Charlotte Perrin

Research interests

- Partial differential equations
- Fluid mechanics, Multi-phase flows
- Granular flows
- Singular limits

Contacts

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Current position

2017- Junior CNRS Researcher at Institut de Mathématiques de Marseille (Marseille, France), in the team "Applied Analysis"

Distinction

- CNRS Bronze Medal 2024

Education

2016-2017 **Postdoc** at "Institut für Mathematik" (Prof. Michael Westdickenberg)
RWTH Aachen University (Germany)

2013-2016 **PhD** Student: LAMA Laboratory, Le Bourget-du-Lac, France
Supervisor: Didier Bresch
Heterogeneous models in fluid mechanics: congestion phenomena, granular flows and collective motion

Publications

Publications

[1] N. Chaudhuri, M. Mehmood, **C. Perrin**, and E. Zatorska, "Duality solutions to the hard-congestion model for the dissipative aw-rascle system," *Communications in Partial Differential Equations (to appear)*, 2024, nn..
[2] N. Chaudhuri, L. Navoret, **C. Perrin**, and E. Zatorska, "Hard congestion limit of the dissipative aw–rascle system," *Nonlinearity*, vol. 37, no. 45018, 2024, nn..
[3] A.-L. Dalibard and **C. Perrin**, "Local and global well-posedness of one-dimensional free-congested equations," *Annales Henri Lebesgue*, vol. 7, pp. 1175–1243, 2024, nn..
[4] F. Ancona, R. Bianchini, and **C. Perrin**, "Hard-congestion limit of the p-system in the bv setting," *ESAIM: Proceedings and Surveys*, vol. 72, pp. 41–63, 2023, nn..
[5] C. Burtea, S. Gavrilyuk, and **C. Perrin**, "Hamilton's principle of stationary action in multiphase flow modeling," *Panorama et Synthèse*, 2024, nn. Lecture Notes (available on HAL) to appear in Panoramas & Synthèses.
[6] A.-L. Dalibard, G. Lopez-Ruiz, and **C. Perrin**, "Traveling waves for the porous medium equation in the incompressible limit: Asymptotic behavior and nonlinear stability," *Indiana University Mathematics Journal*, vol. 73, no. 2, pp. 581–643, 2024, nn..
[7] **C. Perrin** and K. Saleh, "Analysis and implementation of numerical staggered schemes for the free-congested Navier-Stokes equations," *SIAM Journal on Numerical Analysis*, vol. 60, no. 4, pp. 1824–1852, 2022, nn. preprint available on HAL.
[8] A.-L. Dalibard and **C. Perrin**, "Partially congested propagation fronts in one-dimensional Navier-Stokes equations," *Journal of Elliptic and Parabolic Equations*, vol. 7, pp. 491–507, 2021, nn..
[9] R. Bianchini and **C. Perrin**, "Soft congestion approximation to the one-dimensional constrained Euler equations," *Nonlinearity*, vol. 34, no. 10, p. 6910, 2021, nn..
[10] **C. Perrin**, "A remark on memory effects in constrained fluid systems," *ESAIM Proceedings and Surveys*, vol. 69, pp. 56–69, 2020, nn..
[11] A.-L. Dalibard and **C. Perrin**, "Existence and stability of partially congested propagation fronts in a one-dimensional navier-stokes model," *Communications in Mathematical Sciences*, vol. 18, no. 7, pp. 1775–1815, 2020, nn..
[12] **C. Perrin** and K. Saleh, "A convergent fv-fe scheme for the stationary compressible navier-stokes equations," *IMA Journal of Numerical Analysis*, vol. 41, no. 2, pp. 826–899, 2021, nn..
[13] D. Bresch, S. Necasova, and **C. Perrin**, "Compression effects in heterogeneous media," *Journal de l'École Polytechnique*, vol. 6, pp. 433–467, 2019, nn..
[14] **C. Perrin**, "An overview on congestion phenomena in fluid equations," *Proceeding des journées EDP*, 2019, nn. proceeding Journées EDP 2018.
[15] **C. Perrin** and M. Westdickenberg, "One-dimensional granular system with memory effects," *SIAM Journal of Mathematical Analysis*, vol. 50, no. 6, pp. 5921–5946, 2018, nn..
[16] **C. Perrin**, "Modelling of phase transitions in one-dimensional granular flows," *ESAIM: Proceedings and Surveys*, vol. 58, pp. 78–97, 2017, nn..
[17] M. Fabre, S. Faure, M. Laurière, B. Maury, and **C. Perrin**, "Non-classical solution of a conservation law arising in vehicular traffic," *ESAIM Proceedings and Surveys*, vol. 55, pp. 131–147, 2016, nn..
[18] **C. Perrin**, "Pressure-dependent viscosity model for granular media obtained from compressible navier–stokes equations," *Applied Mathematics Research eXpress*, vol. 2016, no. 2, pp. 289–333, 2016, nn..
[19] **C. Perrin** and E. Zatorska, "Free/congested two-phase model from weak solutions to multi-dimensional compressible navier-stokes equations," *Communications in Partial Differential Equations*, vol. 40, no. 8, pp. 1558–1589, 2015, nn..
[20] D. Bresch, **C. Perrin**, and E. Zatorska, "Singular limit of a navier–stokes system leading to a free/congested zones two-phase model," *Comptes Rendus Mathematique*, vol. 352, no. 9, pp. 685–690, 2014, nn..

5.1 Preprints

Talks

6.1 Invitations in conferences (2020-2024)

- EquaDiff 2024, Karlstad, mini-symposia "Boundary Layers and Singular Limits", "Mathematics of Porous Media"
- CEA/GAMNI Conference, IHP Paris, January 2024
- Workshop on Fluid-Structure Interactions, Université Libre de Bruxelles, January 2024
- Workshop on Stability, Mixing and Fluid Dynamics, Münster (Germany), August 2023
- Workshop Maathrafic, Tours, June 2023
- Workshop CRISIS "Local and nonlocal aspects in fluid mechanics", Lyon, March 2023
- Conference MathFlows 2022, CIRM Marseille, December 2022
- Conference "New trends in complex flows", IHP Paris, September 2022
- Workshop on Compressible Multiphase Flows, Strasbourg, May 2022
- Conference 75th birthday of Jean-Claude Saut, Toulouse, May 2022
- Workshop ANR SingFlows, Bordeaux, April 2022
- Conférence "Perspectives on Multiphase Fluid Dynamics,Continuum Mechanics and Hyperbolic Balance Laws", CIRM, mars 2022
- Workshop "Turb1D", online, November 2021
- Conference "Fluid mechanics: qualitative study and asymptotic behavior of solutions", Peyresq (France), September 2021
- MSRI workshop "Recent Developments in Fluid Dynamics" (Online), April 2021
- Conference "Vorticity, Rotation, Symmetry (V) - Global Results and Nonlocal Phenomena", CIRM, Marseille, October 2020

6.2 Recent invitations in seminars (2020-2024)

- Analysis Seminar, Nice, March 2024
- Kick-off ANR BOURGEONS, Paris, January 2024
- PDEs seminar, Laboratoire de Mathématiques de Besançon, December 2023
- HYPERBO workshop, I2M Marseille, November 2023
- Analysis Seminar, Ecole Polytechnique, November 2023
- CEMRACS Seminar, CIRM Marseille, August 2022
- Seminar Laboratoire de Mécanique et d'Acoustique, Marseille, June 2022
- PDEs - Numerical Analysis Seminar, IRMA, Strasbourg, February 2022
- Applied PDEs Seminar, Imperial College London, February 2022
- INRIA-LJLL joint seminar (Online), Paris, January 2021
- Necas Seminar (Online), Prague, November 2020

Projects, Research Groups

7.1 Current projects

- IMPT project (2022-2025) "Modeling and mathematical analysis of complex gravity flows"
- ANR BOURGEONS (2024-2027) PI: Anne-Laure Dalibard
- ANR CRISIS (2021-2024), PI: Francesco Fanelli

7.2 Past projects

- ANR SingFlows (2019-2022) PI: David Gérard-Varet
- Research member in the MSRI program "Mathematical Fluid Dynamics" (Berkeley), January-May 2021
- PEPS projects of INSMI: grants obtained in 2018 and 2019
- ANR Dyficolti (2014-2017) PI: D. Lannes
- GDR MathGeoPhy (member of the council in 2022-2023), EGRIN (member of the council in 2019-2021), Films

Teaching

8.1 Aix-Marseille Université (2019–)

- "Shallow water equations", Master 2
- "Continuous dynamical systems", Master 1
- Masterclass, Mini-course (3H) "Introduction to Shallow Water equations"

8.2 N'Djamena University (Tchad)

- Ecole CIMPA - Automne 2024 : "Modélisation d'écoulements fluides et environnement"
  - cours "Introduction à la modélisation mathématique des écoulements fluides"
  - cours/TP "Modéles compartimentaux pour la circulation océanique"
- Postgraduate Course (7h - Online) "Introduction to fluid modeling and shallow water equations", January 2023

8.3 North-West University (South Africa)

- 3MC Postgraduate Course (7h - Online) "Introduction to fluid modeling and shallow water equations", September 2022

8.4 Université Savoie Mont Blanc (2013-2016)

- Numerical methods (3rd year)
- Statistics and Probabilities (2nd year)
- Differential equations (3rd year)
- Analysis and linear algebra (1st year)

Other activites

9.1 Student supervision

- PhD: Emile Deleage (oct. 2022–)
- Internships: Maelle Labeille (2020; 2024), Camille-Lucia Cathalan (2024)

9.2 Administrative responsabilities

- Member of the scientific council of the "RT Terre et Energies" (2024–)

- Member of the Research and Academic Councils of Aix-Marseille University (2020-2023)
- Member of selection committee for assistant professor positions : Marseille (2019), Orsay (2019), Orléans (2020), Bordeaux (2023), Marseille (2023), Nancy (2024)
- Member of a thesis committee : Renald Chalayer (2019), Amina Mecherbet (2019), Youssouf Nasseri (2021), Lamine Sokhna (2021), Gabriela Lopez-Ruiz (2021), Aubin Brunel (2022), Mahieddine Adim (2024)

Other Activities

10.1 Organization of conferences and workshops

- Workshop Hyperbo 2024, December 2024, Marseille
- Workshop Hyperbo 2023, November 2023, Marseille
- Workshop Hyperbo 2022, Decembre 2022, Marseille
- Research school associated to the GdR MathGeoPhy, October 26-27-28 2022, IHP Paris
- Workshop "Conservation laws and traffic", January 2019, Marseille
- Workshop "Complex fluids and granular madia", June 2018, Marseille
- Conference Inter'actions for PhD students, May 2015, Grenoble

Science Popularization

- scientific talks to undergraduate math. students
- popularization talk for "Treize Mintes Marseille" (April 2024)
- scientific talk to undergraduate female students "Maths C pour L" (February 2024)
- Speed-meeting in highschool
- Scientific talk to highschool female students (Les Cigales, 2022)
- **Amphis pour tous (February 2015, Savoie Mont Blanc University)** joint presentation with Didier Bresch : "Transhumances, traffic jams, the mathematics of collective motion"
- **Workshop "Maths à Modeler" (January-March 2014)** mathematical project in primary school with Tom Hirschowitz