

# OpenFOAM in Combustion Research



## Modeling Combustion in IC Engines using the OpenFOAM Technology: Model Development, Validation and Application to Real Configurations

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Register: [https://nus-sg.zoom.us/webinar/register/WN\\_e0x15c8XQkaWzavxdIBDVw](https://nus-sg.zoom.us/webinar/register/WN_e0x15c8XQkaWzavxdIBDVw)

Host: Dr. Leo (XiaoHang) Fang, University of Oxford



### Abstract

Internal combustion engines are complex devices where performance, pollutant emissions and fuel consumption depend on multiple interacting physical and chemical processes. To be still employed as prime mover for transportation systems and power generator, IC engines are facing unprecedented challenges where new fuels and advanced combustion systems are necessary to reduce the greenhouse gas and pollutant emissions. Within this context, the development of suitable computational models and methodologies for IC engine simulations becomes very important since a continuous development and improvement of the current numerical approaches can support such transition. The presentation illustrates how the OpenFOAM open-source technology could be tailored for the development of computational models and methodologies for the simulation of internal combustion engines. Different cases studies will be reported and for each one of them the different steps related to the model development, validation using fundamental test-case and real engine configurations will be illustrated. Examples includes: CI combustion with conventional and alternative fuels (DME); modeling SI combustion with simplified and advanced approaches to describe the ignition process; simulation of advanced combustion modes (PCCI, HCCI, Dual-fuel); model validation using experimental data from the Engine Combustion Network community.

### About the Speaker

Professor Tommaso Lucchini is an associate professor at the Energy Department of Politecnico di Milano. His research and teaching activities are focused on fluid machines, computational fluid dynamics and internal combustion engines. He currently teaches “Fluid Machines for Low-Carbon Technology” (MSc in Energy Engineering), “Fluid Machines” (BSc in Mechanical Engineering) and “Computational Fluid Dynamics with Open-Source software” (PhD Interdoctoral course). He is part of the Internal Combustion Engine Research group and he develops models and methodologies for the simulation of internal combustion engines using the OpenFOAM technology. He uses and develops OpenFOAM since 2004 for IC engine simulations focusing on gas exchange, fuel-air mixing and combustion modeling. The main result achieved by Prof. Tommaso Lucchini in his entire career is represented by the development of an open-source code for the simulation of gas-exchange, fuel-air mixing and combustion in IC engines. Such code includes the state of the art of numerical models and for this reason, it can be used as a possible alternative to commercial codes. Furthermore, the availability of advanced spray and combustion models makes that code also an ideal tool for detailed investigations in the context of research and industrial projects.

