

Urbain Vaes

Curriculum Vitae

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Current position

- Since 11/2020 **Postdoctoral researcher**, *MATERIALS team*, Inria and CERMICS (École des Ponts), France.
- Funding from the *Fondation Sciences Mathématiques de Paris*.
 - Research focus: Variance reduction methods for the calculation of transport coefficients in computational statistical physics.

Prior postdoctoral experience

- 2019 – 2020 **Research Associate**, *Imperial College London*, United Kingdom.
- *Postdoc advisers*: Prof G.A. Pavliotis and Prof J.A. Carrillo.
 - *Research group*: Applied and Numerical Analysis.
 - *Teaching*: I was responsible for teaching the course “Computational Stochastic Processes” in the Spring term of 2020.
 - *Research interests*: Numerical methods for Fokker–Planck–Kolmogorov equations; Stochastic methods in molecular dynamics; Mean-field equations for interacting diffusions; Derivative-free methods for inverse problems.

Education

- 2014 – 2019 **Ph.D. in Applied Mathematics**, *Imperial College London*, United Kingdom.
- *Supervisors*: Prof. G.A. Pavliotis and Prof S. Kalliadasis.
 - *Thesis title*: Topics in multiscale modeling: numerical analysis and applications.
 - *Teaching*: I was a graduate teaching assistant for the following courses: *Real analysis* (2015), *Probability and statistics* (2015), *Differential equations* (2016) and *Introduction to numerical analysis* (2016).
- 2013 – 2014 **MRes in Mathematical Sciences**, *Imperial College London*, United Kingdom.
- *Specialization*: Scientific computation.
 - *Thesis*: Simulation of stochastic equations with multiple scales, supervised by Prof. G.A. Pavliotis.
 - *Grade*: distinction (Taught component: 91/100, Research component: 96/100).
- 2011 – 2013 **MSc in Mechanical Engineering**, *Université catholique de Louvain*, Belgium.
- *Specialization*: Numerical methods for solid and fluid mechanics.
 - *Thesis*: Discontinuous Galerkin method for the simulation of 4th order partial differential equations, supervised by Prof. J.-F. Remacle.
 - *Grade*: Summa cum laude.
- 2011 – 2012 **Erasmus exchange**, *Delft University of Technology*, the Netherlands.
- *Grade*: 9/10.
- 2008 – 2011 **BSc in Electrical and Mechanical Engineering**, *Université catholique de Louvain*, Belgium.
- *Grade*: Summa cum laude.

Published and submitted papers

1. *Scaling limits for the generalized Langevin equation* (with G.A. Pavliotis and G. Stoltz). Submitted to *J. Nonlinear Sci.* (July 2020).
2. *Wasserstein stability estimates for covariance-preconditioned Fokker–Planck equations* (with J.A. Carrillo). Accepted for publication in *Nonlinearity* (Sept. 2020).
3. *Mean-field limits for interacting diffusions with colored noise: phase transitions and spectral numerical methods* (with S.N. Gomes and G.A. Pavliotis). *Multiscale Model. Simul.*, 18(3), pp. 1343–1370 (2020).
4. *A linear, second-order, energy stable, fully adaptive finite element method for phase-field modeling of wetting*

phenomena (with B. Aymard, M. Pradas and S. Kalliadasis). J. Comput. Phys. X, 2:100010 (2019).

5. *Spectral methods for multiscale stochastic differential equations* (with A. Abdulle and G.A. Pavliotis). SIAM/ASA J. Uncertain. Quantif. 5(1), pp. 720–761 (2017).

Papers in preparation

- *Consensus-based sampling* (with J.A. Carrillo, F. Hoffmann, A.M. Stuart).
- *Derivative-free Bayesian Inversion Using Multiscale Dynamics* (with G.A. Pavliotis and A.M. Stuart).

Scientific software

- *A Python library for the Hermite spectral method*. <https://github.com/urbainvaes/hermipy>.
- *A FreeFem++ solver for the Cahn-Hilliard equation*. <https://github.com/urbainvaes/cahn-hilliard>.

Presentations and posters

- 02/2020 **Seminar presentation**, *The generalized Langevin equation: long-time behavior and diffusive transport in a periodic potential*, Applied PDEs seminar, Imperial College London.
- 12/2019 **Conference presentation**, *A multiscale derivative-free approach to Bayesian inverse problems*, SIAM Conference on Analysis of Partial Differential Equations, Imperial College London.
- 11/2019 **Seminar presentation**, *The generalized Langevin equation: long-time behavior and diffusive transport in a periodic potential*, Junior Applied Mathematics Seminar (JAMS), Imperial College London.
- 06/2019 **Conference presentation**, *Optimal control for equations of Fokker–Planck type*, The 28th Biennial Numerical Analysis Conference, University of Strathclyde.
- 06/2019 **Seminar presentation**, *The generalized Langevin equation in a periodic potential*, Applied Mathematics Seminar, École Nationale des Ponts et Chaussées.
- 11/2016 **Conference presentation**, *Comparison between the molecular dynamics and Cahn-Hilliard-Navier-Stokes approaches for the simulation of droplet coalescence and wetting phenomena*, Annual Meeting of the APS Division of Fluid Dynamics.
- 02/2016 **Seminar presentation**, *Hermite spectral method for multiscale SDEs and application to multiscale SPDEs*, Applied Mathematics Seminar, École Nationale des Ponts et Chaussées.
- 02/2016 **Conference poster**, *Hermite spectral method for multiscale SDEs*, COSMOS workshop: Computational Statistics and Molecular Simulation, École Nationale des Ponts et Chaussées.
- 12/2015 **Conference presentation**, *Hermite spectral method for multiscale SDEs*, Workshop on Challenges in Statistical Mechanics: from Mathematics to Molecular Dynamics to Technological Applications, Imperial College London.

Other workshops attended

- 06/2015 *New Perspectives in Markov Chain Monte Carlo*, Universidad de Valladolid.
- 07/2014 *Summer School on Stochastic Dynamics*, University of Warwick.

Research visits

- 06/2019 one-week collaboration with Gabriel Stoltz, *École Nationale des Ponts et Chaussées*.
- 02/2016 one-week collaboration with Gabriel Stoltz, *École Nationale des Ponts et Chaussées*.
- 06/2015 one-week collaboration with Assyr Abdulle, *École polytechnique fédérale de Lausanne*.

Awards

- 2015 **Prize for excellence in support of teaching and learning**.
Faculty of Natural Sciences, Imperial College London
- 2008, 2013 **Plus grande distinction avec les félicitations du jury**.
École polytechnique de Louvain

Languages skills

Native French
Fluent English

Intermediate Dutch, Spanish

Software skills

Proficient python, C, C++, java, MATLAB, git, \LaTeX , GNU Make
Intermediate HTML, php, gms, mpi, FreeFem++