Thibault Moli MAUREL OUJIA

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EDUCATION

Ph.D. in Applied Mathematics

Aix–Marseille University, France

Jan 2021—June 2024

Thesis : On the Particle Dynamics in Fully Developed Turbulence: Tessellation, Multiresolution and Machine Learning Methods
Supervisor : Prof. Kai Schneider and Dr. Keigo Matsuda

Master in Applied Mathematics

Aix–Marseille University, France

Sept 2018—June 2020

Bachelor in Mathematics

Aix–Marseille University, France

Sept 2015—June 2018

EMPLOYMENT

Apollo 11 Postdoctoral Fellow

School of Aeronautics and Astronautics, Purdue University, IN, USA

July 2024—Present West Lafayette, IN, USA

- **Supervisor** : Prof. Kazuki Maeda
- **Description** : Modeling, simulation and analysis of high-speed reacting flows with application to aerospace propulsion and energy systems.

Temporary Teaching and Research Associate (ATER)

Aix–Marseille University, France

Sept 2023—June 2024 Marseille, France

RESEARCH EXPERIENCE

JSPS Short-term Fellowship 2023

JAMSTEC and Nagoya University, Japan

May 2023—Aug 2023 Yokohama and Nagoya, Japan

- **Host** : Dr. Keigo Matsuda and Prof. Katsunori Yoshimatsu
- **Project** : Development of parallelized tessellation-based divergence & rotation of particle laden turbulence

CTR Summer Program 2022

Stanford University, CA, USA

July 2022—Aug 2022 Palo Alto, CA, USA

- **Collaborator** : Kai Schneider, Keigo Matsuda, Thibault Oujia, Jacob West, Suhas S. Jain and Kazuki Maeda
- **Project** : Development of multiscale techniques for analyzing clustering in particle laden turbulence, including tools from machine learning.

HONORS AND AWARDS

- Apollo 11 Postdoctoral Fellowship, Purdue University, 2024
- JSPS Short-Term Fellowship, Japan Society for the Promotion of Science, 2023
- CTR Summer Program, Center for Turbulence Research (CTR), Stanford University, 2022

RESEARCH INTEREST

- **Fluid Dynamics**: Particle-laden flows; turbulence; multiphase flows.
- **Computational Analysis**: Tessellation techniques; multiresolution analysis.
- **Combustion**: Reactive molecular dynamics; supersonic combustion; hypersonic applications; shock wave interactions.
- **Machine Learning**: Predictive statistics; simulation acceleration.

PUBLICATIONS

Journal Articles

- Z. Lin, T. Maurel–Oujia, S. Benkadda, and K. Schneider, "Tessellation-based analysis of impurity clustering in the edge plasma of tokamaks," ***Journal of Plasma Physics***, vol. 91, no. 1, E30, 2025.
- J. Bergmann, T. Maurel–Oujia, X.-Y. (Yin, J.-C. Nave, and K. Schneider, "Singularity formation of vortex sheets in 2D Euler equations using the characteristic mapping method," ***Physics of Fluids***, 2024.
- T. Maurel–Oujia, S. S. Jain, K. Matsuda, K. Schneider, J. R. West, and K. Maeda, "Neural network models for preferential concentration of particles in two-dimensional turbulence," ***Theoretical and Computational Fluid Dynamics***, 2024.
- J. R. West*, T. Maurel–Oujia*, K. Matsuda, K. Schneider, S. S. Jain, and K. Maeda, "Clustering, rotation, and swirl of inertial particles in turbulent channel flow," ***International Journal of Multiphase Flow***, p. 104 764, 2024, (*Co-corresponding authors).
- Z. Lin, T. Maurel–Oujia, B. Kadoch, *et al.*, "Synthesizing impurity clustering in the edge plasma of tokamaks using neural networks," ***Physics of Plasmas***, vol. 31, no. 3, 2024.
- T. Maurel–Oujia, K. Matsuda, and K. Schneider, "Computing differential operators of the particle velocity in moving particle clouds using tessellations," ***Journal of Computational Physics***, vol. 498, p. 112 658, 2024.
- S. V. Apte, T. Oujia, K. Matsuda, B. Kadoch, X. He, and K. Schneider, "Clustering of inertial particles in turbulent flow through a porous unit cell," ***Journal of Fluid Mechanics***, vol. 937, 2022.
- T. Oujia, K. Matsuda, and K. Schneider, "Divergence and convergence of inertial particles in high-reynolds-number turbulence," ***Journal of Fluid Mechanics***, vol. 905, 2020.

Referred Conference Proceedings

- T. Maurel–Oujia and K. Maeda, "Microscopic simulation and analysis of reactive shock wave in a H_2/O_2 fuel mixture," **12th International Conference on Multiphase Flow (ICMF)**.
- T. Maurel–Oujia, K. Matsuda, and K. Schneider, "Multiresolution analysis of convergence and divergence of inertial particle velocity in turbulence," **13th Turbulence and Shear Flow Phenomena (TSFP13)**.
- T. Maurel–Oujia, S. S. Jain, K. Matsuda, K. Schneider, J. West, and K. Maeda, "Synthesis of preferential concentration of particles in isotropic turbulence using neural networks," **18th European Turbulence Conference (ETC18)**.
- K. Matsuda, T. Maurel–Oujia, and K. Schneider, "Clustering formation of inertial particles in high reynolds number isotropic turbulence," **18th European Turbulence Conference (ETC18)**.
- J. Bergmann, T. Maurel–Oujia, X. Y. Yin, J.-C. Nave, and K. Schneider, "On singularities in vortex sheets in 2D Euler flows using a high resolution characteristic mapping method," **18th European Turbulence Conference (ETC18)**.
- T. Oujia, J. West, K. Matsuda, K. Schneider, S. S. Jain, and K. Maeda, "Divergence and rotation of inertial particles in a four-way coupled channel flow," **11th International Conference on Multiphase Flow (ICMF)**.
- T. Oujia, K. Matsuda, and K. Schneider, "Extreme divergence and rotation values of the inertial particle velocity in high reynolds number turbulence using delaunay tesselation," **12th Turbulence and Shear Flow Phenomena (TSFP12)**.

Technical Reports

- T. Oujia, S. S. Jain, K. Matsuda, K. Schneider, J. West, and K. Maeda, "Neural networks for synthesizing preferential concentration of particles," in ***Center for Turbulence Research (CTR), Proceedings of the Summer Program 2022***. 2022, Stanford University.
- J. West, T. Oujia, K. Matsuda, K. Schneider, S. S. Jain, and K. Maeda, "Divergence and curl of the inertial particle velocity in a four way coupled turbulent channel flow," in ***Center for Turbulence Research (CTR), Proceedings of the Summer Program 2022***. 2022, Stanford University.
- K. Matsuda, K. Schneider, T. Oujia, J. West, S. S. Jain, and K. Maeda, "Multiresolution analysis of inertial particle tessellations for clustering dynamics," in ***Center for Turbulence Research (CTR), Proceedings of the Summer Program 2022***. 2022, Stanford University.

Conference Abstracts

- T. Maurel–Oujia and K. Maeda, "Combined molecular dynamics simulations and regression analysis for high-speed reacting flows," in Salt Lake City, USA, **Bull. Amer. Phys. Soc.**, 2024.
- T. Maurel–Oujia, K. Matsuda, and K. Schneider, "Multiscale analysis of inertial particle dynamics in turbulent flows using a tessellation-based method," in Washington, USA, **Bull. Amer. Phys. Soc.**, 2023.
- T. Maurel–Oujia, S. Jain, K. Matsuda, K. Schneider, J. West, and K. Maeda, "Synthesizing inertial particle distribution in isotropic turbulence using neural networks," in Washington, USA, **Bull. Amer. Phys. Soc.**, 2023.
- L. Zetao, T. Maurel–Oujia, B. Kadoch, *et al.*, "Analysis of inertial impurity clustering in the edge plasma of tokamaks," in **EFTC 2023, 20th European Fusion Theory Conference**, 2023.

- L. Zetao, T. Maurel–Oujia, B. Kadoch, *et al.*, "Data-driven modeling of impurity transport in the edge plasma of tokamaks," in **12th ITER International School**, 2023.
- T. Maurel–Oujia, K. Matsuda, and K. Schneider, "A tessellation-based approach to analyze elementary processes of inertial particles in turbulence," in Kyoto, Japan, **RIMS workshop**, 2023.
- J. Bergmann, T. Oujia, X.-Y. B. Yin, J.-C. Nave, and K. Schneider, "High resolution vortex layer computations in 2D Euler flows using a characteristic mapping method," in 67(19), Indianapolis, USA, **Bull. Amer. Phys. Soc.**, 2022.
- T. Oujia, S. Jain, K. Matsuda, K. Schneider, J. West, and K. Maeda, "Physics-informed neural networks for synthesizing preferential concentration of particles in turbulent flows," in 67(19), Indianapolis, USA, **Bull. Amer. Phys. Soc.**, 2022.
- K. Schneider, T. Oujia, J. West, K. Matsuda, S. Jain, and K. Maeda, "On divergence, curl, and helicity of the inertial particle velocity in a 4-way coupled channel flow," in Indianapolis, USA, **Bull. Amer. Phys. Soc.**, 2022.
- T. Oujia, K. Matsuda, and K. Schneider, "Quantifying divergence and rotation of the inertial particle velocity in high reynolds number turbulence using voronoi and delaunay tessellation," in 66(17), Phoenix, USA, **Bull. Amer. Phys. Soc.**, 2021.
- T. Oujia, K. Matsuda, and K. Schneider, "Analysis of divergence and rotation of the intertial particle velocity in high reynolds number turbulence," in 65(13), Chicago, USA, **Bull. Amer. Phys. Soc.**, 2020.
- X. He, T. Oujia, B. Kadoch, K. Matsuda, K. Schneider, and S. Apte, "Clustering of inertial particles in turbulent flow through a face-centered cubic cell," in 65(13), Chicago, USA, **Bull. Amer. Phys. Soc.**, 2020.
- T. Oujia, K. Matsuda, and K. Schneider, "On the divergence of the inertial particle velocity in high reynolds number turbulence," in 23-28 August 2020, Milano, Italy, **XXV ICTAM**, 2020.
- T. Oujia, K. Matsuda, and K. Schneider, "Divergence and convergence of inertial particles in high reynolds number turbulence," in 64(13), 639, Seattle, USA, **Bull. Amer. Phys. Soc.**, 2019.
- S. Apte, T. Oujia, X. He, B. Kadoch, K. Matsuda, and K. Schneider, "Pore-scale investigation of clustering of inertial particles in turbulent flow through a porous medium," in 64(13), 638, Seattle, USA, **Bull. Amer. Phys. Soc.**, 2019.

INVITED TALKS

- "Multiscale Analysis of Particle Dynamics in Turbulent Flows Using Tessellation-Based Techniques", 2025, *CIGP Seminar*, **Purdue University**, West Lafayette, IN, USA.
- "Multiscale Dynamics of Inertial Particles in Turbulence: A Tessellation Technique Analysis", 2023, *AAE Special Seminar*, **Purdue University**, West Lafayette, IN, USA.
- "A Tessellation-based Approach for Multiscale Dynamics in Particle-Laden Turbulence", 2023, *CEIST Guest Seminar*, **JAMSTEC**, Yokohama, Japan.
- "A Tessellation-based Approach for Multiscale Dynamics in Particle-Laden Turbulence", 2023, *Fluid Mechanics Special Seminar*, **Nagoya Institute of Technology**, Nagoya, Japan.
- "A tessellation-based approach to study the dynamics of inertial particles in turbulence", 2023, *Onishi Lab. Seminar Series*, **Tokyo Institute of Technology**, Tokyo, Japan.
- "Physics-informed neural networks for synthesizing preferential concentration of particles in isotropic turbulence", 2022, *PiAI Seminar Series*, **Aix–Marseille University, Osaka University, Web Seminar**, Osaka, Japan.

TEACHING EXPERIENCE

Research Mentoring

Purdue University, USA

- **Co-Supervisor**: Prof. Kazuki Maeda (Purdue University–USA)
- **Subject**: Scientific visualization of discrete field data

Sept 2024—Present **Student** : Eylul Ustaoglu (Purdue University–USA)

Aix–Marseille University, France

- **Co-Supervisor** : Prof. Kai Schneider (I2M–France)
- **Subject** : Two–dimensional Characteristic Mapping Method using CUDA

Sept 2021—Mar 2022 **Student** : Julius Bergmann (TU Berlin–Germany)

April 2021—Sept 2021 **Student** : Nicolas Saber (I2M–France)

Course Instructor and Teaching Assistant

Aix–Marseille University, France

- **Analysis I** (Fall 2023, 50%): including continuity, differentiability, limits, derivatives, differential equations, corresponding theorems.
- **Analysis II** (Spring 2024, 100%): including integrals, directional derivatives, series expansion, topology, proofs of corresponding theorems.
- **Mathematical Tools** (Fall 2023, 25%): including trigonometry, geometry (e.g., equations of planes and lines), derivatives, integrals, limits.
- **Mathematical Tools for Life Sciences** (Fall 2023, 50%): including basic mathematics, differential equations, and calculus for biology students.
- **Mathematics Support Program** (Fall 2023, 100%): including assisted students resuming studies or needing extra help, foundational mathematics.