ENERGETICS

Ferrari/DENERG - Development of a Simulation Platform to Assess the Performance of a High Specific Power Engines Operating with Renewable and low carbon Fuels

Funded By	Dipartimento DENERG FERRARI S.P.A. [P.iva/CF:00159560366]
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Context of the research activity	The PhD project aims at creating a methodology to support the design of a new generation of high-performance engines powered by hydrogen or by other prominent fuels with a reduced “carbon footprint”, through the development of simulation models with different degrees of complexity.
Objectives	Nowadays renewable fuels could represent a valuable path to reduce the carbon footprint of the transport sector especially of hard to abate applications. Hydrogen, in particular, seems to be one of the most promising candidates thanks to its excellent combustion properties. H2 engines could also be an effective solution for some market niches, such as racing and hyper-cars, since they can preserve the emotional driving experience of conventional powertrains. Moreover, mass market penetration of H2 engine can benefit from the tough requirements of motorsport and high-performance applications which can boost the development of innovative solutions to tackle the challenges of the hydrogen combustion. As an example, the use of an almost stoichiometric A/F ratio could maximise the power and the transient response of the engine, but it will also lead to an increase reactivity of the mixture which require the development of new technologies (e.g. Water Injection) capable to reduce the likelihood of abnormal combustion phenomena. In such a framework, the optimisation of an H2 engine should extensively rely on simulation tools capable to reproduce the peculiarity of the hydrogen combustion process investigating a wide range of different configurations and calibrations. Therefore, the proposed research activity aims at developing a comprehensive methodology approaches to support, through the synergic use of 0-1-3D numerical simulations, the design of a high-performance hydrogen engine.
Skills and competencies for the development of	The PhD candidate should have a deep knowledge of the operating principles of the internal combustion engine as well as the fundamental law of the thermodynamics. In particular he/she has to know the fundamental aspects of the combustion process since they are crucial for the optimisation

development of the activity	of innovative engine operating with sustainable fuels. Moreover he/she need experience with 1/3D CFD softwares such as GT-Suite and Converge