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Nathan Martin Doctor in Applied Mathematics

Keywords

PDE model, convex optimization, adjoint method, geophysical and free surface flows, rheology, data assimilation, glaciology

Research Experience

AUGUST 2013 - PRESENT :

California Institute of Technology -
Jet Propulsion Laboratory,
Pasadena, United States

Post-doctoral position on the modeling of the grounding line dynamics problem in glaciology. *Theoretical and numerical approach for the modeling of the movement of the singular contact line at the grounded ice/floating ice transition under coastal ice-shelves of ice sheets.*

OCTOBER 2009 - JUNE 2013 :

Institut National des Sciences Appliquées de Toulouse - Institut de Mathématiques de Toulouse: MIP team (Modeling for industrial and physical applications)

PhD in applied mathematics entitled *Direct and inverse modeling of viscoplastic geophysical flows using variational methods – Application to glaciology.* *Derivation of an augmented Lagrangian splitting type algorithm for power-law flows providing significant time and memory savings [1]. Development of an adjoint-based algorithm for inverse modeling of the rheology through sensitivity analysis and parameter identification [2]. Application to ice-sheet modeling: study of the transmission of basal variability to the surface [3]. Development of a computational code for non-Newtonian free surface geophysical flows. PhD supervised by Jérôme Monnier.*

FEBRUARY - JUNE 2009 :

INSAT - IMT: MIP team

Research Master internship : Modeling of non-Newtonian free-surface flows. *PhD preliminary work. Internship supervised by Jérôme Monnier.*

JUILLET - SEPTEMBRE 2008 :

Université de Montréal

Graduate student internship : Optimisation and mixed logit estimation *Development of an optimisation code in C applied to a discrete choice model. Internship supervised by Fabian Bastin*

References

- [1] Martin, N. and Monnier, J., Four-field finite element solver and sensitivities for quasi-Newtonian flows, 2013, *accepted in SIAM-Journal on Scientific Computing.*
- [2] Martin, N. and Monnier, J., Inverse rheometry for power-law geophysical flows investigated using variational approach, 2013, *submitted.*
- [3] Martin, N. and Monnier, J., Of the gradient accuracy in full-Stokes ice flow model: basal slipperiness inference, *The Cryosphere Discussion*, 7, 3853-3897, doi:10.5194/tcd-7-3853-2013,2013. *under minor revision for the journal The Cryosphere.*

Teaching and supervision experience

- September 2010 - July 2012 : **Mathematics Teaching Assistant.** 128 hours of teaching given at Engineering School INSA Toulouse, with 88 hours of tutorial classes for 1st year Bachelor student (Analysis, Integration and Linear Algebra) and 40 hours of practical work for 3rd year Bachelor student (C programming language and Numerical Analysis).
Project supervising of 1st year Master students. 6h of supervising dedicated to the development of an Adaptive Mesh Refinement method applied to the treatment of a boundary condition singularity (grounding line problem in glaciology).
Project supervising of 2nd year Master students. 6h of supervising dedicated to the development of an ALE mesh tracking method using elastic deformation applied to moving domain with a front.
- October 2009 - July 2010 : **Mathematics Teaching Assistant.** 64 hours of teaching given at Engineering School INSA Toulouse, with 30 hours of tutorial classes for 1st year Bachelor student (Logic and Mathematical thinking) and 34 hours of practical work for 3rd year Bachelor student (C programming language and Numerical Analysis).
Project supervising of 1st year Master students. 6h of supervising dedicated to the optimization of Finite Element mesh reading and sparsing.
Project supervising of 1st year Master students. 6h of supervising dedicated to the development of a mixed quadrangular finite element method.

Community services

- 2010-2013: **Elected member of the Scientific council of INSA of Toulouse for a three years term**
- January 2013 : **Mathematical awareness action about Combinatory Games.** Three days of practical work with high school student
- February 2012 : **Mathematical awareness action about Image Compression**

Selected Conferences

- *On the gradient accuracy in Full-Stokes ice flow models: basal slipperiness inference*, **Poster**, 9-13 December, 2013, American Geophysical Union - Fall Meeting (**AGU13**), San Francisco, California, USA.
- *Four-field finite elements for viscoplastic free surface flows and variational data assimilation*, **Oral Presentation**, 12 September 2012, European Congress on Computational Methods in Applied Sciences and Engineering (**ECCOMAS12**), Vienna, Austria.
- *Solveur éléments finis quatre champs et assimilation variationnelle de données pour des écoulements viscoplastiques à surface libre*, **Oral Presentation**, 21-25 May 2012, SMAI, Congrès d'Analyse NUMérique 2012
- *Sensitivity analysis using the variational data assimilation software DassFlow-Ice*, **Oral Presentation**, 3-8 April 2011, European Geosciences Union - General Assembly (**EGU11**), Vienna, Austria.

Degrees

2008-2009 : Research Master in Applied Mathematics: *PDE and Scientific computing*. UNIVERSITÉ PAUL SABATIER - TOULOUSE

2004-2009 : Engineering degree in Mathematical modeling: *Numerical modeling and scientific computing*. INSTITUT NATIONAL DES SCIENCES APPLIQUÉES - TOULOUSE

2004 : Baccalaureate with honours, major in Mathematics. LYCÉE JULES MICHELET - LANNEMEZAN (65)

Computer skills

Languages : Fortran, C, C++, Java, Python, Unix, L^AT_EX.

Softwares : Matlab, Maple, Tapenade (Automatic differentiation).

Languages

English : able to give a scientific presentation, to follow a conference or having a conversation. Writing of scientific articles and technical documentation.

Espagnol : basic skills