Department of Earth Science and Engineering
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Nicolas Barral

Research associate à Imperial College London

Expérience professionnelle

2016 - **Research Associate**, *Imperial College London, Department of Earth Science and Engineering.*
Adaptation de maillage appliquée à la modélisation de l'océan.

2012 - 2015 **Doctorant**, *Inria - Projet Gamma3.*
Encadrant : F. Alauzet. Adaptation de maillage pour géométries mobiles en 3D.

Fév. - Mai 2013 **Visiteur**, *Missippi State University.*
Comparaison de techniques de bouger de maillage.

2011-2012 **Stages de master (2 fois 6 mois)**, *Inria - Projet Gamma3.*
Encadrant : F. Alauzet. Adaptation de maillage instationnaire.

Formation

2018 **Software Carpentry Foundation**, *Instructeur certifié.*

2015 **PhD**, *Inria / Université Paris 6 Pierre et Marie Curie.*

2012 **Master**, *École Centrale Paris*, mention TB.
Master Modélisation et Simulation, co-habilité INSTN, ENSTA, ECP et ENS.

2012 **Diplôme d'ingénieur**, *École Centrale Paris.*
Option Mathématiques Appliquées (méthodes numériques, calcul stochastique, data mining).

Enseignement

2018- **Imperial College London**, *Applying Computational Science.*
ACSE MSc, examinateur (8h), coordinateur : G. Collins

2018- **Imperial College London**, *Modern Programming Techniques.*
ACSE MSc, 4 amphis (12h) + TDs, coordinateur : G. Gorman.

2017- **Imperial College London**, *Numerical Methods 1.*
L1, amphis + TDs, 30h, coordinateur : G. Gorman.

2018 **Imperial College London**, *Shell & git workshop.*
L2, atelier de 2 jours (12h), Instructeur principal.

2016- **Imperial College London**, *Introduction to programming for geoscientists.*
L1, amphis + TDs, 30h, coordinateur : G. Gorman (2016-17) puis N. Barral (2018).

2014 **École Centrale Paris**, *Analyse théorique et numérique des EDPs.*
1ère année d'école d'ingénieur (L3), 20h, coordinatrice : P. Lafitte.

Encadrement

2017- **Imperial College London**, *Joe Wallwork.*
MRes+PhD, Méthodes adaptatives pour la propagation de tsunamis. Encadrant principal : M. Piggott

Compétence

Mathématiques Analyse et méthodes numériques. Adaptation de maillage. Solvers ALE

Physique CFD : Euler compressible, SWE.

Informatique Langages : C, C++, Perl, Python, MatLab, Maple, R ; HPC : threads, MPI.

Financements et bourses

2017-2018 **eCSE 11 grant** , *9 month, ARCHER Service*.
Adaptation de maillage parallele dans PETSc/DMPlex.

2016-2017 **Industrial project**, *Imperial College-Weir Group*.
Simulation de pompes centriguges.

2013-2015 **ANR project MAIDESC**.
Maillages adaptatifs pour les interfaces instationnaires avec déformations, étirements, courbures.
Partenaires : Inria, Univ. Montpellier, Univ. Bordeaux, Ecole des Mines de Paris.

2013 **Bourse**, *Fondation Sciences Mathématiques de Paris*.
Bourse pour un séjour de 4 mois à Mississippi State University.

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List of publications

Journal articles

— **Three-dimensional CFD simulations with large displacement of the geometries using a connectivity-change moving mesh approach**, N. Barral and F. Alauzet, Engineering with Computers, 2018.
— **Time-accurate anisotropic mesh adaptation for three-dimensional time-dependent problems with body-fitted moving geometries**, N. Barral, G. Olivier and F. Alauzet, Journal of Computational Physics, 2017.
— **Geometric validity (positive Jacobian) of high-order Lagrange finite elements, theory and practical guidance**, P.L. George, H. Borouchaki and N. Barral, Engineering with Computers, 2015.

Preprints

— **Anisotropic mesh adaptation in Firedrake with PETSc DMPlex**, N. Barral, M.G. Knepley, M. Lange, M.D. Piggott and G.J. Gorman, 25th International Meshing Roundtable, Washington DC, USA, September 2016.
— **Construction and geometric validity (positive Jacobian) of serendipity Lagrange finite elements, theory and practical guidance**, P.L. George, H. Borouchaki and N. Barral, to be published.

Proceedings with peer review

— **Verification of Unstructured Grid Adaptation Components**, M. Park, A. Balan, W. Anderson, M. Galbraith, P. Caplan, H. Carson, T. Michal, J. Krakos, D. Kamenetskiy, A. Loseille, F. Alauzet, L. Frazza, and N. Barral, AIAA Scitech 2019 Forum, AIAA Paper 2019-1723, San Diego, CA, USA, Jan 2019.
— **Unstructured Grid Adaptation and Solver Technology for Turbulent Flows**, M. Park, N. BArral, D. Ibanez, D. Kamenetskiy, J. Krakos, T. Michal and A. Loseille, 56th AIAA Aerospace Sciences Meeting, AIAA Paper 2018-1103, Kissimmee, FL, USA, Jan 2018.
— **First Benchmark of the Unstructured Grid Adaptation Working Group**, D. Ibanez, N. Barral, J. Krakos, A. Loseille, T. Michal and M. Park, Proc. of the 26th International Meshing Roundtable, Procedia Engineering, vol 203, pp. 154-166, Washington DC, USA, 2017.
— **Metric-based anisotropic mesh adaptation for three-dimensional time-dependent problems involving moving geometries**, N. Barral, F. Alauzet and A. Loseille, 53th AIAA Aerospace Sciences Meeting, AIAA Paper 2015-2039, Kissimmee, FL, USA, Jan 2015.
— **Two mesh deformation methods coupled with a changing-connectivity moving mesh method for CFD Applications**, N. Barral, E. Luke and F. Alauzet, Proc. of the 23th International Meshing Roundtable, Procedia Engineering, vol 82, pp. 213-227, London, England, 2014.
— **Large displacement body-fitted FSI simulations using a mesh-connectivity-change moving mesh strategy**, N. Barral and F. Alauzet, 44th AIAA Fluid Dynamics Conference, AIAA Paper 2014-2773, Atlanta, GA, USA, June 2014.

Communications

— **Tidal power plant modelling using anisotropic mesh adaptation in Thetis**, N. Barral, A. Angeloudis, S. Kramer, G. Gorman and M. Piggott, Firedrake '18 : The Firedrake user and developer workshop, London, UK, 2018.
— **An anisotropic mesh adaptation approach for regional tidal energy hydrodynamics modelling**, N. Barral, A. Angeloudis, S. Kramer, G. Gorman and M. Piggott, EGU, Vienna, Austria, 2018.
— **Anisotropic mesh adaptation in Firedrake**, N. Barral, M.G. Knepley, M. Lange, M.D. Piggott and G.J. Gorman, Firedrake '17 : The Firedrake user and developer workshop, London, UK, 2017.

— **Parallel anisotropic mesh adaptation with DMPlex and Pragmatic**, N. Barral, M.G. Knepley, M. Lange, M.D. Piggott and G.J. Gorman, ADMOS 2017, Verbania, Italy, June 2017.
— **Anisotropic mesh adaptation in DMPlex**, N. Barral and M. Knepley, PETSc users meeting, Boulder, CO, USA, 2017.
— **Anisotropic mesh adaptation in Firedrake with PETSc DMPlex**, N. Barral, M.G. Knepley, M. Lange, M.D. Piggott and G.J. Gorman, 25th IMR, Washington DC, September 2016.
— **Anisotropic error estimates for adapted dynamic meshes**, N. Barral and F. Alauzet, ADMOS 2015, Nantes, France, June 2015.
— **Large displacement simulations with an efficient mesh-connectivity-change moving mesh strategy**, N. Barral and F. Alauzet, WCCM 2014, Barcelona, Spain, July 2014.
— **Parallel time-accurate anisotropic mesh adaptation for time-dependent problems**, N. Barral and F. Alauzet, WCCM 2014, Barcelona, Spain, July 2014.

Research reports

— **Moving mesh methods in Fluidity and Firedrake**, T. McManus, J. Percival, B. Yeager, N. Barral G. Gorman and M. Piggott, 2017.
— **Carreaux Bézier-Serendip de degré arbitraire**, P.L George, H. Borouchaki and N. Barral, INRIA RR-8624, 2014.
— **Construction et validation des éléments Serendip associés à un carreau de degré arbitraire**, P.L George, H. Borouchaki and N. Barral, INRIA RR-8572, 2014.
— **Construction et validation des éléments réduits associés à un carreau simplicial de degré arbitraire**, P.L George, H. Borouchaki and N. Barral, INRIA RR-8571, 2014.

Ph.D. thesis

— **Time-accurate anisotropic mesh adaptation for three-dimensional moving mesh problems**, N. Barral, Université Pierre et Marie Curie, 2015.

Talks and seminars

— **Framework pour des simulations côtières avec adaptation de maillage anisotrope**, Rencontres MathOcéan, Bordeaux, Janvier 2019.
— **Adaptation de maillage anisotrope pour simulations instationnaires**, Séminaire Calcul Scientifique et Modélisation, Institut Mathématique de Bordeaux, Bordeaux, Octobre 2018.
— **Time-accurate anisotropic mesh adaptation for three-dimensional moving mesh problems**, N. Barral, AMCG Seminar, Imperial College, London, December 2015.
— **Adaptation de maillages non structurés pour des problèmes instationnaires, et maillage en géométrie mobile**, N. Barral, Numerical Analysis and PDEs Seminar, Ecole Centrale Paris, November 2014.
— **Du réel au numérique : la science des maillages**, P.L. George and N. Barral, Pint of Science, 2015.

Awards

— **IMR Meshing Contest Award**, 23th International Meshing Roundtable, London, October 2014.