Politecnico di Torino

ENERGETICS

DENERG - Innovative cooling solutions for novel energy and propulsion systems

Funded By	Dipartimento DENERG
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Context of the research activity	The aeroengine market is experiencing changes in the design processes and research efforts are mainly driven by the need to comply with pollutant emissions reduction and improved performance. Innovative design procedures should be defined basing on novel optimization tools to achieve a global multi-objective optimization of the aeroengine components. The research activity will specifically target novel solutions for the design of high temperature flows components.
Objectives	The needs introduced by the pollutant emission regulations are thrusting the use of alternative fuels and the development of improved designs for the propulsors components. That is especially true in the defence field, where a few actors are working to develop the next-gen fighters in cooperation with the European governments and institutions. In that context, the NEUMANN project funded by the European Commission represents an incredible opportunity to reconsider the design procedure of aeroengines components, focusing on the development of reliable numerical tools for high-performance computing. The research activity aims at deploying innovative solutions and methods to design new components for the thermal behaviour of high temperature flows. The capability to cool down the turbine components in an efficient way is a key factor to enable the new generation engines and to consistently boost their performance. Optimization methods will hence be implemented for the design of innovative components while taking into consideration unsteady flows. Uncertainty quantification will be later introduced to complete the transition towards robust design methods. Each step of the research will be validated using available experimental data from academic test cases. More in details, a preliminary version of the algorithm will be used to optimize a known geometry under steady boundary conditions for conventional working parameters. The impact of turbulence modelling will be quantified for the investigated cases, thus releasing a design practice able to reduce numerical inaccuracies. Component interaction will be accounted for by using loosely coupled approaches. Further on, the impact of different material will be considered by means of a limited number of conjugate heat transfer

	analyses performed on the most promising solutions. Manufacturing uncertainties will eventually be implemented in the model to improve the overall performance of the numerical method. Progressive refinements in the speed and performance of the optimization method will allow for detecting global maxima rather than of local ones.

Skills and competencies for the development of the activity	The candidate should hold a solid knowledge of the basic technical characteristics of gas turbines. A basic knowledge of computational fluid dynamics (with commercial tools, not necessarily in heat transfer analysis) is also required. Experience in the optimization field and in Python programming may represent an added value.