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Further improving the environmental performances of Internal Combustion Engines (ICE) increasingly requires moving beyond traditional multidimensional simulation tools based on a cycle averaged approach (RANS), and to reliably predict and control individual engine cycles under realistic operating conditions. Large-Eddy Simulation (LES) offers this unique potential by predicting spatially filtered flow realisations, thus opening up new perspectives for extending the scope of application of CFD for ICES.

Since its 1st edition in 2008, the LES4ICE conference provides a forum for exchange concerning research and development of LES and related experimental techniques for their application to ICE flows. It brings together researchers and engineers working in the field of piston engine combustion to debate the state of the art in LES applied to ICES and examine advanced experimental techniques capable of supporting and validating its development.

The present special issue proposes an extract from the contributions to the 2016 edition of LES4ICE, following a reviewing process by the conference’s Scientific Committee. The selected seven articles provide an overview on recent key findings from Particle Image Velocimetry studies of the flow at a late crank angle close to fuel injection resulting from the compression of a tumbling intake flow. This highly innovative approach was shown to allow identifying the causes for cyclic variability observed in a production direct injection spark-ignition engine.

Another key factor for ensuring an accurate resolution of the resolved scales in LES is the quality of the computational mesh which can be difficult to ensure during all phases of a four-stroke engine cycle. Falkenstein et al. [2] report on the development of a LES code combining overset Cartesian grids with an immersed boundary method to handle engine-like wall bounded geometries. A first application to the LES of a steady flow-bench allows validating the developed LES code by comparing its predictions with experimental findings.

Despite the increasing performance of massively parallel computers and the increased spatial resolution they allow, an accurate simulation of complex turbulent reactive flows still requires the availability of LES combustion models able to address turbulence/chemistry interactions at both the resolved and unresolved scales.

Davidovic et al. [3] propose a LES formulation of a Multiple Representative Interactive Flamelet model, and apply it to the LES of a reactive Diesel-like liquid spray in a well mastered constant volume vessel for which detailed experimental results are available via the Engine Combustion Network.

Yildar et al. [4] report the development of a LES model for combustion under Controlled Auto-Ignition conditions, and apply it to explore in detail the ignition and combustion mechanisms in a single cylinder engine running such a combustion mode.

Finally, a high-potential field for LES is its usage to gain an unprecedented detailed insight and understanding of turbulent flow and combustion in piston engines and how they impact their performances.

Nicollet et al. [5] report the usage of LES to confirm and complement findings from Particle Image Velocimetry studies of the flow at a late crank angle close to fuel injection resulting from the compression of a tumbling intake flow. This highly innovative approach was shown to allow identifying the causes for cyclic variability observed in a production direct injection spark-ignition engine.
Shekhawat et al. [6] present a study of the early flame kernel growth in a homogeneous charge spark-ignition research engine using PIV and LES, and on its link to cyclic combustion variability.

Finally X. Yang and T-W. Kuo [7] used LES of flow inside a motored research single cylinder engine to study the correlation between cyclic variability of the swirl generated by intake and compression and the variability of the intake valve curtain flow.

References

1. Nguyen T., Kempf AM. (2017) Investigation of Numerical Effects on the Flow and Combustion in LES of ICE, Oil Gas Sci. Technol. 72, 25.
2. Falkenstein T., Kang S., Davidovic M., Bode M., Pitsch H., Kamatsuchi T., Nagao J., Arima T. (2017) LES of Internal Combustion Engine Flows Using Cartesian Overset Grids, Oil Gas Sci. Technol. 72, 26.
3. Davidovic M., Falkenstein T., Bode M., Cai L., Kang S., Hinrichs J., Pitsch H. (2017) LES of n-Dodecane Spray Combustion Using a Multiple Representative Interactive Flamelets Model, Oil Gas Sci. Technol. 72, 29.
4. Yildar E., Kuenne G., He C., Schiessl R., Benzinger MS., Neurohr M., di Mare F., Sadiki A., Janicka J. (2017) Understanding the Influences of Thermal and Mixture Inhomogeneities on the Auto-Ignition Process in a Controlled Auto-Ignition (CAI) Engine Using LES, Oil Gas Sci. Technol. 72, 33.
5. Nicollet F., Krüger C., Schorr J., Nicoud E., Colin O., Angelberger C., Bode J., Böhm B. (2017) A PIV-Guided Large-Eddy Simulation of In-Cylinder Flows, Oil Gas Sci. Technol. 72, 28.
6. Shekhawat Y., Haworth D.C., d’Adamo A., Berni F., Fontanesi S., Schiffmann P., Reuss D.L., Sick V. (2017) An Experimental and Simulation Study of Early Flame Development in a Homogeneous-charge Spark-Ignition Engine, Oil Gas Sci. Technol. 72, 32.
7. Yang X., Kuo T-W. (2017) Correlation of CCV Between In-Cylinder Swirl Ratio and Polar Velocity Profile in Valve Seat Region Using LES Under Motored Engine Condition, Oil Gas Sci. Technol. 72, 38.