AEROSPACE ENGINEERING

DIMEAS - Multiscale thermo-fluid dynamics analysis of heat exchangers produced by additive manufacturing

Funded By	Dipartimento DIMEAS
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Context of the research activity	The research will be focused on the characterization of thermo-fluid dynamics performance of heat exchangers produced by additive manufacturing. Both numerical and experimental activities will be carried out. The numerical activities will include the development of models and numerical tools to support the design and optimization of high-performance heat exchangers. Experimental activities will be carried out to validate simulations and to develop corrections for the existing numerical models.
Objectives	Recent advances in additive manufacturing paved the way toward the production of new high-performance heat exchangers which can be efficiently used for aerospace, automotive and naval applications. The use of additive manufacturing allows to produce complex geometries which cannot be obtained by traditional techniques. This complexity introduces significant challenges during the design process of these components. First of all, the geometrical complexity makes the design space very large. Furthermore, the computational cost of high-fidelity simulations for these components are prohibitive. The research activity will be carried out in collaboration with Dumarey in the framework of a regional research project. The numerical research activity will be focused on the following objectives: * Development of numerical procedures for high-fidelity simulations of complex heat-exchangers * Development of homogenized porous media models to reduced the computational cost of high-fidelity simulations * Development of reduced order models to speed-up the first steps of the design process * Development of uncertainty quantification procedures Furthermore, the research activity will include also experimental studies with the following goals: * Development of reliable and traceable measurement procedures for thermo-fluid dynamics performance (pressure loss and heat transfer) * Experimental characterization of reference heat exchangers * Exploitation of experimental data to validate numerical simulations * Exploitation of experimental data to improve existing numerical models by

	means of data-driven corrections obtained through machine-learning approaches

Skills and competencies for the development of the activity	The candidate must have a solid background in thermo-fluid dynamics, scientific computing and programming. Since the research activity will include the development of new numerical tools, the candidate is expected to have experience in programming and development of numerical codes for computational fluid dynamics and reduced order models.