotic Mixing within a Translating Droplet by Oscillatory Rotation," American Physical Society 60th Annual Meeting of the Division of Fluid Dynamics, Salt Lake City, UT, USA, November 2007.
- "Mixing within a Drop Immersed in a Fluid and Subjected to Translation and Unsteady Rotation," American Physical Society 59th Annual Meeting of the Division of Fluid Dynamics, Tampa, FL, USA, November 2006.

Poster Presentations

- "Targeting Complete Chaotic Mixing Using Electroosmotic Mixer," Fluid DTU Summer School, Complex Fluid Motions, Krogerup Højskole, Danmark, August 2009.
- "A Possible Way to Create Controlled Mixing Inside a Droplet," Bennett Conference, Carnegie Mellon University, Mechanical Engineering Department, Pittsburgh, PA, USA, April 2008.
- "Controlled Mixing inside a Droplet Through Resonances Strategy," Chaos, Complexity and Transport: Theory and Applications, Marseille, France, June 2007.

Teaching/Advising

- **Teaching Assistant**
  - Fundamentals of Mechanical Engineering, Spring and Fall 2008.
- **Undergraduate Students Advising**
  - David Chang (CMU Mechanical Engineering Class of 2011), "Computational Fluid Dynamics Experimentation in a T Microchannel," Fall 2009, Spring 2010 (24-391, 24-392), Summer 2010 (SURF grant recipient) and Fall 2010.
  - Hang Cao (2nd year Engineering school Ecole Centrale Marseille), "Controlling Chaotic Behavior in an Electronic Oscillator by Bi-chromic Forcing," Summer 2010.
  - Hainsheng Wang (2nd year Engineering school Ecole Centrale Marseille), "Controlling Chaotic Behavior in an Mechanical Inverted Pendulum by Bi-chromic Forcing," Summer 2010.
  - Mathieu Labour (2nd year Engineering school Ecole Centrale Marseille), "Chaotic Behavior in an Inverted Pendulum," Summer 2009.

- Nathaniel Zaharia (CMU Mechanical Engineering Class of 2009), "Electrohydrodynamic Instabilities in Microchannels," Spring and Fall 2008 (24-391, 24-392).
- Javier Novales (CMU Electrical and Computer Engineering Class of 2011), "Construction of a Measuring System for Angular Displacement of a Beam," Fall 2008.
- Justin Pratt (CMU Mechanical Engineering Class of 2011), "Construction of a Periodic Electromagnetic Forcing," Fall 2008 (24-391).

- **Graduate Students Advising**
  - Jiachuan He (CMU Mechanical Engineering Class of 2012), "Optimizing Heat Transfer with Chaos inside a T Microfluidic Channel," Fall 2010 (24-794).
  - Ashik Mohideen (CMU Mechanical Engineering Class of 2011), "Controlling Chaotic Bouncing Droplet by Bi-chromic Forcing," Spring 2010 (24-794).
  - Roshan Ravinda (CMU Mechanical Engineering Class of 2010), "Design and Construction of a Chaotic Beam," Fall 2008.

Reviewer

- Microfluidics and Nanofluidics, Springer Berlin / Heidelberg.
- Communications in Nonlinear Science and Numerical Simulation, Elsevier.

Collaborations

- C. Chandre, Centre de Physique Théorique , Marseille, France.
- K. Uguz, Chemical Engineering Department, Boğaziçi University, Istanbul, Turkey.
- P. Singh, Mechanical Engineering Department, New Jersey Institute of Technology, Newark, NJ, USA.