

Teddy Pichard

Assistant professor
Applied mathematics department at École polytechnique

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Curriculum vitae

Education and professional experiences

2018-now	Assistant professor at the Applied mathematics departments at <i>École polytechnique</i>
2016-2018	Postdoc at Laboratoire Jacques-Louis Lions in <i>Sorbonne université</i> Project : "Hyperbolic PDE with discontinuous sources" with : N. Aguillon, B. Després, E. Godlewski, M. Ndjinga
2013-2016	PhD in cotutelle between <i>RWTH Aachen University</i> and <i>Université de Bordeaux</i> Thesis : "Mathematical modelling of dose deposition in phototherapy" with : S. Brull, B. Dubroca and M. Frank <i>Reviewers :</i> B. Perthame and C. Hauck <i>Commity :</i> M. Herty, B. Després, A. Klar, D. Aregba-Driollet
2010-2013	Engineering diploma at <i>ENSEIRB-MATMECA</i> et research master at <i>Université de Bordeaux</i>
2008-2010	Preparatory classes, Math-Physics at <i>Lycée Descartes de Tours</i>

Teaching

Courses

X 3rd y	(Lecture)	since 2022	<i>Transport and diffusion</i>
X 2nd y	(Tutorials)	since 2019	<i>Introduction to numerical analysis</i>
X 2nd y	(projects)	since 2021	<i>Problem solving in applied math</i>
Bach 2nd y	(Lec-tuto)	since 2018	<i>Computational linear algebra</i>
Master1 biomec	(Lec-tuto)	since 2020	<i>Mathematical modeling of biological systems</i>
Master1 math	(Lectures)	since 2020	<i>Moment models in kinetic theory</i>
X 3rd y	(projects)	2018-2021	<i>Practical numerical methods</i>
X 2nd y	(Tutorials)	2018-2019	<i>Numerical analysis and optimization</i>
Bach 3rd y (Sorbonne)	(Tutorials)	2017-2018	<i>Numerical approximation of functions</i>

Other teaching duties

X 2nd y	(Coordination)	since 2020	Collective scientific projects
X 3rd y	(Coordination)	since 2019	Projects on PDE and numerical analysis in physics, mechanics and biology

⁰update September 8, 2023

Supervisions

- **Zoubair Tazakkati** (Master training) Summer 2021 then (PhD) starting October 2023, *Grad model and simulation of out-of-equilibrium heating of neutrals by electrons in cold plasma sheaths*, Co-supervision: A. Alvarez Laguna,
- **Gaspard Brunelle** (Master training) Fall-Winter 2023, *Around polynomial reconstructions in high order Finite Volume schemes*,
- **Arthur Loison** (PhD) 2020-now, *Eulerian modeling of separated and dispersed two-phase flows*, Co-supervision: S. Kokh, M. Massot,
- **Katia Ait-Ameur** (Postdoc) 2020-now, *DG schemes with limitation adapted to moment models for disperse flows*, Co-supervision: S. Kokh, M. Massot, M. Pelanti,
- **Louis Reboul** (PhD ; unofficial) 2019-now, *Modeling and simulating plasmas for propulsion*, Supervision: A. Bourdon, M. Massot,

Programing

- Fortran (90 to 2008), C++, Python, Jupyter, Maple, Matlab
- Development of KIDS2 code for dose computation in radiotherapy (≈ 10000 lines of Fortran 2003)
- Participation to the development of Josiepy et SAMURAI codes in CMAP

Fundings

- 2023-27: Funding DGA-AID through CIEDS in collaboration X-ENSTA: Project OpenNumDef,
- 2023: Funding EuroteQ to visit M. Abdelmalik (TU Eindhoven),
- 2022: Funding NUS to visit Z. Cai (NU Singapore),
- 2020-23: Funding DGA-AID in collaboration X-ENSTA: Projet MMEED,
- 2020: Funding Gaspard Monge Visiting Professor to invite C. P. T. Groth (3-4 months) at école polytechnique,
- 2019: Funding PEPS JCJC INSMI,
- 2013-2016: Scholarship PEPS-IDEX Bordeaux for cotutelle PhD.

Other activities : Responsibilities and scientific diffusion

- Reviewers for the journals: Comput. and Appl. Math., J. Comput. Phys., ESAIM: Proc.&Survey, SIAM Multiscale Mod. Simul., SIAM J. Appl. Math., Europ. J. Mech. B: Fluids, Transac. on Math. Software
- Organisation of mini-symposia at CANUM 2020, biennale SMAI 2021, ECCOMAS 2022, CANUM 2022, RGD 2022, SIAM CSE 2023, ECCOMAS 2024
- Organisation of the seminars of the HPC team (2018-2020), and of the analysis pole (2022-today)

Publications

Preprint and work in progress

- [W1] M. Abdelmalik, Z. Cai, T. Pichard, **Moment methods for the 3D radiative transfer equation based on φ -divergences**, under review,
- [W2] L. Reboul, T. Pichard, M. Massot, **Second-order asymptotic preserving schemes for non-linear hyperbolic balance laws with stiff relaxation source term**, under review,
- [W3] T. Pichard, **Some recent advances on the method of moments in kinetic theory**, *Proc. SMAI 2021*, under review,
- [W4] A. Loison, T. Pichard, S. Kokh, M. Massot, **Two-scale modelling of two-phase flows based on the Stationary Action Principle and a Geometric Method Of Moments**, under review,
- [W5] A. Loison, T. Pichard, S. Kokh, M. Massot, **A two-scale two-phase flow model with capillarity and mass transfer between scales**, under review,
- [W6] K. Ait-Ameur, A. Loison, T. Pichard, M. Massot, **Simulation of polydisperse oscillating droplets with kinetic schemes for geometric moment equations**, under review,
- [W7] M. Abdelmalik, Z. Cai, T. Pichard, **Some extensions of the φ -divergence moment closures for the radiative transfer equation**, under review,
- [W8] K. Ait-Ameur, S. Kokh, M. Massot, T. Pichard, **On limitation techniques for discontinuous Galerkin applied to moment equation for polydisperse flows**, in preparation,

Articles

- [A10] K. Ait-Ameur, S. Kokh, M. Pelanti, M. Massot, T. Pichard, **An acoustic-transport splitting method for the barotropic Baer-Nunziato two-phase flow model**, accepté dans *ESAIM: Proceeding and surveys*,
- [A9] T. Pichard, **A moment closure based on a projection on boundary of the realizability domain: Analysis and extension**, *Kin. Rel. Mod.*, 15(5): 793-822, 2022,
- [A8] T. Pichard, N. Aguilon, B. Després, E. Godlewski, M. Ndjinga, **Existence and uniqueness of generalized solutions to hyperbolic system with linear fluxes and stiff sources**, *J. Hyp. Diff. Eq.*, 18(3): 653-700, 2021,
- [A7] T. Pichard, **A moment closure based on a projection on boundary of the realizability domain: 1D case**, *Kin. Rel. Mod.*, 13(6): 1243-1280, 2020,
- [A6] A. Alvarez-Laguna, T. Pichard, T. Magin, P. Chabert, A. Bourdon, M. Massot, **An asymptotic preserving well-balanced scheme for the isothermal fluid equation in low-temperature plasma applications**, *J. Comput. Phys.*, 419: 1-29, 2020
- [A5] T. Pichard, B. Dubroca and S. Brull : **A numerical approach for a system of transport equations in the field of radiotherapy**, *Commun. Comput. Phys.*, 25(4): 1097–1126, 2019,
- [A4] G. Birindelli, J.-L. Feugeas, J. Caron, B. Dubroca G. Kantor, J. Page, T. Pichard, V. T. Tikhonchuk, Ph. Nicolai : **High performance modelling of the transport of energetic particles for photon radiotherapy**, *Phys. Med. ; Proc. SFPM conference*, 2017,
- [A3] T. Pichard, G. W. Alldredge, S. Brull, B. Dubroca and M. Frank : **An approximation of the M_2 closure : application in radiotherapy dose simulation**, *J. Sci. Comput.*, 71(1) : 71-108, 2017,
- [A2] T. Pichard, D. Aregba-Driollet, S. Brull, B. Dubroca and M. Frank : **Relaxation schemes for the M_1 model with space-dependent flux : application to radiotherapy dose calculation**, *Commun. Comput. Phys.*, 19 (01) : 168-191, 2016,

- [A1] J. Caron, J.-L. Feugeas, B. Dubroca, G. Kantor, C. Dejean, T. Pichard, Ph. Nicolai, E. D’Humières, M. Frank, V. Tikhonchuk : **Deterministic model for the transport of energetic particles : application in the electron radiotherapy**, *Phys. Medica*, 31 (8) : 912-921, 2015.

Proceedings

- [C6] L. Reboul, T. Pichard, M. Massot, **A simple second-order Implicit-Explicit asymptotic preserving scheme for the Hyperbolic Heat equations**, accepted as *Proc. RGD32*, 2022,
- [C5] T. Pichard, **On the discretization of discontinuous sources of hyperbolic balance laws**, *Proc. ECCOMAS 2022*, 2022
- [C4] T. Pichard, **Existence of steady two-phase flows with discontinuous boiling effects**, *Proc. HYP conf. 2018, AIMS on Appl. Math.*, 10, pp. 603-610, 2020,
- [C3] T. Pichard, S. Brull, B. Dubroca and M. Frank, **On the transverse diffusion of beams of photons in radiation therapy**, *Proc. HYP2016 conference, Springer Proc. Math. Stat.*, vol. 237: 465-477, 2018,
- [C2] T. Pichard, G.W. Alldredge, S. Brull, B. Dubroca and M. Frank, **The M_2 model for dose simulation in radiation therapy**, *Proc. 24th Int. Conf. on Transport Theory, J. Comput. Theor. Transport*, 2016,
- [C1] T. Pichard, D. Aregba-Driollet, S. Brull, B. Dubroca and M. Frank, **Relaxation schemes for the M_1 model with space-dependent flux : application to radiotherapy dose calculation**, *Proc. M&C + SNA + MC conference*, 2015.