

Thibault Moli MAUREL OUJIA

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📍 West Lafayette, IN, USA

🌐 ThibaultMaurelOujia



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 Université & École Centrale, 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

- T. Maurel-Oujia and K. Maeda, "Sub-continuum structures of reactive shock waves in gaseous H_2/O_2 mixtures," **accepted, Physical Review Fluids**, 2025.
- 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)**.
- K. Matsuda, T. Maurel-Oujia, and K. Schneider, "Relationship between inertial particle divergence and local flow structure in homogeneous isotropic turbulence," **12th International Conference on Multiphase Flow (ICMF)**.
- 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 tessellation," **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 inertial 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.