Disertante/ Speaker:
Dr. Tommaso Lucchini

Titulo/ title:
Modeling in-cylinder flows and combustion with the OpenFOAM technology

Resumen/Abstract:
To fulfill the future emission standards and fuel consumption reduction targets, IC engine combustion and after-treatment systems need further improvements in the next years. Within this context, the role of computational fluid dynamics will be even more important due to the need to optimize the engine in a wide range of operating conditions typical of new driving cycles like RDE or WLTC.
Predictive, fast and robust models are required to study any engine component and to provide at the same time reliable boundary conditions for the simulations of the other ones. This will drastically reduce the development time and the need to perform experimental tests.
Because of its available capabilities for mesh handling, numerical and physical modeling and flexibility in the implementation of new models, OpenFOAM® is a unique tool which can be extensively applied and customized for complex applications of CFD like simulation of IC engines. This work is focused on the development of suitable libraries and solvers to model reacting flows in internal combustion engines (in-cylinder and after-treatment systems) using the OpenFOAM technology. Starting from the consolidated code structure which is publicly available, author's efforts were focused on automatic mesh generation, tabulation of detailed kinetics for combustion modeling, simulation of fuel-air mixing process, multi-scale modeling of after-treatment devices. Different case studies, including both academic and real engine configurations, were selected to assess and validate the proposed methodology.

Bio Conferencista/ Bio Lecturer:
Tommaso Lucchini is associate professor at the Department of Energy of Politecnico di Milano since 2015. In the same Department he achieved his Phd in 2006 (thesis title : "Prediction of Combustion in Internal Combustion Engines"). worked as post-doc in 2006-2008 period and as assistant profesor from 2009 to 2014.
His research and teaching activities are focused in the field of Fluid Machines and, in particular, Internal Combustion Engines. He works on CFD modeling of in-cylinder flows (gas-exchange, fuel-air mixing and combustion) and he develops the LibICE code, which is based on the OpenFOAM technology. He is involved in different research and industrial collaborations with different companies and universities working in the fields of Diesel and spark-ignition combustion. The main results achieved in his research activity includes:
- development of a comprehensive methodology for the simulation of gas exchange, fuel-air mixing and combustion in GDI engines.
- consistent comparison of different models for Diesel combustion using detailed kinetics in both engines and constant-volume vessels.
- development of combustion models based on tabulated kinetics for Diesel combustion
- development of a comprehensive model for spark-ignition combustión including the effects of electrical circuit.
He is author of more than 80 scientific publications.