Frédéric LEGOLL

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Birth date: December 15, 1975
Citizenship: French

Last update: May 2024

EDUCATION and ACADEMIC POSITIONS

Sept. 2005- Researcher at **Laboratoire Navier**, Ecole des Ponts ParisTech (ENPC).
Civil engineer in chief (since 2011).
Member of the MATHERIALS team-project (Inria), following the MICMAC team-project.
Professor at Ecole des Ponts ParisTech.

Habilitation Thesis defended on October 17, 2011.
Title: Mathematical and numerical study of some models in multiscale simulation of materials (`http://tel.archives-ouvertes.fr/tel-00783334`).

2004-2005 Postdoc in Minneapolis (**Institute for Mathematics and its Applications**), participation in the thematic year "Mathematics of Materials: multiple scales, disorders and singularities". Mentor: Mitchell Luskin.

2001-2004 Ph.D. in applied mathematics, **CERMICS** laboratory, ENPC (including a collaboration with **EDF**, the French electricity supplier), defended on August 31, 2004.
Title: Molecular and multiscale methods for the numerical simulation of materials (`http://cermics.enpc.fr/∼legoll/these_Legoll.pdf`).
Keywords: coupling of atomistic and continuum descriptions of materials, molecular dynamics, numerical analysis of algorithms for Hamiltonian dynamical systems.
Supervisors: Claude Le Bris (CERMICS) and Yvon Maday (University Paris 6).

1998-2001 Student at the **Ecole des Ponts ParisTech**.
First year: Engineer degree of the Ecole des Ponts ParisTech.
Second year: One-year internship with **General Electric** (industrial project management within a team in charge of the design of new industrial breakers).
Third year: Master degree in numerical analysis and scientific computing (DEA d'Analyse Numérique, University Paris 6).

1995-1998 Student at the **Ecole Polytechnique** (Paris). Engineer degree (1998).
Third year: Internship in the Theoretical Physics Dept. of CEA (3 months, under the direction of Paul Bonche). Analysis and numerical simulation of a nuclear physics model ("Bubble-nuclei"). Best physics internship award of the Ecole Polytechnique.

RESEARCH INTERESTS

Mathematical analysis and numerical methods for:

- stochastic homogenization of elliptic PDEs: variance reduction strategies, weakly random materials, parameter identification;
- multiscale problems: Multiscale Finite Element Method (MsFEM) approaches, inverse problems, thin structures (plates);
- molecular dynamics: effective dynamics, reduction of dimension, coarse-graining, multiscale in time problems, parareal algorithms for parallel computation in time-dependent problems, numerical schemes for Hamiltonian problems;
- atomistic to continuum coupling: variational framework, finite temperature setting.

EDITORIAL ACTIVITIES

Member of the Editorial Board of

- SIAM Multiscale Modeling and Simulation (2012-),
- ESAIM Proceedings (2012-),
- Journal of Machine Learning for Modeling and Computing (2024-).

Reviewer for projects submitted to the Agence Nationale de la Recherche (France), EPSRC (UK), FWF (Austria), FNS (Switzerland), DFG (Germany), European Union funding agencies and CECAM.

Reviewer for articles submitted to various journals, including Archive for Rational Mechanics and Analysis, BIT, Computer Methods in Applied Mechanics and Engineering, COCV, CPDE, Discrete and Continuous Dynamical Systems-S, International Journal for Numerical Methods in Engineering, IMA Journal of Numerical Analysis, Journal of Chemical Physics, Journal of Computational Physics, Journal of the Mechanics and Physics of Solids, Journal of Nonlinear Science, Journal of Statistical Physics, M2AN, M3AS, Nonlinearity, SIAM journals.

COMMITTEES

Member of the following Ph.D. thesis / Habilitation committees:

- David Beaujouan (Ph.D. thesis, Orsay University and CEA, Nov. 7, 2012), referee
- Ludovic Chamoin (Habilitation, ENS Cachan, Oct. 11, 2013)
- Yu Cong (Ph.D. thesis, Lorraine University, Dec. 6, 2013)
- Frank Ouaki (Ph.D. thesis, Ecole Polytechnique and IFPEn, Dec. 16, 2013), chairman
- Oleh Krehel (Ph.D. thesis, Eindhoven University, Oct. 13, 2014), referee
- Matteo Capaldo (Ph.D. thesis, ENS Cachan, Nov. 23, 2015)
- Daniel Elfverson (Ph.D. thesis, Uppsala University, Oct. 30, 2015), main referee (opponent)
- Dena Kazerani (Ph.D. thesis, Pierre et Marie Curie University, Nov. 29, 2016), chairman
- Upanshu Sharma (Ph.D. thesis, Eindhoven University, Jan. 12, 2017)
- Brian Staber (Ph.D. thesis, Paris-Est University, June 29, 2018)
- Qingqing Feng (Ph.D. thesis, Ecole Polytechnique, September 20, 2019), referee
- Edoardo Paganoni (Ph.D. thesis, EPFL, August 28, 2020), referee
- Pascal Thibaudeau (Habilitation, Sorbonne Université, April 9, 2021), referee

- Amandine Boucart (Ph.D. thesis, Institut Polytechnique de Paris, April 4, 2023), referee

Member of the Scientific Committee of the SciCADE 2015 Conference (Potsdam, Sept. 2015) and of the SciCADE 2017 Conference (Bath, Sept. 2017).

Member of the INRA hiring committee for "Chargé de Recherches" (assistant professor), Spring 2016.

Member of the ANR evaluation committee CES 40 (Fall 2016 – Summer 2019).

SUPERVISION

I participated in the supervision of the following Ph.D. thesis:

- Mouhamad Hammoud, *Modelization and numerical simulation of the coupling between discrete and continuous media* (defended on December 17, 2009; supervisor: D. Duhamel);
- Kimiya Minoukadeh, *Deterministic and stochastic methods for molecular simulation* (defended on November 24, 2010; supervisor: E. Cancès);

I supervised or co-supervised the following Ph.D. thesis:

- Ronan Costaouec, *Numerical methods for homogenization: application to random media* (defended on November 23, 2011);
- Florian Thomines, *Multiscale numerical approaches: Application to homogenization of random materials* (defended on November 21, 2012);
- William Minvielle, *Some problems related to statistical error in stochastic homogenization* (defended on September 25, 2015);
- François Madiot, *Multiscale finite element methods for advection diffusion problems* (defended on December 8, 2016);
- Pierre-Loik Rothé, *Numerical methods for the estimation of fluctuations in multi-scale materials and related problems* (defended on December 12, 2019);
- Adrien Lesage, *Multi-scale methods for calculation and optimization of thin structures* (defended on December 16, 2020);
- Alex Libal, *Probabilistic approaches for fatigue of materials* (resigned on Summer 2022 after 2 years);
- Rutger A. Biezemans, *Multiscale methods: non-intrusive implementation, advection-dominated problems and related topics* (defended on September 21, 2023);
- Simon Ruget, *On the construction of coarse approximation for a Schrödinger problem involving highly oscillatory potential* (defense expected Fall 2025);
- Albéric Lefort, *Multiscale numerical methods for reaction-diffusion equations and related problems* (defense expected Fall 2025);
- Jean Ruel, *Certified and robust reduced models for the simulation of elongated structures* (defense expected Fall 2026);

I mentored the following Postdoctoral researchers:

- Matthew Dobson, September 2009 – June 2012
- Kun Li, September 2011 – July 2013
- Simon Lemaire, June 2014 – June 2015
- Thomas Hudson, September 2014 – August 2016

- Michael Bertin, March 2015 – February 2016
- Upanshu Sharma, March 2017 – July 2019
- Shuyang Xiang, June 2017 – May 2018
- Olga Gorynina, January 2019 – January 2022
- Amandine Boucart, April 2023 – March 2024

LONG-TERM INVITATIONS

- IPAM Los Angeles, Fall 2017: 4 weeks (core participant within the "Complex high-dimensional energy landscapes" program, Sept.-Dec. 2017).
- IPAM Los Angeles, December 2012: 3 weeks (core participant within the "Materials Defects" program, Sept.-Dec. 2012).
- Texas A & M University, December 2011: 2 weeks (collaboration with Y. Efendiev).
- Minneapolis, May 2009: 3 weeks at the IMA (Institute for Mathematics and its Applications).
- Berlin, July 2008: 3 weeks at the Technische Universität, with participation in the program "Analytical and numerical aspects of partial differential equations".
- Bonn, Spring 2008: 3 weeks with the HIM Junior Trimester Program on Computational Mathematics (Numerical methods in molecular simulation, organized with T. Lelièvre, M. Rousset and G. Stoltz).
- Minneapolis, April 2006: 3 weeks at the IMA (Institute for Mathematics and its Applications), collaboration with M. Luskin and E. Tadmor.

JOURNAL ARTICLES

1. *Survival probability of structures under fatigue: a data-based approach*, arxiv preprint 2403.05397 (with F.-B. Cartiaux, A. Libal and J. Reygner).
2. *Embedded corrector problems for homogenization in linear elasticity*, arxiv preprint 2307.03537 (with V. Ehrlacher, B. Stamm and S. Xiang).
3. *A variance reduction strategy for numerical random homogenization based on the equivalent inclusion method*, Computer Methods in Applied Mechanics and Engineering, vol. 417, part A, 116389, 2023 (with S. Brisard and M. Bertin).
4. *Probabilistic formulation of Miner's rule and application to structural fatigue*, Probabilistic Engineering Mechanics, vol. 74, 103500, 2023 (with F.-B. Cartiaux, A. Ehrlacher, A. Libal and J. Reygner).
5. *Combining machine-learned and empirical force fields with the parareal algorithm: application to the diffusion of atomistic defects*, Comptes Rendus Mécanique, vol. 351 (S1), 479-503, 2023 (with O. Gorynina, T. Lelièvre and D. Perez).
6. *Non-intrusive implementation of a wide variety of Multiscale Finite Element Methods*, Comptes Rendus Mécanique, vol. 351 (S1), 135-180, 2023 (with R.A. Biezemans, C. Le Bris and A. Lozinski).
7. *Non-intrusive implementation of Multiscale Finite Element Methods: an illustrative example*, Journal of Computational Physics, vol. 477, 111914, 2023 (with R.A. Biezemans, C. Le Bris and A. Lozinski).
8. *An introductory review on a posteriori error estimation in Finite Element computations*, SIAM Review, vol. 65 (4), 963-1028, 2023 (with L. Chamoin).

9. *An MsFEM approach enriched using Legendre polynomials*, SIAM Multiscale Modeling and Simulation, vol. 20 (2), 798-834, 2022 (with P.-L. Rothé, C. Le Bris and U. Hetmaniuk).
10. *Mathematical analysis of a coupling method for the practical computation of homogenized coefficients*, Control, Optimisation and Calculus of Variations, vol. 28, 44, 2022 (with O. Gorynina and C. Le Bris).
11. *An adaptive parareal algorithm: application to the simulation of molecular dynamics trajectories*, SIAM Journal on Scientific Computing, vol. 44 (1), B146-B176, 2022 (with T. Lelièvre and U. Sharma).
12. *Some remarks on a coupling method for the practical computation of homogenized coefficients*, SIAM Journal on Scientific Computing, vol. 43 (2), A1273-A1304, 2021 (with O. Gorynina and C. Le Bris).
13. *Parareal computation of stochastic differential equations with time-scale separation: a numerical study*, Computing and Visualization in Science, vol. 23, 9, 2020 (with T. Lelièvre, K. Myerscough and G. Samaey).
14. *Goal-oriented error estimation and adaptivity in MsFEM computations*, Computational Mechanics, vol. 67 (4), 1201-1228, 2021 (with L. Chamoin).
15. *An embedded corrector problem for homogenization. Part II: Algorithms and discretization*, Journal of Computational Physics, vol. 407, 109254, 2020 (with E. Cancès, V. Ehrlacher, B. Stamm and S. Xiang).
16. *Effective dynamics for non-reversible stochastic differential equations: a quantitative study*, Nonlinearity, vol. 32 (12), 4779-4816, 2019 (with T. Lelièvre and U. Sharma).
17. *An embedded corrector problem for homogenization. Part I: Theory*, SIAM Multiscale Modeling and Simulation, vol. 18 (3), 1179-1209, 2020 (with E. Cancès, V. Ehrlacher, B. Stamm and S. Xiang).
18. *Stochastic homogenization of a scalar viscoelastic model exhibiting stress-strain hysteresis*, Mathematical Modelling and Numerical Analysis, vol. 54 (3), 879-928, 2020 (with T. Hudson and T. Lelièvre).
19. *Multiscale Finite Element methods for advection-dominated problems in perforated domains*, SIAM Multiscale Modeling and Simulation, vol. 17 (2), 773-825, 2019 (with C. Le Bris and F. Madiot).
20. *A posteriori error estimation and adaptive strategy for the control of MsFEM computations*, Computer Methods in Applied Mechanics and Engineering, vol. 336, 1-38, 2018 (with L. Chamoin).
21. *Fourier-based numerical approximation of the Weertman equation for moving dislocations*, International Journal for Numerical Methods in Engineering, vol. 113 (12), 1827-1850, 2018 (with M. Josien, Y.-P. Pellegrini and C. Le Bris).
22. *On the best constant matrix approximating an oscillatory matrix-valued coefficient in divergence-form operators*, Control, Optimisation and Calculus of Variations, vol. 24 (4), 1345-1380, 2018 (with C. Le Bris and S. Lemaire).
23. *Stable approximation of the advection-diffusion equation using the invariant measure*, arxiv preprint 1609.04777 (with C. Le Bris and F. Madiot).
24. *Pathwise estimates for an effective dynamics*, Stochastic Processes and their Applications, vol. 127 (9), 2841-2863, 2017 (with T. Lelièvre and S. Olla).
25. *Examples of computational approaches for elliptic, possibly multiscale PDEs with random inputs*, Journal of Computational Physics, vol. 328, 455-473, 2017 (with C. Le Bris).

26. *Stabilisation de problèmes non coercifs via une méthode numérique utilisant la mesure invariante (Stabilization of non-coercive problems using the invariant measure)*, C. R. Acad. Sci. Paris, Série I, vol. 354 (8), 799-803, 2016 (with C. Le Bris and F. Madiot).
27. *An accurate scheme to solve cluster dynamics equations using a Fokker-Planck approach*, Computer Physics Communications, vol. 207, 170-178, 2016 (with T. Jourdan, G. Stoltz and L. Monasse).
28. *A numerical comparison of some Multiscale Finite Element approaches for advection-dominated problems in heterogeneous media*, Mathematical Modelling and Numerical Analysis, vol. 51 (3), 851-888, 2017 (earlier extended version: arxiv preprint 1511.08453) (with C. Le Bris and F. Madiot).
29. *Some variance reduction methods for numerical stochastic homogenization*, Philosophical Transactions of the Royal Society A, vol. 374 (2066), 20150168, 2016 (with X. Blanc and C. Le Bris).
30. *Special Quasirandom Structures: a selection approach for stochastic homogenization*, Monte Carlo Methods and Applications, vol. 22 (1), 25-54, 2016 (with C. Le Bris and W. Minvielle).
31. *Coupling a reactive potential with a harmonic approximation for atomistic simulations of material failure*, Computer Methods in Applied Mechanics and Engineering, vol. 305, 422-440, 2016 (with I.G. Tejada, L. Brochard, T. Lelièvre, G. Stoltz and E. Cancès).
32. *Stress Gradient elasticity theory: existence and uniqueness of solution*, J. of Elasticity, vol. 123 (2), 179-201, 2016 (with K. Sab and S. Forest).
33. *An embedded corrector problem to approximate the homogenized coefficients of an elliptic equation*, C. R. Acad. Sci. Paris, Série I, vol. 353 (9), 801-806, 2015 (with E. Cancès, V. Ehrlacher and B. Stamm).
34. *Periodic homogenization using the Lippmann–Schwinger formalism*, arXiv preprint 1411.0330 (with S. Brisard).
35. *Combining a reactive potential with a harmonic approximation for molecular dynamics simulation of failure: construction of a reduced potential*, Proceedings of the 2014 ICMSQUARE conference, Journal of Physics: Conference Series, vol. 574, 012041, 2015 (with I.G. Tejada, L. Brochard, G. Stoltz, T. Lelièvre and E. Cancès).
36. *A control variate approach based on a defect-type theory for variance reduction in stochastic homogenization*, SIAM Multiscale Modeling and Simulation, vol. 13 (2), 519-550, 2015 (with W. Minvielle).
37. *A parameter identification problem in stochastic homogenization*, ESAIM Proceedings, vol. 48, 190-214, 2015 (with W. Minvielle, A. Obliger and M. Simon).
38. *An MsFEM type approach for perforated domains*, SIAM Multiscale Modeling and Simulation, vol. 12 (3), 1046-1077, 2014 (with C. Le Bris and A. Lozinski).
39. *Approximation grossière d'un problème elliptique à coefficients hautement oscillants (Coarse approximation of an elliptic problem with highly oscillatory coefficients)*, C. R. Acad. Sci. Paris, Série I, vol. 351 (7-8), 265-270, 2013 (with C. Le Bris and K. Li).
40. *Variance reduction using antithetic variables for a nonlinear convex stochastic homogenization problem*, Discrete and Continuous Dynamical Systems – S, vol. 8 (1), 1-27, 2015 (with W. Minvielle).
41. *Multi-Level Monte Carlo approaches for numerical homogenization*, SIAM Multiscale Modeling and Simulation, vol. 13 (4), 1107-1135, 2015 (with Y. Efendiev and C. Kronsbein).

42. *Effective dynamics for a kinetic Monte-Carlo model with slow and fast time scales*, Journal of Statistical Physics, vol. 153 (6), 931-966, 2013 (with S. Lahbabi).
43. *On a variant of random homogenization theory: convergence of the residual process and approximation of the homogenized coefficients*, Mathematical Modelling and Numerical Analysis, vol. 48 (2), 347-386, 2014 (with F. Thomines).
44. *MsFEM à la Crouzeix-Raviart for highly oscillatory elliptic problems*, Chinese Annals of Mathematics, Series B, vol. 34 (1), 113-138, 2013 (with C. Le Bris and A. Lozinski).
45. *Finite-Temperature Quasi-Continuum*, Applied Mechanics Reviews, vol. 65 (1), 010803, 2013 (with E.B. Tadmor, W.K. Kim, L.M. Dupuy and R.E. Miller).
46. *A micro-macro parareal algorithm: application to singularly perturbed ordinary differential equations*, SIAM Journal on Scientific Computing, vol. 35 (4), A1951-A1986, 2013 (with T. Lelièvre and G. Samaey).
47. *Derivation of Langevin dynamics in a nonzero background flow field*, Mathematical Modelling and Numerical Analysis, vol. 47 (6), 1583-1626, 2013 (with M. Dobson, T. Lelièvre and G. Stoltz).
48. *Multiscale Finite Element approach for "weakly" random problems and related issues*, Mathematical Modelling and Numerical Analysis, vol. 48 (3), 815-858, 2014 (with C. Le Bris and F. Thomines).
49. *Rate of convergence of a two-scale expansion for some "weakly" stochastic homogenization problems*, Asymptotic Analysis, vol. 80 (3-4), 237-267, 2012 (with C. Le Bris and F. Thomines).
50. *Asymptotic behaviour of Green functions of divergence form operators with periodic coefficients*, Applied Mathematics Research Express, vol. 2013 (1), 79-101, 2013 (with X. Blanc and A. Anantharaman).
51. *A numerical strategy for coarse-graining two-dimensional atomistic models at finite temperature: the membrane case*, Computational Materials Science, vol. 66, 84-95, 2013 (with X. Blanc).
52. *Negative thermal conductivity of chains of rotors with mechanical forcing*, Phys. Rev. E, vol. 84 (6), 061108, 2011 (with A. Iacobucci, S. Olla and G. Stoltz).
53. *Symmetric parareal algorithms for Hamiltonian systems*, Mathematical Modelling and Numerical Analysis, vol. 47 (3), 717-742, 2013 (with X. Dai, C. Le Bris and Y. Maday).
54. *Effective dynamics using conditional expectations*, Nonlinearity, vol. 23 (9), 2131-2163, 2010 (with T. Lelièvre).
55. *Symplectic schemes for highly oscillatory Hamiltonian systems: the homogenization approach beyond the constant frequency case*, IMA Journal of Numerical Analysis, vol. 33 (1), 30-56, 2013 (with M. Dobson and C. Le Bris) (earlier extended version: arXiv 1008.1030).
56. *Variance reduction in stochastic homogenization using antithetic variables*, Markov Processes and Related Fields, vol. 18 (1), 31-66, 2012 (with X. Blanc, R. Costaouec and C. Le Bris) (earlier version: `http://cermics.enpc.fr/~legoll/hdr/FL24.pdf`).
57. *Symplectic schemes for highly oscillatory Hamiltonian systems with varying fast frequencies*, C. R. Acad. Sci. Paris, Série I, vol. 348 (17-18), 1033-1038, 2010 (with M. Dobson and C. Le Bris).
58. *Integrators for highly oscillatory Hamiltonian systems: an homogenization approach*, Discrete and Continuous Dynamical Systems – B, vol. 13 (2), 347-373, 2010 (with C. Le Bris).

59. *Finite-temperature coarse-graining of one-dimensional models: mathematical analysis and computational approaches*, Journal of Nonlinear Science, vol. 20 (2), 241-275, 2010 (with X. Blanc, C. Le Bris and C. Patz).
60. *Variance reduction in stochastic homogenization: proof of concept, using antithetic variables*, Boletin Soc. Esp. Mat. Apl., vol. 50, 9-27, 2010 (with R. Costaouec and C. Le Bris).
61. *Thermal conductivity of the Toda lattice with conservative noise*, Journal of Statistical Physics, vol. 140 (2), 336-348, 2010 (with A. Iacobucci, S. Olla and G. Stoltz).
62. *Beyond multiscale and mutiphysics: multimaths for model coupling*, Networks and Heterogeneous Media, vol. 5 (3), 423-460, 2010 (with X. Blanc, C. Le Bris and T. Lelièvre).
63. *Free energy calculations: An efficient adaptive biasing potential method*, Journal of Physical Chemistry B, vol. 114 (17), 5823-5830, 2010 (with B. Dickson, T. Lelièvre, G. Stoltz and P. Fleurat-Lessard).
64. *Approximation numérique d'une classe de problèmes en homogénéisation stochastique (Numerical approximation of a class of problems in stochastic homogenization)*, C. R. Acad. Sci. Paris, Série I, vol. 348 (1-2), 99-103, 2010 (with R. Costaouec and C. Le Bris).
65. *Non-ergodicity of Nosé-Hoover dynamics*, Nonlinearity, vol. 22 (7), 1673-1694, 2009 (with M. Luskin and R. Moeckel).
66. *Coupled Discrete and Continuum Approach to the Behavior of Ballast*, Ninth International Conference on Computational Structures Technology proceeding, Athènes (Sept. 2008) (with M. Hammoud, D. Duhamel and K. Sab).
67. *Some improvements of the Activation-Relaxation Technique method for finding transition pathways on potential energy surfaces*, Journal of Chemical Physics, vol. 130 (11), 114711, 2009 (with E. Cancès, M.-C. Marinica, K. Minoukadeh and F. Willaime).
68. *A temperature control technique for nonequilibrium molecular simulation*, Journal of Chemical Physics, vol. 128 (7), 074105, 2008 (with B. Leimkuhler and E. Noorizadeh).
69. *Some remarks on sampling methods in molecular dynamics*, ESAIM Proceedings, vol. 22, 217-233, 2008 (with T. Lelièvre and G. Stoltz).
70. *Dérivation de schémas numériques symplectiques pour des systèmes hamiltoniens hautement oscillants (derivation of symplectic numerical schemes for highly oscillatory hamiltonian systems)*, C. R. Acad. Sci. Paris, Série I, vol. 344 (4), 277-282, 2007 (with C. Le Bris).
71. *Non-ergodicity of the Nosé-Hoover thermostatted harmonic oscillator*, Archive for Rational Mechanics and Analysis, vol. 184 (3), 449-463, 2007 (with M. Luskin and R. Moeckel).
72. *Theoretical and numerical comparison of some sampling methods for molecular dynamics*, Mathematical Modelling and Numerical Analysis, vol. 41 (2), 351–389, 2007 (with E. Cancès and G. Stoltz).
73. *Analysis of a prototypical multiscale method coupling atomistic and continuum mechanics: the convex case*, Acta Mathematicae Applicatae Sinica, vol. 23 (2), 209-216, 2007 (with X. Blanc and C. Le Bris).
74. *Analysis of a prototypical multiscale method coupling atomistic and continuum mechanics*, Mathematical Modelling and Numerical Analysis, vol. 39 (4), 797-826, 2005 (with X. Blanc and C. Le Bris).
75. *Long-time averaging for integrable Hamiltonian dynamics*, Numerische Mathematik, vol. 100 (2), 211-232, 2005 (with E. Cancès, F. Castella, Ph. Chartier, E. Faou, C. Le Bris and G. Turinici).

76. *High-order averaging schemes with error bounds for thermodynamical properties calculations by molecular dynamics simulations*, Journal of Chemical Physics, vol. 121 (21), 10346-10355, 2004 (with E. Cancès, F. Castella, Ph. Chartier, E. Faou, C. Le Bris and G. Turinici).
77. *Numerical homogenization of nonlinear viscoplastic two-dimensional polycrystals*, Computational and Applied Mathematics, vol. 23 (2-3), 309-325, 2004.
78. *Designing reversible measure invariant algorithms with applications to molecular dynamics*, Journal of Chemical Physics, vol. 117 (23), 10452-10464, 2002 (with R. Monneau).

BOOK CHAPTERS

1. *Introduction to numerical stochastic homogenization and the related computational challenges: some recent developments*, W. Bao and Q. Du eds., Lecture Notes Series, Institute for Mathematical Sciences, National University of Singapore, vol. 22, 197-272, 2011 (with A. Anantharaman, R. Costaouec, C. Le Bris and F. Thomines).
2. *Some remarks on free energy and coarse-graining*, in Numerical Analysis of Multiscale Computations, B. Engquist, O. Runborg and R. Tsai eds., Springer Lecture Notes in Computational Science and Engineering, vol. 82, Springer, 279-329, 2012 (with T. Lelièvre).
3. *Variance reduction in stochastic homogenization: the technique of antithetic variables*, in Numerical Analysis of Multiscale Computations, B. Engquist, O. Runborg and R. Tsai eds., Springer Lecture Notes in Computational Science and Engineering, vol. 82, Springer, 47-70, 2012 (with X. Blanc, R. Costaouec and C. Le Bris).
4. *Multiscale methods coupling atomistic and continuum mechanics: some examples of mathematical analysis*, in Analytical and Numerical Aspects of Partial Differential Equations, E. Emmrich and P. Wittbold eds., de Gruyter (2009), 193-245.

TALKS

- SIAM UQ 2024 conference (Trieste, February 2024)
- 28th International Domain Decomposition (DD28) conference (KAUST university, January 2024)

- International Workshop on Multiscale Model Reduction and Scientific Machine Learning (Hong Kong, December 2023)
- IFPEN-Inria joint laboratory 2023 workshop (Rueil-Malmaison, November 2023)
- COMPLAS conference (Barcelona, September 2023)
- EnuMath conference (Lisbon, September 2023)
- ICIAM 2023 conference (Tokyo, online, August 2023)
- Parallel-in-Time (PinT) 2023 conference (Hamburg, July 2023), **invited speaker**
- ADMOS 2023 conference (Goteborg, June 2023)
- IPAM workshop "Scale-Bridging Materials Modeling at Extreme Computational Scales" (Los Angeles, April 2023)
- Colloquium of the CRC 1114 "Scaling Cascades in Complex Systems" (Berlin, January 2023)

- Numerical Analysis seminar of the Department of Mathematics of the University of Hong Kong (Online seminar, October 2022)
- Congrès Français de Mécanique (CFM) 2022 (Nantes, August 2022), **keynote lecture**
- WCCM congress (Yokohama, online, August 2022), **keynote lecture**
- Parallel-in-Time (PinT) 2022 conference (Marseille, July 2022)
- Seminar within the CEA-EDF-Inria summer school on "Certification d'erreurs dans des simulations numériques" (Saclay, June 2022)
- ECCOMAS 2022 congress (Oslo, June 2022)
- Annual meeting of the TIME-X project (Leuven, April 2022)
- EMMC 2022 conference (Oxford, April 2022)
- Workshop of the ANR QuAMProcs project (Paris, March 2022)

- Workshop on "Generalized Langevin Equations in classical and quantum simulations" (Paris, October 2021)
- 2nd French-German workshop on Multiscale Problems (Besançon, September 2021)
- COMPLAS 2021 conference (Barcelona, September 2021)
- USNCCM congress (Chicago, online, July 2021)
- Mittag-Leffler Institute workshop on "New trends in numerical multiscale methods and beyond" (Stockholm, online, July 2021)
- ADMOS 2021 conference (Goteborg, online, June 2021)
- SIAM conference on Mathematical Aspects of Materials Science (Bilbao, online, May 2021)
- WCCM congress (Paris, online, January 2021)

- 26th International Domain Decomposition (DD26) conference (Hong-Kong, online, December 2020)
- French-German workshop on multiscale problems (Augsburg University, online, June 2020)
- Workshop on "Multiscale methods for deterministic and stochastic dynamics" (Geneva, January 2020)

- MORTech 2019 workshop (Paris, November 2019)
- Workshop on "New trends in asymptotic methods for multiscale PDEs" (Karlstad, Sweden, October 2019)
- COMPLAS 2019 conference (Barcelona, September 2019)
- ICIAM 2019 conference (Valencia, Spain, July 2019)
- Weekly seminar of the Laboratoire de Mécanique et d'Acoustique (LMA, Marseille, June 2019)
- MAFELAP (Mathematics of Finite Elements and Applications) 2019 conference (London, June 2019)
- Coupled problems 2019 conference (Barcelona, June 2019)
- ADMOS 2019 conference (Alicante, Spain, May 2019)
- 14th Colloque National en Calcul des Structures (Giens, May 2019)
- CECAM workshop "Big data and Uncertainty Quantification" (Lausanne, March 2019)

- Weekly seminar on ”Probabilités, Statistiques, Contrôle” of ENSTA (Palaiseau, March 2019)
- SIAM CSE 2019 conference (Spokane, USA, February 2019)
- University of Chicago CAMP seminar (Chicago, February 2019)

- NumDiff 15 conference (Halle, September 2018)
- AIMS conference (Taipei, July 2018)
- University of Chicago CAMP seminar (Chicago, May 2018)
- EMMC 2018 conference (Nantes, March 2018)

- Workshop on “UQ for Stochastic Systems and Applications” (IPAM, November 2017)
- MORTech 2017 conference (Sevilla, November 2017), **keynote lecture**
- Numerical analysis weekly seminar (Geneva University, October 2017)
- Multiscale theory and computation conference (Minneapolis, September 2017)
- SciCADE conference (Bath, September 2017)
- COMPLAS 2017 conference (Barcelona, September 2017)
- USNCCM congress (Montreal, July 2017)
- CIMPA Summer school on multiscale methods (Lucknow, India, July 2017)
- ADMOS 2017 conference (Verbania, Italy, June 2017)
- UNCECOMP conference (Rhodes Island, June 2017)
- University of Chicago CAMP seminar (Chicago, April 2017)
- HIM workshop on “Numerical Inverse and Stochastic Homogenization” (Bonn, February 2017)
- Mini CASA workshop (Eindhoven, January 2017)

- IFPEn weekly seminar (Paris, December 2016)
- CASA weekly seminar (Eindhoven, November 2016)
- Workshop on “Recent developments in numerical methods for model reduction” (Paris, November 2016)
- MMM 2016 conference (Dijon, October 2016)
- EMMC 2016 conference (Brussels, Sept. 2016)
- WCCM congress (Seoul, July 2016), **keynote lecture**
- AIMS conference (Orlando, July 2016)
- Weekly seminar of the LMS laboratory (Ecole Polytechnique, June 2016)
- ECCOMAS 2016 congress (Hersonissos, Greece, June 2016)
- EMI-PMC 2016 conference (Nashville, May 2016)

- NEEDS – Porous media workshop (Paris, December 2015)
- PDEs and Probability days on “Random homogenization” (Paris, December 2015)
- Workshop “Gradient flows, Large deviations and Applications” (Eindhoven, November 2015)
- Workshop “Reduced Basis, POD and PGD Model Reduction Techniques” (ENS Cachan, November 2015)
- Weekly seminar of Numerical Analysis (KTH, Stockholm, October 2015)

- Workshop on "Mathématiques appliquées et nanoélectronique" (Grenoble, September 2015)
- SciCADE conference (Potsdam, September 2015)
- ICIAM conference (Beijing, August 2015)
- Workshop on "Multiscale Modeling and Analysis in Materials Science" (Shanghai, August 2015)
- BIRS workshop on the "Developments in the Theory of Homogenization" (Banff, July 2015)
- BIRS workshop on "Free-energy calculations: a mathematical perspective" (Oaxaca, July 2015)
- Equadiff conference (Lyon, July 2015)
- Second Reunion Conference of the IPAM "Materials Defects" program (Lake Arrowhead, June 2015)
- Workshop on "Dimension reduction: mathematical methods and applications" (Penn State University, March 2015)
- Euromech Colloquium on "Multiscale Computational Methods for bridging scales in materials and structures" (Eindhoven, February 2015)
- GdR ModMat annual meeting (Lyon, January 2015)

- GdR ModMat workshop "De l'atome au code industriel" (Marseille, December 2014)
- Annual NEEDS meeting (Nantes, October 2014)
- 7th International Conference on Multiscale Materials Modeling (MMM-14) (Berkeley, October 2014)
- BIRS workshop on "Multiscale Models of Crystal Defects" (Banff, September 2014)
- WCCM congress (Barcelona, July 2014)
- AIMS conference (Madrid, July 2014)
- 8th Int. Workshop on Parallel Matrix Algorithms and Applications (PMAA 2014, Lugano, July 2014)
- Workshop on "Computational Multiscale Methods" (Oberwolfach, June 2014)
- First Reunion Conference of the IPAM "Materials Defects" program (Lake Arrowhead, June 2014)
- Augsburg-Munich joint weekly seminar (Augsburg, May 2014)
- USACM workshop on "Computational Aspects of Multiscale Materials Modeling" (Evanston, May 2014)
- GSSI International Workshop, "From Atomistic to Continuum Models in Materials Science" (L'Aquila, April 2014)
- Imperial College weekly seminar (London, February 2014)

- Workshop on "Computational coarse-graining of many-body systems" (Warwick, December 2013)
- Workshop "Stochastic Modeling of Multiscale Systems" (Eindhoven, December 2013)
- MoMaS Multiphase Seminar Days (Orsay, October 2013)
- SciCADE conference (Valladolid, September 2013)
- CEMRACS summer school (Marseille, August 2013)
- SES 50th Annual Technical Meeting (Providence, July 2013)

- USNCCM congress (Raleigh, July 2013)
- SIAM conference on Mathematical Aspects of Materials Science (Philadelphia, June 2013)
- Workshop on slow-fast dynamics (Barcelona, June 2013)
- 11th Colloque National en Calcul des Structures (Giens, May 2013)
- Workshop on "Multiscale modelling and simulation in material science" (Shanghai, April 2013)
- Workshop on "Interplay of Theory and Numerics for Deterministic and Stochastic Homogenization" (Oberwolfach, March 2013)
- **Weekly seminar of the Jacques-Louis Lions laboratory (Paris, March 2013)**
- Weekly seminar of the Mathematics Department (Université de Besançon, February 2013)

- Culminating workshop of the IPAM "Materials Defects" program (Lake Arrowhead, December 2012)
- Workshop on "Computational Methods for Multiscale Modeling of Materials Defects" (IPAM, December 2012)
- "Homogenization and multiple scales" weekly seminar (Paris 6 University, November 2012)
- BIRS workshop on "Nonequilibrium Statistical Mechanics" (Banff, November 2012)
- Kickoff meeting of the "Laboratoire International Associé Nancy/UIUC" (Nancy, November 2012)
- 22nd Int. Workshop on Computational Mechanics of Materials (Baltimore, September 2012)
- NumDiff 13 Conference (Halle, September 2012)
- ECCOMAS 2012 congress (Wien, September 2012)
- WCCM congress (Sao Paulo, July 2012)
- AIMS conference (Orlando, July 2012)
- CECAM workshop "Free energy calculations: from theory to applications" (Paris, June 2012)
- Workshop "Mathematics meets chemistry and physics" (Erlangen, March 2012)
- American Physical Society March Meeting (Boston, March 2012)
- Workshop on "Mathematical theory and computational methods for multiscale problems" (Singapore, January 2012)

- Numerical analysis seminar, Texas A & M University (College Station, November 2011)
- GdR CHANT workshop "Interactions EDP/probas: modèles probabilistes pour la simulation moléculaire" (Grenoble, November 2011)
- EMS School on Mathematics for Multiscale Phenomena (Bedlewo, October 2011)
- Summer school of the Large Scale Initiative FUSION (Paris, September 2011)
- Workshop on "Mathematics in Materials Science" (Beijing, September 2011)
- ENUMATH conference (Leicester, September 2011)
- USNCCM congress (Minneapolis, July 2011)
- ICIAM conference (Vancouver, July 2011)
- AMS von Neumann symposium on "Multimodel and multialgorithm coupling for multiscale problems" (Snowbird, July 2011)

- Workshop on "Coarse-graining of many body systems" (Heraklion, June 2011)
- Workshop on "Ginzburg-Landau equations, Dislocations and Homogenization"(Ile de Ré, May 2011)
- 10th Colloque National en Calcul des Structures (Giens, May 2011)
- Caltech ACM Seminar (Pasadena, April 2011)
- BIRS workshop on "Stochastic multiscale methods" (Banff, March 2011)
- Weekly seminar, Fraunhofer Institute (Kaiserslautern, March 2011)
- Weekly seminar of the POEMS project-team (Paris, February 2011)
- Annual conference of the Spanish Mathematics Society (Avila, February 2011)
- Mini-workshop "Mathematical analysis for peridynamics"(Oberwolfach, January 2011)
- Workshop on "Random Media" (IPAM, January 2011)
- Workshop "Multiscale simulation of heterogeneous materials" (Louvain, January 2011)

- "Numerical sciences for mechanics" weekly seminar (Ecole Centrale Paris, November 2010)
- Conference "Large scale stochastic dynamics" (Oberwolfach, November 2010)
- Conference on Highly Oscillatory Problems (Cambridge, September 2010)
- Dynamics Days Europe 2010 conference (Bristol, September 2010)
- Multiscale molecular modelling conference (Edinburgh, July 2010)
- SIAM conference on Emerging topics in Dynamics Systems and PDEs (Barcelona, June 2010)
- SIAM conference on Mathematical Aspects of Materials Science (Philadelphia, May 2010)
- Annual conference of the German Society of Mathematics (Munich, March 2010)
- Workshop "Highly oscillatory problems" (Saint-Malo, January 2010)

- **Applied mathematics seminar, Collège de France (Paris, December 2009)**
- LN3M conference (Lyon, September 2009)
- ICNAAM 2009 conference (Crete, September 2009)
- Workshop "PDE and Materials" (Oberwolfach, September 2009)
- CECAM workshop on "Deterministic thermostats" (Lausanne, July 2009)
- USNCCM congress (Columbus, July 2009)
- Second annual conference of the EPSRC network "Mathematical challenges of molecular dynamics" (Bath, July 2009)
- Capstone conference (Warwick, June 2009)
- Workshop "Computational multiscale methods" (Oberwolfach, June 2009)
- Workshop "Multiscale models in solids mechanics" (Oxford, June 2009)
- IMA Mathematics and Chemistry seminar and IMA conference on "Molecular simulations: algorithms, analysis and applications" (Minneapolis, May 2009)
- EPFL weekly seminar (Lausanne, April 2009)
- IMA Mathematics and Chemistry seminar (February 2009)

- Zentrum Mathematik weekly seminar, T.U. München (December 2008)
- Workshop "Interplay of Analysis and Probability in Physics" (Oberwolfach, December 2008)

- EDF LAMSID weekly seminar (Paris, November 2008)
- IMA workshop "Development and analysis of multiscale methods" (Minneapolis, November 2008, poster)
- Minisymposium "Mathematical issues in multiscale materials modeling", 4th International Conference on Multiscale Materials Modeling (MMM-08) (Tallahassee, October 2008)
- Max Planck Institute Oberseminar (Leipzig, July 2008)
- Kolloquium der Arbeitsgruppe Modellierung, Numerik, Differentialgleichungen, Technische Universität Berlin (July 2008)
- BIRS workshop "Free Energy Calculations" (Banff, June 2008)
- Workshop "Gradient models and elasticity" (Warwick, June 2008)
- Workshop "ITER: aspects plasmas et matériaux" (Paris, May 2008)
- Minisymposium "Atomistic to Continuum Coupling Methods for Solids", SIAM Conference on Mathematical Aspects of Materials Science (Philadelphia, May 2008)
- Applied mathematics department weekly seminar, Bonn University (April 2008)

- IMA summer program on Classical and Quantum approaches in Molecular Modeling (Minneapolis, July 2007)
- SciCADE 2007 conference (Saint-Malo, July 2007)
- Multiple time scale problems and foundation of Molecular Dynamics workshop (Princeton, May 2007)
- 8th Colloque National en Calcul des Structures (Giens, May 2007)
- LAMI internal seminar (Montpellier, May 2007)
- Applying Geometric Integrators workshop (Edinburgh, April 2007)
- Highly Oscillating Problems program, Newton Institute (Cambridge, April 2007)
- Second Atomistic to Continuum Coupling Methods workshop (Austin, April 2007)

- WIAS Institute weekly seminar (Berlin, December 2006)
- Understanding Molecular Simulation workshop (Edinburgh, November 2006)
- GdR CHANT workshop (Lyon, November 2006)
- WCCM congress (Los Angeles, July 2006)
- Networks and Heterogeneous Media launching workshop (Salerno, June 2006)
- Warwick University weekly seminar (June 2006)
- Minisymposium "Molecular Dynamics", CANUM 2006 (Guidel, May 2006)
- Aerospace Engineering and Mechanics department seminar, University of Minnesota (Minneapolis, April 2006)
- First Atomistic to Continuum Coupling Methods workshop (Albuquerque, March 2006)
- Weekly seminar on numerical methods (Laboratoire J.-L. Lions, February 2006)
- GdR CHANT workshop (Grenoble, January 2006)

- Culminating workshop of the IPAM "Bridging Time and Length Scales in Materials Science and Bio-Physics" program (Lake Arrowhead, December 2005)
- Meshfree Methods for Partial Differential Equations workshop (Bonn, September 2005)
- Sandia National Laboratories internal seminar (Albuquerque, July 2005)
- "Foundations of Computational Mathematics" conference (Santander, July 2005)

- Postdoc seminar of the University of Minnesota (Minneapolis, June 2005)
- Dynamical Systems seminar of the University of Minnesota (Minneapolis, May 2005)
- IMA workshop on "Atomic motion to macroscopic models" (Minneapolis, April 2005)
- Workshop on "Multiscale numerical methods for advanced materials", MultiMat european network (Paris, March 2005)

- Moleküle im Rechner weekly seminar (FU Berlin, December 2004)
- Conference "Molecular simulation: Algorithmic and Mathematical aspects" (Paris, December 2004)
- IMA Materials seminar (Minneapolis, October 2004)
- XXI International Congress of Theoretical and Applied Mechanics (Warsaw, August 2004, poster)
- Mini-symposium "Introduction au CEMRACS 2004", CANUM 2004 (Obernai, June 2004)
- SIAM Conference on Mathematical Aspects of Materials Science (Los Angeles, May 2004, poster)
- CECAM workshop on "Accelerating Dynamical Simulations" (Lyon, March 2004)

- Workshop on Discrete Atomistic Models and Their Continuum Limits (Berlin, December 2003)
- Workshop on Structural Dynamical Systems (Bari, June 2003)
- CECAM workshop "Reactive classical potentials versus hybrid methods" (Lyon, June 2003)

- 2nd Symposium on Computational Modeling of Multi-Scale Phenomena (Petropolis, August 2002)
- CANUM 2002 (Biarritz, May 2002)

CONFERENCE ORGANIZATION

- Mini-symposium on "Multilevel and asymptotic-preserving methods for uncertainty quantification in multiscale systems" (SIAM UQ 2024 conference, Trieste, Feb. 2024), organized with G. Samaey (Leuven).
- Invited session on "Computational approaches for heterogeneous materials" (COMPLAS conference, Barcelona, Sept. 2023), organized with J. Zeman (Prague).
- Mini-symposium on "Computational approaches for multiscale problems and their applications" (SIAM CSE 2023 conference, Amsterdam, Feb. 2023), organized with A. Lozinski (U. of Besancon).
- Mini-symposium on "Computational approaches for multiscale, possibly random problems" (ICIAM 2019 conference, Valencia, Spain, July 2019), organized with C. Le Bris (ENPC).
- Mini-symposium on "Multiscale and domain decomposition approaches for PDEs with rough coefficients" (SIAM CSE conference, Spokane, Feb. 2019), organized with U. Hetmaniuk (University of Washington).
- Mini-symposium on "Multiscale modelling: numerical methods and applications" (SciCADE 2017 conference, Bath, Sept. 2017), organized with A. Abdulle (EPFL).

- Mini-symposium on "Adaptivity for multiscale problems" (USNCCM congress, Montreal, July 2017), organized with L. Chamoin (LMT Cachan) and K. Van der Zee (Nottingham).
- Mini-symposium on "Mathematical theory and computational techniques for multiscale materials modeling" (8th International Conference on Multiscale Materials Modeling, Dijon, Oct. 2016), organized with W. Curtin (EPFL), C. Garcia-Cervera (UCSB), J. Kermode (Warwick), X. Li (Penn State), A. Lozinski (Besançon), M. Luskin (Minneapolis) and C. Ortner (Warwick).
- Workshop on "Stochastic and multiscale inverse problems" (ENPC, Oct. 2014), organized with V. Ehrlacher (ENPC), T. Lelièvre (ENPC) and K. Sab (ENPC).
- Mini-symposium on "Recent advances on parareal algorithms" (SciCADE 2013 conference, Valladolid, Sept. 2013), organized with Y. Maday (Paris 6).
- Mini-symposium on "Multi-scale methods for heterogeneous materials" (USNCCM congress, Raleigh, July 2013), organized with R. Cottereau (Centrale Paris), L. Graham-Brady (Johns Hopkins) and M. Ostoja-Starzewski (U. of Illinois).
- Mini-symposium on "The atomistic basis of non-equilibrium thermal processes in materials" (USNCCM congress, Raleigh, July 2013), organized with B. Kraczek (US Army Research Laboratory), R. Jones (Sandia National Laboratories) and K. Mandadapu (Sandia National Laboratories).
- Mini-symposium on "Atomistic basis of thermal processes in driven systems" (22nd International Workshop on Computational Mechanics of Materials (IWCMM XXII), Baltimore, Sept. 2012), organized with B. Kraczek (US Army Research Laboratory), R. Jones (Sandia National Laboratories) and K. Mandadapu (Sandia National Laboratories).
- CEA-EDF-INRIA summer school on "Simulation of hybrid dynamical systems and applications to molecular dynamics" (Paris, Sept. 2010), organized with E. Faou (Rennes), T. Lelièvre (ENPC) and G. Stoltz (ENPC).
- Mini-symposium on "Molecular Dynamics" (Dynamics Days Europe conference, Bristol, Sept. 2010), organized with B. Leimkuhler (Edinburgh).
- Mini-symposium on "Coarse-graining and effective dynamics in molecular simulation" (Multiscale Molecular Modelling conference, Edinburgh, July 2010), organized with T. Lelièvre (ENPC).
- Mini-symposium "Arlequin, FE2 and other embedded domains methods for multimodel and multiscale mechanical problems: advances, analyses and computation of challenging fine scales applications" (ECCM congress, Paris, May 2010), organized with H. Ben Dhia (Centrale Paris), F. Feyel (ONERA) and V. Kouznetsova (Eindhoven).
- Mini-symposium on "Numerical methods and their applications in molecular simulation" (ICNAAM 2009 conference, Crete, Sept. 2009), organized with E. Cancès (ENPC).
- Mini-symposium on "Multimodel and Multiscale Approaches in Solid Mechanics: Algorithms and Applications Advances" (USNCCM congress, Columbus, July 2009), organized with H. Ben Dhia (Centrale Paris).
- Workshop "Numerical methods in molecular simulation" (HIM, Bonn, April 2008), organized with T. Lelièvre (ENPC), M. Rousset (INRIA) and G. Stoltz (ENPC).
- Workshop on "Models and numerical methods for granular materials" (Paris, November 2007).

- Mini-symposium on "Molecular dynamics" (SciCADE 2007 conference, Saint-Malo, July 2007), organized with E. Darve (Stanford).

- Co-organization of a Focus group on "Molecular dynamics and Sampling" at IMA, Minneapolis, Spring 2005, within the annual thematic year (with B. Leimkuhler).

TEACHING ACTIVITIES

since Sept. 2018	M.S. course on "Time-dependent problems" (39h for second-year students at ENPC): Spectral decomposition of self-adjoint and compact operators (theory and numerical approximation), time-dependent PDEs (spectral decomposition, Galerkin approximation, qualitative properties, discretization), hyperbolic problems.
since Sept. 2021	B.S. course on "Partial Differential Equations: variational approaches" (15h for first-year students at ENPC): Sobolev spaces, variational formulation of PDEs, Lax-Milgram theorem, differential calculus.
since Sept. 2015	B.S. course on "Mathematical Tools for Engineers" (9h for first-year students at ENPC).
since Sept. 2023	Graduate course on "PDE and modelisation" at Sorbonne Université (24h).

Some previous courses:

Sept. 2006 – June 2018	M.S. course on "Mathematics of multiscale models" at ENPC (39h for second-year students at ENPC): algorithms for Hamiltonian dynamics, mathematical and numerical analysis of heat and wave equations, convex and nonconvex optimization, multi-scale modelling.
Sept. 2002 – June 2015	B.S. course on Analysis at ENPC (36h for first-year students at ENPC): Banach and Hilbert spaces, Lebesgue integral, distributions, Lax-Milgram theorem, solving the Poisson problem, Fourier transformation.
Sept. 2008 – June 2023	Graduate course on "Multiscale problems: theoretical and numerical aspects" at University Paris 6 (24h): atomistic to continuum modelling, complex fluids, homogenization, multiscale-in-time problems.