

PERSONAL INFORMATION **Andrea Palumbo**

## WORK EXPERIENCE

<b>November 2020 – October 2022</b>	<b>Post-doctoral research fellow</b>
Name and address of employer	Sapienza University of Rome – Department of Mechanical and Aerospace Engineering, V. Eudossiana, 18, 00184, Roma, Italia
Work sector	Fluid-dynamic research, SSD: ING-IND/06
Main activities and responsibilities	Research title: “High-fidelity numerical simulation of hypersonic three-dimensional shock/boundary layer interactions”. Duration: one year, extended to two years. Supervisor: prof. S. Pirozzoli. Main subjects: direct numerical simulation of supersonic/hypersonic turbulent boundary layers; simulations of three-dimensional shock-wave/boundary layer interaction.
<b>April 2020 – September 2020</b>	<b>Post-doctoral research fellow</b>
Name and address of employer	University of Naples “Federico II” – Department of Industrial Engineering, P.le Tecchio, 80, 80125, Napoli, Italia
Work sector	Fluid-dynamic research, SSD: ING-IND/06
Main activities and responsibilities	Research title: “Numerical simulations of plasma synthetic jets in crossflow conditions”. Duration: 6 months. Supervisor: prof. L. de Luca. Main subjects: boundary layer control, modelling of pressure losses in internal flows. Teaching assistant for “Fluid dynamic stability” course for the Master’s degree in Aerospace Engineering. Advisor of Master degree thesis.

## EDUCATION AND TRAINING

<b>February 2017 – January 2020</b>	<b>PhD in Industrial Engineering (Doctor Europaeus)</b>	<b>EQF 8</b>
Name and type of organisation providing education and training	University of Naples “Federico II” – Department of Industrial Engineering, P.le Tecchio, 80, 80125, Napoli, Italia	
Principal subjects/occupational skills covered	Thesis title: “Combined numerical and experimental investigation on the interaction of synthetic jets and crossflow”. Supervisor: prof. L. de Luca. Main research subjects: active flow control techniques, numerical simulation of turbulent flows, CFD solver performance evaluation, fluid-dynamic stability. Teaching assistant for “Thermo-fluid-dynamics” and “Fluid dynamic stability” courses. Advisor for Bachelor/Master degree theses in Aerospace Engineering. Tutor for “Calculus I” courses for the Department of Industrial Engineering and the Department of Chemical, Material and Production Engineering.	
<b>October 2018 – July 2019</b>	<b>Visiting PhD Student</b>	
Name and type of organisation providing education and training	Arts et Métiers ParisTech – Laboratoire de Dynamique des Fluides, 151 Boulevard de l’Hôpital, 75013 Paris, France	
Principal subjects/occupational skills covered	Direct numerical simulation and stability analysis of the interaction between continuous/pulsed jets and a boundary layer flow. Supervisor: prof. J.-Ch. Robinet.	
<b>December 2013 – October 2016</b>	<b>Master’s degree in Aerospace Engineering</b>	<b>EQF 7</b>
Final grade	110/110 cum Laude and special mention; weighted averaged mark: 29.7/30	
Thesis	Thesis title: “Effect of a Synthetic Jet Actuator on the Continuous Water Spray Behaviour”. Supervisor: prof. L. de Luca.	
Name and type of organisation providing education and training	University of Naples “Federico II” – Department of Industrial Engineering, P.le Tecchio, 80, 80125, Napoli, Italia	
<b>July 2016 – October 2016</b>	<b>Master thesis traineeship</b>	
Name and address of employer	Istituto Motori del CNR, Via Guglielmo Marconi, 4, 80125 Napoli NA.	
Principal subjects/occupational skills covered	Particle Image Velocimetry (PIV) analysis of the control of a liquid spray by means of synthetic jets; post-processing of PIV data.	

October 2010 – December 2013 **Bachelor's degree in Aerospace Engineering** EQF 6  
 Final grade 110/110 cum Laude and special mention; weighted averaged mark: 29.6/30  
 Thesis Thesis title: "Effects of non-linear damping in resonant cavities". Supervisor: prof. L. de Luca.  
 Name and type of organisation providing education and training University of Naples "Federico II" – Department of Industrial Engineering, P.le Tecchio, 80, 80125, Napoli, Italia

September 2005 – July 2010 **High-school Diploma** EQF 4  
 Final Grade 100/100  
 Name and type of organisation providing education and training Liceo Scientifico "G. Mercalli", Via Andrea D'Isernia, 34, 80122, Napoli

**FELLOWSHIPS**

- 2020 Winner of a post-doctoral fellowship at the Department of Mechanical and Aerospace Engineering of the University of Rome "La Sapienza".
- 2020 Winner of a post-doctoral fellowship at the Department of Industrial Engineering of the University of Naples "Federico II".
- 2018 Award by STAR Program (University of Naples Federico II) for a visiting position at Arts et Métiers ParisTech. (<http://www.coinor.unina.it/programmastar>)
- 2016 Winner of a fellowship for the Doctorate School in Industrial Engineering at the University of Naples "Federico II".

**PERSONAL SKILLS**

Mother tongue Italian

Other languages	UNDERSTANDING		SPEAKING		WRITING
	Listening	Reading	Spoken interaction	Spoken production	
English	B2	B2	B2	B2	B2
French	A2	A2	A2	A2	A2

Levels: A1 and A2: Basic user – B1 and B2: Independent user – C1 and C2: Proficient user  
[Common European Framework of Reference for Languages](#)

Certifications **PET**– Preliminary English Test (B1) - 2006

Computer skills Wide use of open-source (OpenFOAM, Nek5000/NekRS, Gerris, Basilisk, STREAMS) and commercial CFD codes (ANSYS Fluent, ANSYS Icem, Star-CCM+) and post-processing software (Visit, Tecplot 360, ParaView). Good knowledge of grid generator programs for CFD (Pointwise) and CAD (Catia, NX Siemens).  
 Extensive knowledge of MATLAB and wide use of the SIMULINK toolbox.  
 Good knowledge of the programming languages C, C++, Fortran, Python.  
 Advanced knowledge of L<sup>A</sup>T<sub>E</sub>X, Windows, Microsoft Office. Wide use of Linux systems.  
 Good knowledge of High Performance Computing (HPC) systems and wide use of supercomputers for numerical analysis; attended several training courses/seminars regarding HPC systems, hybrid CPU/GPU configurations, parallel computing and programming languages.

Supercomputer projects 2022: Principal investigator (PI) of IscraB project DSHOW (DNS of Supersonic/Hypersonic compression corner flows) on MARCONI 100 supercomputer (CINECA, Bologna)  
 2021: Principal Investigator (PI) of IscraC project ENABLING (EfficieNcy Analysis of Boundary-Layer transition-promotING systems), on GALILEO100 and MARCONI100 supercomputer (CINECA, Bologna).  
 2020: Principal Investigator (PI) of IscraC project NIDI (Numerical Investigation of Dual-jet Interaction), on GALILEO supercomputer (CINECA, Bologna).  
 2019: Principal Investigator (PI) of IscraC project NISIDA (Numerical Investigation on Synthetic jets Issuing from a Double-orifice Actuator), on MARCONI supercomputer (CINECA, Bologna).  
 Participation in several Prace, Iscra-B and Iscra-C projects.

**Reviewer service** Reviewer for the following international journals:

- Journal of Fluid Mechanics
- Physics of Fluids
- AIAA Journal
- Aerospace (MDPI)
- Processes (MDPI)
- Energies (MDPI)
- Water (MDPI)
- Applied Sciences (MDPI)
- Sensors (MDPI)

Reviewer service for AIAA SciTech Forum and Exhibition (2020,2021,2022,2023)

## OUTLINE OF RESEARCH ACTIVITIES

- Main research interests**
- Computational fluid dynamics (CFD)
  - Supersonic and hypersonic flows
  - Transitional and turbulent flows
  - Active flow control
  - Fluid dynamic stability
  - Multi-phase flows
  - Film cooling systems

### Main research collaborations **STabilità di un GETto Sintetico in crossflow (STAGES)**

The project was developed in collaboration with Arts et Métiers ParisTech and CNRS/Université Paris-Saclay, and funded by STAR program (UniNa). The activity dealt with the investigation of the global instabilities and transition to turbulence generated by the interaction between a synthetic jet and a laminar flat-plate boundary layer, particularly next to the jet exit orifice and in the downstream region.

#### **CleanSky 2 – AirGreen2 Consortium**

This project involved several international partners, such as: CIRA, IMAST, ONERA, SICAMB, Siemens, Umbra Cuscinetti and several universities. The activity regarded the development of PSJ actuators to be integrated in a morphing flap structure of a new-generation aircraft.

#### **SyntHetic jet Actuators for Flow conTrol (SHAFT)**

This project was conducted in collaboration with CIRA. Its main objective was the numerical and experimental investigation of the control of the flow over a backward-facing ramp by means of piezo-driven synthetic jets. A preliminary characterization of the in-house designed and manufactured actuator was carried out in quiescent conditions by means of numerical simulations, lumped element modeling and experimental measurements

#### **CFD Analysis to estimate the sensitivity of the pressure drop, measured through a shaped hole, by a proper pneumatic gauge, as the geometrical parameters are changed**

This project was conducted within a research contract by Avio Aero. The aim of the work was to analyze the pressure loss inside cooling holes using open-source CFD codes and theoretical methods. Effects of the main geometric parameters (hole diameter, length, slope and inclination angles) were analyzed by means of RANS computations, using the OpenFoam software.

#### **High-fidelity numerical simulation of hypersonic three-dimensional shock boundary layer interactions**

The activity was funded by AFOSR (Air Force Office of Scientific Research), and regarded the development of a direct numerical simulations approach for three-dimensional turbulent shock/boundary-layer interaction (SBLI). As a preliminary step of the research, simulations of supersonic/hypersonic zero-pressure-gradient boundary layers were carried out. In a subsequent phase, the SBLI flow field was considered, both in two-dimensional and three-dimensional (skewed) configurations.

Research output Research articles:

- A. Ceci, A. Palumbo, J. Larsson, S. Pirozzoli. “On low-frequency unsteadiness in swept shock-wave/boundary layer interactions”. *Accepted for publication on Journal of Fluid Mechanics*. 2023.
- A. Palumbo, O. Semeraro, J.-Ch. Robinet, L. de Luca. “Boundary layer transition induced by low-speed synthetic jets”. *Physics of Fluids*. Vol. 34, Article No. 1241134. 2022. DOI: 10.1063/5.0128798. ISSN: 1070-6331
- A. Ceci, A. Palumbo, J. Larsson, S. Pirozzoli. “Numerical tripping of high-speed turbulent boundary layers”. *Theoretical and Computational Fluid Mechanics*. Vol. 36, pp. 865-886. 2022. DOI: 10.1007/s00162-022-00623-0. ISSN: 1432-2250
- A. Palumbo, L. de Luca. “Experimental and CFD Characterization of a Double-Orifice Synthetic Jet Actuator for Flow Control”. *Actuators*. Vol. 10, Issue 12, Article No. 326. 2021. DOI: 10.3390/act10120326. ISSN: 2076-0825.
- A. Palumbo, M. Chiatto, L. de Luca. “The role of the critical layer in the channel flow transition revisited”, *Meccanica*. Vol. 54, Issue 14, pp. 2169-2182. 2019. DOI: 10.1007/s11012-019-01079-z. ISSN: 1572-9648.
- M. Chiatto, A. Palumbo, L. de Luca. “Design approach to predict synthetic jet formation and resonance amplifications”. *Experimental Thermal and Fluid Science*. Vol. 107, pp. 79-87. 2019. DOI: 10.1016/j.expthermflusci.2019.05.013. ISSN: 0894-1777.
- F. Capuano, A. Palumbo, L. de Luca. “Comparative study of spectral-element and finite-volume solvers for direct numerical simulation of synthetic jets”. *Computers & Fluids*. Vol. 179, pp. 228-237. 2019. DOI: 10.1016/j.compfluid.2018.11.002. ISSN: 0045-7930.
- A. Palumbo, M. Chiatto, L. de Luca. “Measurements versus numerical simulations for slotted synthetic jet actuator”. *Actuators*. Vol. 7, Issue 3, Article No. 59. 2018. DOI: 10.3390/act7030059. ISSN: 2076-0825.
- M. Chiatto, A. Palumbo, L. de Luca. “A Calibrated Lumped Element Model for the Prediction of PSJ Actuator Efficiency Performance”. *Actuators*. Vol. 7, Issue 1, Article No. 10. 2018. DOI: 10.3390/act7010010. ISSN: 2076-0825.

Conference proceedings/abstracts: (the speaker is underlined)

- A. Ceci, A. Palumbo, J. Larsson, S. Pirozzoli, *On low-frequency unsteadiness in three-dimensional shock/boundary layer interactions*, 75<sup>th</sup> Annual Meeting of the Division of Fluid Mechanics, Indianapolis, 20-22 November 2022.
- A. Ceci, A. Palumbo, J. Larsson, S. Pirozzoli, *Numerical tripping of supersonic/hypersonic boundary layers*, ECCOMAS Conference, Oslo, 5-9 June 2022.
- M. Di Renzo, A. Ceci, A. Palumbo, J. Larsson, S. Pirozzoli, *Wall-pressure spectra in shock wave/turbulent boundary layer interactions with a crossflow*, ParCFD 2022, Alba, 25-27 May 2022.
- A. Palumbo, O. Semeraro, J.-Ch. Robinet, L. de Luca, *Receptivity to synthetic jet actuation in boundary layer flows*, AIAA SciTech 2020, Orlando, 6-10 January 2020.
- A. Palumbo, A. Della Pia, M. Chiatto, L. de Luca, *Numerical study on the flow field generated by a double-orifice synthetic jet device*, XXIV AIMETA Conference, Roma, 15-19 September 2019.
- M. Chiatto, A. Palumbo, G. de Felice, L. de Luca, *Multi-slotted synthetic jet actuator for flow control of separated flows*, 15<sup>th</sup> International Conference on Fluid Control, Measurements and Visualization, Napoli, 27-30 May 2019.

- A. Palumbo, *Global stability analysis of synthetic jet in crossflow*, Giornata dei dottorandi italiani in ingegneria aerospaziale, Pisa, 29-31 October 2018.
- A. Palumbo, F. Capuano, L. de Luca, *Performances of two open-source codes in the numerical simulation of synthetic jets*, ECCOMAS Conference, Glasgow, 11-15 June 2018.
- M. Chiatto, M. Arena, A. Palumbo, R. Pecora, L. de Luca, *Towards a flow control method based on PSJ actuators: a feasibility study*. Euromech Colloquium 593, Delft, 14-16 March 2018.
- M. Chiatto, A. Palumbo, L. de Luca. *Piezo-driven and Plasma Synthetic Jet Actuators. A comparative investigation*. Global Workshop on Functional Materials and Devices, Singapore, January 11-13, 2018.
- M. Chiatto, A. Palumbo, L. de Luca. *Experimental Characterization of Plasma Synthetic Jet Actuators*. XXIII AIMETA Conference. Salerno, 4-7 September 2017.
- M. Chiatto, A. Palumbo, L. de Luca. *Development of a physical model for plasma synthetic jet actuators*. XXII AIMETA Conference. Genova, 14-17 September 2015.

Napoli, January 2023.