

Supervisor Expression of Interest

MSCA - Marie Sklodowska Curie Action - (PF) Postdoctoral Fellowship 2025

Supervisor name: Chiara Bisagni

Email address: chiara.bisagni@polimi.it

Link "Pagina docente": <https://www.aero.polimi.it/it/personale/chiara.bisagni>

Department Name: Department of Aerospace Science and Technology

Research topic: Aerospace Composite Structures

MSCA-PF Research Area Panels:

- ECO_Economic Sciences
- ENG_Information Science and Engineering
- ENV_Environmental and Geosciences
- LIF_Life Sciences
- MAT_Mathematics
- PHY_Physics
- SOC_Social Sciences and Humanities
- CHE_Chemistry

Brief description of the Department and Research Group (including URL if applicable):

The Department of Aerospace Science and Technologies (DAER) graduates about 30% of aerospace engineers in Italy. It has a global research staff of 17 Full Professors, 22 Associate Professors, and 30 Assistant Professors. Its research activity can be divided into five main branches, namely Structures, Aerodynamics, Engines, Systems, and Space.

The research activities of the post-doc will be carried out in the NABUCCO group. The aim of the NABUCCO research group is to enhance the efficiency of future aircraft and space structures by implementing composite materials and innovative concepts. The research group is exploring new methods for the design of composite structures combining numerical and analytical tools with experimental tests. These methods concern advanced techniques based on finite elements, machine learning techniques and analytical formulations, for robust and efficient solution of nonlinear problems, and the modelling of damage phenomena. In this framework, composite structures are investigated considering the new requirements of buckling and post-buckling for aeronautical and space applications.

TITLE of the project: Data driven design optimization of composite structures operating in the post-buckling regime

Brief project description:

The research activity aims to enhance the efficiency of future aerospace composite structures by conducting data driven design optimization to ensure their safe use in the post-buckling field. Although structural buckling has traditionally been viewed as a potentially dangerous issue to be avoided due to its association with catastrophic failure, the nonlinear behavior associated with this phenomenon could actually be advantageous in the current push for more efficient structures.

The methodology to be developed will implement multidisciplinary design approaches capable of designing optimal structures with specific requirements for post-buckling behavior and damage tolerance. It will involve an integrated approach encompassing the development of most, if not all, of the following phases:

- Analytical or semi-analytical formulations for the rapid structural design and analysis of composite structures operating in the post-buckling field;
- Multi-objective optimization methodologies combined with neural networks for optimal and robust design;
- High-fidelity simulation capabilities using finite element analysis, taking into account the nonlinear post-buckling field as well as the analysis of damage initiation and propagation;
- Multiscale modeling techniques for simulating material behavior across different length scales (micro, meso, and macro) to understand and predict their properties and performance;
- Advanced testing techniques for the validation and evaluation of the proposed optimized composite structures.

The research will be conducted in close collaboration with the research activities carried out in the ERC Advanced Grant NABUCCO (New Adaptive and BUCKling-driven COmposite aerospace structures), a project funded by the European Research Council of the European Commission.