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03/12/12

E I N L A D U N G

zu einem Vortrag im Rahmen des

Kolloquiums Thermo- und Fluiddynamik

und des

ERCOFTAC Visitors Programme

Datum: **Mittwoch, 9. Januar 2013**

Zeit: **16:15 Uhr**

Ort: Maschinenlaboratorium ETH Zürich
~~**Hörsaal ML H 44**~~ ➔ ***Neuer Hörsaal: ML E 12***

Referent: **Prof. Johannes Janicka**
Institute of Energy and Power Plant Technology
Darmstadt University of Technology, Germany

Thema: **Turbulence and Cycle to Cycle Variations: The Potential of Large Eddy Simulation for the Prediction of IC Engines**

One of the most important issues in the design of internal combustion (IC) engines are cycle-to cycle variations of the flow and their effects on mixing and combustion processes. These variations may cause combustion failures leading to a total loss of the energy stored in a full cylinder load and to the ejection of unburnt hydrocarbons into the environment.

In this study Large eddy simulation (LES) based analysis of the unsteady variations of mixing and combustion processes is presented. The impact of parameters of fuel spray injection on flow field pattern and intensity of cyclic variations of temperature, pressure and mass fraction is pointed out. Influence of the in-cylinder charge motion on the fuel-air mixing processes and the liquid fuel penetration is examined. For this purpose non-reacting as well as reacting two-phase flows have been analyzed.

Numerical investigation of cyclic variability of a motored 4-stroke, single-cylinder engine is presented. Quantitative and qualitative comparison between experimental and numerical data of the velocity field have been performed and discussed at selected crank angle. Multi-cycle Large Eddy Simulation was carried out to examine higher statistical velocity moments providing an insight into the physical processes that lead to anomalous flow events. This investigation has twofold purpose: assessing the accuracy and reliability of the numerical tool employed to predict cyclic variability in IC engines and identifying the defining characteristics of the physical processes that lead to such behavior.

To understand the mechanisms that are responsible for cycle-to-cycle variations the interactions between numerical and modeling errors in the simulations are also investigated. The effects of the numerical and modeling errors on the calculation field have been assessed.

The underlying correlations between cyclic variability in the velocity field, spray boundary conditions and the spatial distribution of equivalence ratio in a realistic direct injection spark ignition engine have been investigated by means of Proper Orthogonal Decomposition (POD). The method of snapshots has been employed to perform both phase-dependent and phase-independent decomposition of the scalar-velocity correlations. LES based simulation of 30 engine cycles has been used for POD analysis.

Host: Prof. P. Jenny

Gäste sind willkommen!

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