

# PAOLO MARIA ZOLLA

## EDUCATION AND RESEARCH

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### Post-doctoral Research fellow – Sapienza University of Rome

November 2024 – Present

- Combustion instability prediction using CFD low-order numerical simulations for liquid rocket engines
- Hybrid rocket engines low-order modeling and multi-disciplinary optimization of hybrid-based launch vehicles for multiple applications
- CFD software development
- Advanced machine learning

### Ph.D. in Rocket Propulsion – Sapienza University of Rome

November 2021 – November 2024

#### Excellent evaluation

- Combustion instability prediction using CFD low-order numerical simulations for liquid rocket engines
- Hybrid rocket engines low-order modeling and multi-disciplinary optimization of hybrid-based launch vehicles exploiting advanced machine learning techniques
- Design of high altitude test facilities using CFD
- Design and testing of water based noise suppression systems for small-scale supersonic hot jets

### Self-employment contract for occasional work – Department of Mechanical and Aerospace Engineering of “Sapienza” University of Rome

11<sup>th</sup> March 2024 – 10<sup>th</sup> June 2024

- Support in conducting simulations and post-processing activities for the study of combustion stability in liquid propellant rocket engines

### Visiting student at German Aerospace Center (DLR – Lampoldshausen)

1<sup>st</sup> March 2023 – 1<sup>st</sup> July 2023

- Combustion instability prediction using low-order numerical simulations for liquid rocket engines. Comprehensive analysis of the BKD test case

### Self-employment contract for occasional work – Department of Mechanical and Aerospace Engineering of “Sapienza” University of Rome

1<sup>st</sup> March 2023 – 30<sup>th</sup> April 2023

- Support for the parallelization of the software and post-processing activities of the numerical database for the study of combustion instability

## LANGUAGES

- ✓ ITALIAN: Native
- ✓ ENGLISH: Excellent
- ✓ SPANISH: Elementary

## Post-Graduate fellowship – CRAS (Center of Aerospace Research of Sapienza)

2020 – 2021

- Design of water based noise suppression systems for small-scale supersonic hot jets
- Combustion instability numerical simulations using reduced order models, accounting for the real gas behavior of supercritical fluids
- Hybrid rocket engines multidisciplinary optimization exploiting feedforward neural networks and reduced order models

## M.Sc. in Space and Astronautical Engineering – Sapienza University of Rome

2018 – 2020

Final grade: 110 cum laude/110

Weighted average: 29.5/30.0

Thesis: “Low-order modeling and performance analysis of hybrid rocket propulsion”

Advisor: Prof. Daniele Bianchi

## Bachelor’s degree in Aerospace Engineering – Sapienza University of Rome

2015 – 2018

Final grade: 110 cum laude/110

Weighted average: 30.0/30.0

Thesis: “Combustion instability in liquid rocket engines and solid rocket motors”

Advisor: Prof. Diego Lentini

## SKILLS

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### IT Skills

Programming and software knowledge: Fortran, Matlab, Python, C, C++, Bash, Mathematica, LaTeX, Tecplot, MS Office  
Operative systems: Linux, Mac OS, Windows

### Other Skills

- Adaptability and critical thinking in the workplace, aimed at problem solving
- Presentation and organization of scientific results, drafting of technical reports
- Capability of working individually and in a team
- Collaborative, resourceful, flexible, and stress tolerance
- Highly motivated, determined, perseverant, fast learner
- Exceptional leader skills and group management

## AWARDS

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### BEST PAPER: 2021 Propulsion & Energy Forum Hybrid rockets session

“Machine Learning Techniques for Flight Performance Prediction of Hybrid Rocket Engines”

2021

### WINNER: 17<sup>th</sup> Pegasus Student Conference

“A Computational Tool for the Design of Hybrid Rockets”

2021

## PUBLICATIONS

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**P.M. Zolla**, A. Montanari, M. Grossi, F. Nasuti: "Comprehensive Analysis of the CVRC Test Case using Low-Order Modeling of Combustion Instability". *AIAA SciTech Forum*. 2025

**P.M. Zolla**, R. Mendes, M.T. Migliorino, D. Bianchi: "Multi-disciplinary Optimization of Throttleable Hybrid Rocket-based Launch Vehicle for Lunar Ascent to Lunar Gateway". *AIAA SciTech Forum*. 2025

F. Nasuti, D. Bianchi, M.T. Migliorino, M. Grossi, M. Fiore, **P.M. Zolla**, B. Latini, M. Fabiani, G. Cocirla, A. Sereno, A. Montanari, V. Barbato: "Progress in Applied Research in Liquid Rocket Propulsion by T(H)RUST Research Team at Sapienza University of Rome". *International Astronautical Congress*. 2024

**P.M. Zolla**, R. Rosa, M.T. Migliorino, D. Bianchi: "Multi-disciplinary Optimization of Single-stage Hybrid Rockets for Lunar Ascent". *Acta Astronautica*. 2024

**P.M. Zolla**, A. Montanari, S. D'Alessandro, M. Pizzarelli, F. Nasuti, R.C. Pellegrini, E. Cavallini: "Low-Order Modeling Approach for the Prediction of Transverse Combustion Instabilities in Multi-injector Engines". *CEAS Space Journal*. 2024

**P.M. Zolla**, A. Montanari, M. Grossi, F. Nasuti, W. Armbruster, M. Börner, J. Hardi: "Low-Order Modeling of Combustion Instability: A Comprehensive Analysis of the BKD Test Case". *AIAA SciTech Forum*. 2024

**P.M. Zolla**, A. Zavoli, M.T. Migliorino, D. Bianchi: "Integrated Optimization of a Three-Stage Clustered Hybrid Rocket Launcher using Neural Networks". *AIAA SciTech Forum*. 2024

**P.M. Zolla**, A. Zavoli, M.T. Migliorino, D. Bianchi: "Surrogate Neural Network Model for Integrated Ascent Trajectory Optimization of Throttleable Hybrid Rockets". *International Astronautical Congress*. 2023

F. Nasuti, D. Bianchi, M.T. Migliorino, M. Grossi, M. Fiore, M. Rotondi, **P.M. Zolla**, B. Latini, M. Fabiani, G. Cocirla, A. Sereno, A. Montanari, V. Barbato: "T(H)RUST: applied research activities on liquid rocket propulsion at Sapienza University of Rome". *International Astronautical Congress*. 2023

A. Montanari, **P.M. Zolla**, S. D'Alessandro, M. Pizzarelli, F. Nasuti, R.C. Pellegrini, E. Cavallini: "Sensitivity Study on a Low-Order Model for the Analysis of Transverse Combustion Instability". *Aerospace Europe Conference*. 2023

**P.M. Zolla**, R. Rosa, M.T. Migliorino, D. Bianchi: "Multi-disciplinary Optimization of Single-stage Hybrid Rocket with Swirl Injection for Lunar Ascent". *AIAA SciTech Forum*. 2023

**P.M. Zolla**, M. Fiore, P.E. Lapenna, D. Bianchi, F. Nasuti: "A Design Strategy for Water-based Noise Suppression Systems in Liquid Rocket Engines Firing Tests". *CEAS Space Journal*. 2022

A. Zavoli, **P.M. Zolla**, L. Federici, M.T. Migliorino, D. Bianchi: "Surogate Neural Network for Rapid Flight Performance Evaluation of Hybrid Rocket Engines". *Journal of Spacecraft and Rockets*. 2022

**P.M. Zolla**, A. Montanari, S. D'Alessandro, M. Pizzarelli, F. Nasuti: "Low Order Modeling of Combustion Instability Using a Hybrid Real/Ideal Gas Mixture Model". *EUCASS*. 2022

**P.M. Zolla**, M.T. Migliorino, D. Bianchi, F. Nasuti, R.C. Pellegrini, E. Cavallini: "A Computational Tool for the Design of Hybrid Rockets". *Aerotecnica Missili & Spazio*. 2021

A. Zavoli, **P.M. Zolla**, L. Federici, M.T. Migliorino, D. Bianchi: "Machine Learning Techniques for Flight Performance Prediction of Hybrid Rocket Engines". *Propulsion & Energy Forum*. 2021

S. D'Alessandro, **P.M. Zolla**, M. Pizzarelli, B. Favini, F. Nasuti: "A Hybrid Real/Ideal Gas Mixture Model in the Framework of Low Order Modeling of Combustion Instability". *Propulsion & Energy Forum*. 2021