Jonathan Viquerat

Research Engineer
PhD in applied mathematics

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Personal webpage

Professional experience

2018 – Present **Research engineer**, *CEMEF Mines ParisTech, (Sophia Antipolis, France)*, CFL research group, Topic : Machine learning for CFD problems (MINDS project).
Reference : Elie Hachem, elie.hachem@mines-paristech.fr, +33 4 93 95 74 58

2015 – 2018 **Research engineer**, *INRIA, (Sophia Antipolis, France)*, Nachos project-team, Topic : Development of a discontinuous Galerkin solver suite for nano-optics problems.
Reference : Stéphane Lanteri, stephane.lanteri@inria.fr, +33 4 92 38 77 34

2012 **Master's degree internship (2^{nd} year)**, *INRIA, (Sophia Antipolis, France)*, Nachos project-team, Topic : Discontinuous Galerkin time-domain method for nanophotonics.
Reference : see above

2011 **Master's degree internship (1^{st} year)**, *University College, (London, UK)*, Mechanical engineering department, Topic : Assessment of transcatheter aortic valve devices by numerical simulation on commercial solver.
Reference : Gaetano Burriesci, g.burriesci@ucl.ac.uk, +44 20 7679 3922

Projects

Minds A project bringing together numerical computation and data sciences, including :

- A research activity organized around supervised and reinforcement learning for CFD problems,
- The development of an agnostic coupling interface, in C++ and Python, between numerical simulation codes and machine learning libraries aimed at non-experts,
- The co-advising of two PhD students (J. Chen, *Physically-informed machine learning for turbulent flows* - H. Ghraieb, *Deep reinforcement learning for shape optimization*),
- A website (see `https://cfl-minds.github.io/`),
- Regular seminars, given by experts in the field (`https://www.youtube.com/channel/UCUzBdy7ovH102TvHLtM8pZQ`).

Diogenes Development of a discontinuous Galerkin library in modern Fortran for nano-optics applications. This project included several tasks, such as :

- A parallel discontinuous Galerkin time-domain solver for Maxwell's equations, with an advanced mesh processing library, a mesh partitioning tool, a material processing tool for metal and semiconductor permittivity laws, and a coupling with optimization libraries,
- The computation of a large set of real-life problems, set up in collaboration with academic and industrial partners (CNRS LPMC, Bristol University, C2N, CEA LETI, ...),
- A website (see `https://diogenes.inria.fr/`).

Studies

2012 – 2015 **PhD in applied mathematics and numerical simulation**, *INRIA, (Sophia Antipolis, France)*, Nachos project-team, Topic : Discontinuous Galerkin time-domain method for nanophotonics.
Reference : see above

2009 – 2012 **Engineering degree in applied mathematics**, *ENSTA ParisTech (Paris, France)*.

2011 – 2012 **Master's degree in modelisation and numerical simulation, with distinctions**, *CEA (Saclay, France)*.

2007 – 2009 **"Classes préparatoires" in mathematics, physics and chemistry**, *Lycée Massena (Nice, France)*.

Publications

Accepted J. Viquerat, J. Rabault, A. Kuhnle, H. Ghraieb, E. Hachem, *Direct shape optimization through deep reinforcement learning*, Journal of Computational Physics

Accepted H. Ghraieb, J. Viquerat, A. Larcher, P. Meliga, E. Hachem, *Single-step deep reinforcement learning for open-loop control of laminar and turbulent flows*, Physical Review Fluids

Accepted P. Garnier, J. Viquerat, J. Rabault, A. Larcher, A. Kuhnle, E. Hachem, *A review on deep reinforcement learning for fluid mechanics*, Computer and Fluids

Submitted E. Hachem, H. Ghraieb, J. Viquerat, A. Larcher, P. Meliga, *Deep reinforcement learning for the control of conjugate heat transfer with application to workpiece cooling*, Journal of Computational Physics

Submitted J. Chen, J. Viquerat, E. Hachem, *A twin-decoder structure for incompressible laminar flow reconstruction with uncertainty estimation around 2D obstacles*, Neural Computing and Applications

Submitted J. Viquerat, R. Duvigneau, P. Meliga, A. Kuhnle, E. Hachem, *Policy-based optimization : single-step policy gradient method seen as an evolution strategy*, Computer Methods in Applied Mechanics and Engineering

2020 J. Viquerat, E. Hachem, *A supervised neural network for drag prediction of arbitrary 2D shapes in low Reynolds number flows*, Computers and Fluids, vol. 210, pp. 104645

2019 V. Belus, J. Rabault, J. Viquerat, Z. Che, E. Hachem, U. Reglade, *Exploiting locality and translational invariance to design effective deep reinforcement learning control of the 1-dimensional unstable falling liquid film*, AIP Advances, vol. 9, pp. 125014

2019 J. Viquerat, N. Schmitt, C. Scheid, *Simulating 3D periodic structures at oblique incidences with discontinuous Galerkin time-domain methods : theoretical and practical considerations*, SMAI Journal of Computational Mathematics, vol. 5, pp.131 – 159

2019 J. Viquerat, *Efficient time-domain numerical analysis of waveguides with tailored wideband pulses*, Microwave and Optical Technology Letters, vol. 61, pp. 1534 – 1539

2018 J. Viquerat, *Fitting experimental dispersion data with a simulated annealing method for nano-optics applications*, Journal of Nanophotonics, vol. 12, pp. 036014

2018 N. Schmitt, C. Scheid, J. Viquerat, S. Lanteri, *Simulation of three-dimensional nanoscale light interaction with spatially dispersive metals using a high-order curvilinear DGTD method*, Journal of Computational Physics, vol. 373, pp. 210 – 229

2017 S. Lanteri, C. Scheid, J. Viquerat, *Analysis of a generalized dispersive model coupled to a DGTD method with application to nanophotonics*, SIAM Journal of Scientific Computing, vol. 39, pp. 831 – 859

2016 J. Viquerat, S. Lanteri, *Simulation of near-field plasmonic interactions with a local approximation order discontinuous Galerkin time-domain method*, Photonics and Nanostructures-Fundamentals and Applications, vol. 18, pp. 43 – 58

2016 N. Schmitt, C. Scheid, S. Lanteri, A. Moreau, J. Viquerat, *A DGTD method for the numerical modeling of the interaction of light with nanometer scale metallic structures taking into account non-local dispersion effects*, Journal of Computational Physics, vol. 316, pp. 396 – 415

2015 J. Viquerat, *Simulation of electromagnetic wave propagation in nano-optics with a high-order discontinuous Galerkin time-domain method*, PhD thesis (see `https://www.archives-ouvertes.fr/tel-01272010/`)

2015 J. Viquerat, C. Scheid, *A 3D curvilinear discontinuous Galerkin time-domain solver for nanoscale light-matter interactions*, Journal of Computational and Applied Mathematics, vol. 289, pp. 37 – 50

2014 R. Léger, J. Viquerat, C. Durochat, C. Scheid, S. Lanteri, *A parallel non-conforming multi-element DGTD method for the simulation of electromagnetic wave interaction with metallic nanoparticles*, Journal of Computational and Applied Mathematics, vol. 270, pp. 330 – 342

2013 S. Descombes, C. Durochat, S. Lanteri, L. Moya, C. Scheid, J. Viquerat, *Recent advances on a DGTD method for time-domain electromagnetics*, Photonics and Nanostructures - Fundamentals and Applications, vol. 11, issue 4, pp. 291 – 302

2013 S. Tzamtzis, J. Viquerat, J. Yap, M. J. Mullen, G. Burriesci, *Numerical analysis of the radial force produced by the Medtronic-CoreValve and Edwards-SAPIEN after transcatheter aortic valve implantation (TAVI)*, Medical Engineering and Physics, vol. 35, issue 1, pp. 125 – 130

Conferences

2018 GDR Ondes, Paris (France), *Diogenes : a DG-based software suite for nano-optics problems*

2014 Acomen, Ghent (Belgium), *A curvilinear discontinuous Galerkin time-domain method for nanophotonics*

2014 Meta, Singapore, *Discontinuous Galerkin time-domain method for nanophotonics*

2013 Waves, Tunis (Tunisia), *Discontinuous Galerkin Time-Domain method for nanophotonics*

2012 GDR Ondes, Troyes (France), *Méthode Galerkin discontinue en domaine temporel pour la propagation d'ondes électromagnétiques en nano-optique*

Teaching and supervising

2018 – Present **Co-advisor of three PhD students in the MINDS project**, *CEMEF Mines ParisTech (Sophia Antipolis, France)*.

2019 – Present **Advisor of M.Sc. internships**, *CEMEF Mines ParisTech (Sophia Antipolis, France)*.

2014 – 2016 **Advisor of M.Sc. internships**, *INRIA (Sophia Antipolis, France)*.

2010 – 2011 **Computing science teacher in "Classes préparatoires"**, *Lycée Marcelin Berthelot (Saint-Maur des Fossés, France)*.

Skills

Programming C++, Python, Fortran

HPC MPI, OpenMP

Machine learning Tensorflow

Meshes Gmsh, MeshGems

Post-treatment Paraview, Vizir, Medit

Development Git, CI, CMake, Jenkins, Emacs

Systems Linux, Mac OS, Windows

Misc. LaTeX, HTML, CSS

Languages English (fluent)

Hobbies

Sports Climbing, alpinism, ski-touring, canyoning

Others Photography