

Alexandre Munnier

Sex: Male
Nationality: French
Born the third of december, 1972

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Current position

Maître de conférences (associate professor) at the IECN, Nancy university (since 2004).
Member of the INRIA (French National Institute for Research in Computer Science and Control),
CORIDA-project team.

Professional experience

- 2009-2010 One year PIMS/CNRS position at the University of British Columbia, Vancouver.
- 2003-2004 Assistant Professor at the CEREMADE (Mathematics institute of Paris Dauphine University).
- 2002-2003 Assistant Professor at Nancy University.
- 2001-2002 Postdoctoral fellowship at the university autònoma of Madrid (spain).
Advisor : Pr. E. Zuazua.
- 2000-2001 Assistant Professor at the University of Besançon.
- 1995-1997 Compulsory civil national service as Mathematics teacher at the french high school of Barcelona (spain).

Education and Qualification

- 1997-2000 Ph.D. in Applied Mathematics, Franche-Comté University (Besançon, France)
Title: *On the oscillations and stability of liquid bridges under zero gravity*
Advisors: Pr. A. Henrot and Pr. P. Capodanno.
- 1995-1997 Compulsory national service.
- 1993-1995 M. S. in Pure Mathematics, Franche-Comté University (Besançon).
Agrégation in Mathematics (recruitment examination to teach in high school).
- 1992-1993 B. S. in Pure Mathematics, Franche-Comté University (Besançon).

Research interests

I am working on PDEs and more precisely on fluid-structure interaction problems. For these kind of problems, I am interested in the modelling, theoretical studies and numerical simulations.

A fluid-structure interaction problem is a problem that involves equations of Fluid Mechanics and equations of Solid Mechanics, both being coupled. A simple example of such a problem is the motion of a rigid solid in a fluid: the fluid is driven by Euler or Navier-stokes equations coupled with Newton's laws that govern the dynamics of the solid.

The immersed bodies are not always rigid but can also be deformable. One of the most interesting and challenging area among fluid-structure problems is the Biohydrodynamics: the study of animal locomotion in fluid by shape changes.

Publications

- C. Conca, M. Malik and A. Munnier, Detection of a moving rigid solid in a perfect fluid, Inverse Problems, 2010, To appear.
- T. Chambrion and A. Munnier, Locomotion and control of a self-propelled shape-changing body in a fluid. *J. Nonlinear Sci.*, 2010, To appear.
- A. Munnier and P. Bruno, Locomotion of articulated bodies in an ideal fluid: 2d model with buoyancy, circulation and collisions. *Math. Models Methods Appl. Sci.*, To appear.
- A. Munnier, Locomotion of deformables bodies in an ideal fluid: Newtonian versus Lagrangian formalisms. *J. Nonlinear Sci.*, 19(6):665715, 2009.
- A. Munnier, On the self-displacement of deformable bodies in a potential fluid flow. *Math. Models Methods Appl. Sci.*, 18(11):19451981, december 2008.
- J. Houot and A. Munnier, On the motion and collisions of rigid bodies in an ideal fluid. *Asymptot. Anal.*, 56(3-4):125-158, March 2008.
- J. Cartier and A. Munnier, J. Geometric Eddington factor for radiative transfer problems. Numerical methods for hyperbolic and kinetic problems, 271-293, IRMA Lect. *Math. Theor. Phys.*, 7, Eur. Math. Soc., Zrich, 2005.
- A. Munnier and E. Zuazua, Large time behavior for a simplified N -dimensional model of fluid-solid interaction. *Comm. Partial Differential Equations* 30 (2005), no. 1-3, 377-417.
- A. Munnier, Stability and linear oscillations of liquid bridges with varied boundary conditions under zero gravity. *Z. Angew. Math. Phys.* 54 (2003), no. 6, 977-1000.
- A. Munnier, Petites oscillations d'un liquide, dans un container de revolution avec fond lastique, en l'absence de pesanteur. *Z. Angew. Math. Phys.* 48 (1997), no. 4, 629-645.

Softwares

Biohydrodynamics Matlab Toolbox : With B. Pinçon (IECN), we have developed a MATLAB Toolbox for the design, the simulation and the analysis of the animal locomotion in a fluid. More information is available on the Biohydrodynamics Toolbox page: <http://bht.gforge.inria.fr/>.

International cooperations

I am a member of the ANCIF team (Numerical Analysis and Control of Fluid-Structure Interactions). This team includes researchers of the IECN and researchers of the CMM (Centro de Modelamiento Matemático) of the university of Santiago (Chile). I have been invited to the CMM in 2006, 2007, 2008 and 2010.

I spent one year (2009-2010) at the university of British Columbia as a CNRS/PIMS (Pacific Institute for the Mathematical Sciences) invited professor.

Advisor experience

- Post doctoral Co-advisor with Pr. C. Conca (CMM) of Muslim Malik (2008-2010).
- Internship advisor of Tushar Lila, a graduate student from the Indian Institute of Technology of Guwahati (India), within the international internship program of the INRIA (2009).

- Ph. D. Co-advisor together with Pr. M. Tucsnak (IECN) of J. Houot for his Ph. D. thesis entitled *Mathematical study of solids in a perfect fluid* (thesis defense june 2008).
- Co-advisor of O. Lacroix (École Polytechnique, france) together with Pr J. San Martin (CMM, Santiago, Chile) for his research thesis entitled *Numerical study of fishes' locomotion in a perfect fluid*.

Grants

Member of the

- ANR MOSICOB (Modélisation et simulation de fluides complexes biomimétiques)
- ANR GAOS (Geometric analysis of optimal shapes)
- ANR CISIFS (Contrôle et identification pour les systèmes d'interaction fluide-structure)

Selected Teaching experience

Master of Science at Nancy university, Pure Mathematics

- Integral equations (2008).
- Introduction to PDEs (2005, 2006, 2007, 2008).
- Qualitative study of ordinary differential equations (2004, 2005, 2006, 2007, 2008).

École des Mines in Nancy (establishment of teaching and research in engineering)

- Partial differential equations (2004, 2005, 2006, 2007).
- Numerical Analysis (2007).
- Optimization (2007, 2008)

Recent Communications

- When Fish Moonwalk, ACC 2010 (IEEE conference, Baltimore).
- Locomotion in a Perfect Fluid, (PDE seminar, Grenoble) 2010.
- Some Issues Relating to Fluid-Structure Interaction Problems, (UBC, post-docs colloquium, Vancouver) 2009.
- Controllability Results for a Fish-like Swimming Body (UBC, EDP and diff. geometry seminar, Vancouver) 2009.
- Organizer of a symposium *Sur la nage des poissons : analyse mathématique et simulations numériques* at the SMAI conference (Nice) 2009.
- Swimming in a Perfect Fluid (CONICIT, Madrid) 2009.

Languages

French: Mother Tongue.

Spanish: Written, spoken and read fluently.

English: Written, spoken and read fluently.