Valerio Francesco Barnabei

Curriculum Vitae

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Education

- Dec 2021 **Ph.D. in Energy and Environment**, Department of Astronautical, Electric and Energetic Engineering, La Sapienza University of Rome
 - **Thesis:** A Fluid Structure Interaction Framework for Digital Twins in Turbomachinery
- Sep.2018 Qualification to the profession of Industrial Engineer
- May 2017 Master's Degree in Mechanical Engineering, La Sapienza University of Rome, 109/110 (1st)

• **Thesis:** "The Updated Lagrangian formulation in FEM simulation of structures with geometric nonlinearities applied on solar trackers"

May 2014 Bachelor's Degree in Mechanical Engineering, La Sapienza University of Rome, 94/110 (2:2)

• Thesis: "Thermal boundary layer"

Jul.2010 **High school diploma in classical studies** , Liceo Classico Torquato Tasso, Rome

Research Experience

- Apr. 2021 onwards **Research Fellow**, Department of Mechanical and Aeronautical Engineering, La Sapienza University of Rome
 - Research project: Development of models and tools for Fluid Structure Interaction simulations and passive morphing adaptivity in wave energy conversion systems
 - Design and simulation of an innovative Wells turbine with passive morphing techniques and material adaptability

Mar. 2018 - Feb 2021 **Ph.D. Fellowship**, Department of Astronautical, Electric and Energetic Engineering, La Sapienza University of Rome

- Development of FEMpar, a MPI C⁺⁺/ Python software for FSI analysis using Finite Elements and Variational MultiScale models
 - Development of Python preprocessing tools for FEMpar;
 - Implementation in FEMpar of models and algorithms for numerical analysis of Fluid-Structure Interaction in turbomachinery;
 - Validation of FEMpar against popular 2D and 3D test cases;
 - Optimization of FEMpar on the Cluster MARCONI A2 at CINECA
- Design and simulation of turbomachinery with passive morphing techniques and material adaptability;
- CFD and FEA simulations for turbomachinery using commercial and open source software

Oct. 2014 - May 2017 Master's Degree in Mechanical Engineering, La Sapienza University of Rome

- Study and assessment on the application of advanced methods for the solution of non-linear elasticity using Finite Elements
- $\circ\,$ Implementation and validation of the Updated Lagrangian formulation in the in-house software Xenios^{++}
- Design and simulation of a control scheme for the stabilization and trajectory control of a quadrotor UAV
- Design and CFD analysis of a Ljungstrom turbine for an ORC cycle in a waste heat recovery application

Relevant research skills

- Advanced knowledge of numerical methods for Computational Fluid Dynamics (CFD) and Fluid Structure Interaction (FSI):
 - Finite Elements, Finite Volumes, discretization techniques, domain decomposition, meshing techniques;
 - Steady-state and time-advancing solutions, Variational MultiScale methods and weak imposition of boundary conditions;
- Advanced knowledge of software development
 - C^{++} (OOP, stl, MPI, PETSc)
 - Python 3.x (OOP, Pandas, numpy, matplotlib)
- Advanced knowledge of pre and post-processing and analysis of CFD and FEA simulation results
- Advanced knowledge on the following software:
 - OS: Linux/Bash, Windows
 - Microsoft Office: Word, Excel, PowerPoint
 - ANSYS Workbench: Geometry Modeler/SpaceClaim, Meshing, Fluent, Mechanical
 - openFoam: simpleFoam, pimpleFoam, cf-mesh, snappyHexMesh
 - CAD/Meshing/Post: Solidworks, Pointwise, Tecplot, Paraview, Gnuplot
 - MATLAB: MATLAB, Simulink

Languages

Italian (native), English (fluent), German (A1)

Other Experiences

- Dec. 2021 **Participant at IEA Task 47**: Cooperation on the field of detailed aerodynamic measurements on MW scale wind turbines organized by TNO (Netherlands) and DTU (Denmark)
- Dec. 2021 Member of the project Experimental test-bench for the development of a new mini morphable Wells turbine for wave energy conversion integrable into existing port-structures or coastal defense systems against erosion funded by University of Rome La Sapienza
- Dec. 2021 **Conference organizer** for the OWEMES workshop *Off-shore Wind Ener*gy, la prospettiva italiana: progetti, tecnologie, esperienze at University of Rome La Sapienza
- Feb. 2019 External Supervisor for the ISCRA project Development of a parallel software for Domain Decomposition and Finite Element Analysis in Fluid Structure Interaction problems at CINECA
- Jul. 2018 Summer School: 27th Summer School on Parallel Computing, at CINECA

Speaker at the international conferences *IGTI Turbo Expo 2019, 2020, 2021*, ECCOMAS MARINE 2021, ATI 2020, ECOS 2016

Reviewer for Journal of Power And Energy, International Journal of Aerospace Engineering, ASME Turbo Expo, ATI conference

Work Experience

Oct. 2017 - Feb. 2018 Bank of Italy, Engineering Stage, at the Banknote Printing Department - Division Mantainance and Services

> Cooperation in the project for the digitalization of the technical informations and data of the chemical plants related to the banknote production. Creation of a mantainance plan for the chemical plants and their equipment. Cooperation in a feasibility study for the substitution and revamping of the equipment, rationalization of the spare parts, and the reduction of energy consumption.

Publications

- Jun. 2021 Barnabei V.F., Castorrini A., Corsini A., Rispoli F., Morphing of Reversible Axial Fan Blade: A FSI-FEM Study. In Turbo Expo: Power for Land, Sea, and Air (Vol. 84898, p. V001T10A009). American Society of Mechanical Engineers.
- Sep. 2020 Barnabei V.F., Castorrini A., Corsini A., Rispoli F., FSI analysis and simulation of flexible blades in a Wells turbine for wave energy conversion, In E3S Web of Conferences (Vol. 197, p. 11008). EDP Sciences.
- Jul. 2020 Barnabei V.F., Castorrini A., Corsini A., Van der Spuy S.J., Rispoli F., Unsteady flow simulation of an axial fan for dry cooling in a CPS plant using the Variational Multiscale Method, In ASME Turbo Expo 2020: Turbomachinery Technical Conference and Exposition. American Society of Mechanical Engineers Digital Collection.
- Jun. 2019 Castorrini A., Barnabei V.F., Corsini A., Rispoli F., Strongly coupled fluidstructure interaction simulation of a 3D printed fan rotor, In Turbo Expo: Power for Land, Sea, and Air (Vol. 58547, p. V001T09A006). American Society of Mechanical Engineers.
- Jun. 2016 Palumbo C.F., Barnabei V.F., Preziuso, E., Coronetta U., Design and CFD analysis of a Ljungstrom turbine for an ORC cycle in a waste heat recovery application, in Proceedings of the 29th International Conference on Efficiency, Cost, Optimisation, Simulation and Environmental Impact of Energy Systems, June 19. - 23. 2016, Portorož, Slovenia.