AEROSPACE ENGINEERING

DIMEAS - Scientific machine learning and digital twins for multi-physics problems

Funded By	Dipartimento DIMEAS
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Context of the research activity	Scientific machine learning; fluid mechanics; propulsion
Objectives	Sustainable aviation: Hydrogen flames are extremely prone to make the gas turbine noisy and operationally unstable. This is due thermoacoustic instabilities, which are caused by a positive energetic feedback between the acoustics and the heat-release rate from hydrogen chemistry. Thermoacoustic instabilities are a major challenge for gas-turbine manufacturers. These instabilities can be a showstopper for the transition to hydrogen-fuelled power plants because hydrogen chemistry properties are more sensitive to external perturbations than natural gas. In this project, we will create versatile models by combining data from sensors and real-time digital twins, which will provide quantitatively accurate predictions on the dynamics. In parallel, the digital twin will be trained with an ensemble method with scientific machine learning and data assimilation, to both obtain the state, parameters, and model errors. Desirable: Hybrid strategies with classical and quantum algorithms will be designed to speed up the training.
Skills and competencies for the development of the activity	Scientific machine learning; fluid mechanics; computing; programming; optimisation