Dr. Emilie Marchandise

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Belgian, married
Born December 28th, 1980
Languages : French, Dutch and English
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RESEARCH INTEREST

My principal focus of research is the modelling and the development of numerical methods and softwares for the study of complex flows. The applications I'm interested in are essentially biomedical applications (cardiovascular simulations, respiratory flows, fluid-structure interaction in blood vessels).

EDUCATION AND BIOGRAPHY

Assistant Professor 2008-present
Ecole Polytechnique de Louvain, Université catholique de Louvain (UCL), Belgium
institute of Mechanics, Materials and Civil Engineering (iMMC)

FNRS Postdoctoral Researcher 2006-2008
Université Paris Diderot, Paris, France
Biomechanical research.
- Development of numerical methods for the simulation of cardiovascular and respiratory flows.
- In-vitro experiments of arterial and venous blood flow.

AESS in Mathematics and Physics 2006-2007
(Agrégation de l'Enseignement Secondaire Supérieur)
Faculty of Sciences, Université catholique de Louvain (UCL), Belgium
High honors.

Ph.D. in Applied Sciences (FNRS Research Fellow) 2003-2006
Department of Civil Engineering, Université catholique de Louvain (UCL), Belgium
Dissertation title : *Simulation of three-dimensional two-phase flows, coupling of a stabilized finite element method with a discontinuous level set approach.*
Advisor J.-F. Remacle.

M.Sc. in Applied Science 2003-2005
Faculty of Applied Science, Université catholique de Louvain (UCL), Belgium
Highest honors

Dipl. Eng., Civil Engineering 1998-2003
Department of Civil Engineering, Université catholique de Louvain (UCL), Belgium
Final work : *Development of a finite volume code for 3D incompressible turbulent flows.*
Advisor : Prof. Y. Zech
Highest honors

TEACHING EXPERIENCE

Teaching two biomechanic courses (GBIO2040 and MECA2355) for master students at the Université catholique de Louvain (UCL).

Mentoring of undergraduate and graduate students at the Université catholique de Louvain (UCL).
- Graduate course on the dynamics of elastic systems (MECA 2510)
- Undergraduate course on partial differential equations (FSAB 1103)
- Undergradate course on mechanics (statics) (AUCE 1111)
- Project on fluid-structure interactions. Application to the Bridge of Tacoma (AMCO 2158)
- Project on windmills with the CANDI 2000 program (T5)
- Project on designing a bridge (Projet de structures 1)

Teaching mathematics in secondary schools for the A.E.S.S. (agrégation) for a period of 60 hours
- Collège Hayeffes, Mont-Saint-Guibert
- Ecole technique IATA, Namur

PREVIOUS RESEARCH EXPERIENCE

Postdoctoral Stay Feb-June 2007
Institut Jean le Rond d'Alembert, Université Pierre & Marie Curie, Paris, France
Development of a one-dimensional discontinuous Galerkin method for predictive vascular surgery.

Graduate Student Researcher Jan-March 2005
Groupe interdisciplinaire de la recherche en éléments finis (GIREF), Université LAVAL, Quebec
Efficient coupling between a finite element code for fluid dynamics and a discontinuous galerkin method for the level set method for computing multiphase flows.

Summer Intern-Besix August 2002
Besix
Engineer intern on the wharf of the new railway station in Bijlmer (Amsterdam)

Summer Intern-Tractebel September 2001
Tractebel
Trainership in the Geotechnical department in Brussels

RESEARCH TUTORING

Doctoral student 2006-current
Valérie Lacroix
Numerical method for hemodynamic analysis of lower limb arterial bypass surgery.

Doctoral student 2007-current
Marie Willemet
NHEMO : development of a numerical tool for predictive vascular surgery.

Doctoral student 2009-current
Emilie Sauvage
Efficient fluid-structure interaction models for cardiovascular and respiratory simulations

Doctoral student 2009-current
Francois Pochet

Multi-phase flow modelling (Cenaero PhD)

AWARDS

The Taylor & Francis prize for Outstanding innovation in computer methods in biomechanics & biomedical engineering at the CMBBE conference in Valencia (24-27 february)

INVITED PRESENTATIONS

Adaptation of a Coupled 1D-0D Model of the Arterial Hemodynamics to a Pathological Patient-specific Application : The Lower-limb Bypasses, "Space-Time Reduced Modelling for Biological Fluid Dynamics" Symposium at the 6th World Congress of Biomechanics, Singapore, 1-6 August.

PROGRAM COMMITEE, REVIEWING

- Reviewer for several international journals of high impact factor : journal of computational physics, journal of Medical Engineering and Physics, Mathematics and Computers in Simulation, Journal of Computational and Applied Mathematics, International Journal of Modern Physics.
- Board member of the "société de Biomécanique".
- Member of the European Society of Biomechanics.
- Scientific committee of the "Congrès de la Société de Biomécanique"

SCIENTIFIC COLLABORATIONS

- Biofluid group, Laboratoire Matière et Systèmes Complexes, René Diderot University, France
- Cardiovascular mechanics and biofluid dynamics research unit, Ghent University, Belgium
- Cardiovascular biomechanics research group, IRPHE, University of Marseilles, France
- Cardiovascular et thoracic surgery service, St-Luc University hospital, Belgium
- Departement of experimental surgery, Université catholique de Louvain, Belgium
- Pulmonary service, Necker hospital Paris, France
- Cenaero, center of excellence in simulation technologies for aeronautics, Charleroi, Belgium
- FluidDA, center of simulation in applied fluid and structural dynamics, Antwerp, Belgium
- Department of mathematics and statistics, Université Laval, Quebec
- Jean le Rond d'Alembert Institute, Pierre&Marie Curie University, France

REFEREED JOURNAL ARTICLES

[1] E. Marchandise, C. Carton de Wiart, W.G. Vos, C. Geuzaine, and J-F. Remacle, "High quality surface remeshing using harmonic maps. part ii : Surfaces with high genus and of large aspect ratio," *International Journal for Numerical Methods in Engineering*, p. accepted, 2010.

[2] J. Szewczyk, E. Marchandise, P. Flaud, L. Royon, and R. Blanc, "Active catheters for neuroradiology," *Journal of Robotics ans Mechatronics*, vol. 23, no. 1, pp. (ID : Rb23–1–4472), to appear in 2011.

[3] E. Marchandise, G. Compère, M. Willemet, G. Bricteux, C. Geuzaine, and J.-F. Remacle, "Quality meshing based on stl triangulations for biomedical simulations," *International Journal for Numerical Methods in Biomedical Engineering*, vol. 83, pp. 876–889, 2010.

[4] J.-F. Remacle, C. Geuzaine, G. Compère, and E. Marchandise, "High quality surface meshing using harmonic maps," *International Journal for Numerical Methods in Engineering*, vol. 83, pp. 403–425, 2010.

[5] V. Lacroix, M. Willemet, E. Marchandise, and R. Verhelst, "An hemodynamicnext study of the lower limb arterial network and its application in a model for predictive bypass surgery," *Artery Research*, vol. 2, no. 3, pp. 96, 2008.

[6] E. Marchandise, L. Royon, P. Flaud, J. Szewczyk, and R. Blanc, "Thermal and hydrodynamic modeling of active catheters for the neuroradiology," *Computer Methods in Biomechanics and Biomedical Engineering*, accepted 2010.

[7] E. Marchandise and P. Flaud, "Accurate modelling of unsteady flows in collapsible tubes," *Computer Methods in Biomechanics and Biomedical Engineering*, vol. 13, no. 2, pp. 279–290, 2010.

[8] E. Marchandise, M. Willemet, and V. Lacroix, "A numerical hemodynamic tool for predictive vascular surgery," *Medical Engineering & Physics*, vol. 31, pp. 131–144, 2009.

[9] G. Compère, E. Marchandise, and J.-F. Remacle, "Transient adaptivity applied to two-phase incompressible flows," *Journal of Computational Physics*, vol. 227, pp. 1923–1942, 2008.

[10] E. Marchandise, P. Geuzaine, N. Chevaugeon, and J.-F. Remacle, "A stabilized finite element method using a discontinous level set approach for the computation of bubble dynamics," *Journal of Computational Physics*, vol. 225, no. 1, pp. 949–974, 2007.

[11] E. Marchandise and J.-F. Remacle, "A stabilized finite element method using a discontinous level set approach for solving two phase incompressible flows," *Journal of Computational Physics*, vol. 219, no. 2, pp. 780–800, 2006.

[12] E. Marchandise, J.-F. Remacle, and N. Chevaugeon, "A Quadrature free discontinuous Galerkin method for the level set equation," *Journal of Computational Physics*, vol. 212, no. 1, pp. 338–357, 2006.

[13] E. Marchandise, N. Chevaugeon, and J.-F. Remacle, "Spatial and spectral superconvergence of discontinuous galerkin method for hyperbolic problems," *Journal of Computational and Applied Mathematics*, vol. 215, no. 2, pp. 484–494, 2008.

[14] J.-F. Remacle, N. Chevaugeon, E. Marchandise, and C. Geuzaine, "Efficient visualization of high order finite elements," *International Journal for Numerical Methods in Engineering*, vol. 69, no. 4, pp. 750–771, January 2006.

REFEREED PROCEEDING PAPERS

[1] M. Willemet, G. Compère, J.-F Remacle, and E. Marchandise, "Simulation-based femoro-popliteal bypass surgery," in *IFMBE Proceedings, 4th European Conference of the International Federation for Medical and Biological Engineering*, 2009, vol. 22, pp. 2568–2570.

[2] B. Herman, L. Warnier, E. Marchandise, and B. Raucent, "Apprentissage actif de la conception en genie biomedical - mesure de l'efficacite pedagogique par une autoevaluation des competences acquises par les etudiants," in *Rencontres Pedagogie et Formations d'Ingenieurs. Quelles pedagogies pour quelles competences ?*, Toulouse, 2009, pp. 231–236.

[3] G. Compere, J.-F. Remacle, and E. Marchandise, "Transient mesh adaptivity with large rigid-body displacements," in *Proceedings of the 17th International Meshing Roundtable*, Springer Berlin Heidelberg, Ed., 2008, vol. 3, pp. 213–230.

[4] E. Marchandise, P. Geuzaine, and J.-F Remacle, "Level set based parallel computations of unsteady free surface flows," in *Proceedings of the European Conference on Computational Fluid Dynamics*, P. Wesseling, E. Onate, and J. Periaux, Eds., Egmond aan Zee, the Netherlands, September 2006, vol. 1.

[5] E. Marchandise, N. Chevaugeon, P. Geuzaine, and J.-F Remacle, "A discontinuous galerkin level-set formulation for 3d two-phase flows with surface tension," in *Proceedings of Euromech Colloquium 479 : Numerical Simulation of Multiphase Flow with Deformable Interfaces*, Scheveningen, the Netherlands, August 2006, vol. 1.

[6] J.-F. Remacle, S. Soares Frazao, and E. Marchandise, "Adaptative discontinuous galerkin method for the shallow water equation," in *4th European Congress on Computational Methods in Applied Sciences and Engineering*, Jyväskylä, Finland, July 2004, vol. 2, pp. 465–466.

REFEREED ABSTRACTS/PRESENTATIONS

[1] V. Lacroix, M. Willemet, E Marchandise, and R. Verhelst, "Peripheral arterial stiffness assessment for vascular diseased patients : Feasibility of methods and comparison with central pulse wave velocity.," in *Artery10 conference*, Palazzo della Gran Guardia, Verona, Italy, 17-19 October 2010.

[2] V. Lacroix, M. Willemet, E. Marchandise, P. Astarci, and R. Verhelst, "Numerical approach of vascular bypass surgery : feasibility and early results.," in *28èmes Journées de l'Hypertension Artérielle,*, Paris, 2008.

[3] M. Willemet, G. Compere, J.-F Remacle, and E Marchandise, "Simulation-based femoro-popliteal bypass surgery," in *Proceedings of eMBEC : 4th European Congress for Medical and Biomedical Engineering*, Antwerp, 2008.

[4] V. Lacroix, M. Willemet, E Marchandise, and R. Verhelst, "An hemodynamic study of the lower limb arterial network and its application in a model for predictive bypass surgery," in *Artery8 conference*, 2008.

[5] M Willemet, E Marchandise, V. Lacroix, and J.-F. Remacle, "Optimisation of lower limb bypass surgery hemodynamics with a patient specific 1d-0d model," in *Proceedings ECCOMAS Conference*, Venice, 2008.

[6] E. Marchandise, P. Flaud, P. Guesdon, and M. Fullana, "The effect of walking on the leg venous pressure : numerical and experimental modeling," in *Proceedings of the 16th Congress European Society of Biomechanics*, Lucerne, Switzerland, July 2008.

[7] E. Marchandise, L. Royon, P. Flaud, and J. Szewczyk, "Active catheters prototyping : application for neuroradiology," in *8th. World Congress on Computational Mechanics and 5th European Congress on Computational Methods in Applied Sciences and Engineeering*, Venice, Italy, July 2008.

[8] M. Willemet, V. Lacroix, and E. Marchandise, "A numerical hemodynamic tool for predictive vascular surgery.," in *27es Journées de l'Hypertension Artérielle. First International Meeting of the French Society of Hypertension Paris*, Paris, Palais des Congrès, 14 december 2007.

[9] M. Willemet, V. Lacroix, and E. Marchandise, "A numerical hemodynamic tool for predictive vascular surgery," in *Fifth physiological Flow Meeting*, Imperial College London, 3-4 september 2007.

[10] E. Marchandise, "Cardiovascular modeling and simulation application," in *Les séminaires de mécanique*, Université catholique de Louvain, 26 october 2007.

[11] E. Marchandise and V. Lacroix, "Nhemo : Un outil numérique d'analyse hemodynamique de pontages artériels des membres inférieurs.," in *GDR2760 Interaction Fluide Structure Biologique*, Institut de recherches sur les phénomènes hors équilibre. Université de Marseilles., 9-10 may 2007.

[12] E. Marchandise, "Modeling of three-dimensional two-phase flows," in *Séminaire de thermodynamique*, Université catholique de Louvain, Belgium, 31 March 2006.

[13] E. Marchandise and P. Geuzaine, "Level set based parallel computations of unsteady free surface flows," in *Proceedings of the European conference on Computational Fluid Dynamics*, Egmond aan Zee, the Netherlands, 7 September 2006.

[14] E. Marchandise and J.-F. Remacle, "A discontinuous galerkin level-set formulation for 3d two-phase flows with surface tension," in *Proceedings of Euromech Colloquium 479 : Numerical Simulation of Multiphase Flow with Deformable Interfaces*, Scheveningen, the Netherlands, 14 August 2006.

[15] E. Marchandise and J.-F. Remacle, "A stabilized finite element method using a discontinuous level set approach for solving two phase incompressible flows," in *Seventh World Congress on Computational Mechanics*, Los Angeles, California, July 2006.

[16] N. Chevaugeon, J.-F Remacle, and E. Marchandise, "p-adaptivity used as a timestep optimizer," in *Proceedings of the MIT conference on computational fluid and solid mechanics*, Boston, U.S.A., June 2005.

[17] L. Georges, E. Marchandise, and P. Geuzaine, "Improving RANS solvers on unstructured meshes : Applications to the flow past a sphere," in *Proceedings of the MIT conference on computational fluid and solid mechanics*, Boston, U.S.A., June 2005.

[18] E. Marchandise, J.-F. Remacle, and N. Chevaugeon, "On the simulation of two-phase flows with a quadrature-free discontinuous Galerkin method for the level set equation," in *Proceedings of the MIT conference on computational fluid and solid mechanics*, Boston, U.S.A., June 2005.