Aalto University
School of Engineering

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High fidelity simulations of novel combustion concepts

Title of the dissertation	Numerical studies for diesel spray assisted methane ignition at low temperature conditions
Contents of the dissertation	Current research efforts on novel combustion concepts aim to avoid incomplete combustion and restrict the level of harmful greenhouse gas emissions in modern engines. In particular, dual-fuel (DF) internal combustion engine technologies aim to provide cleaner and more efficient combustion by featuring two fuels with different characteristics. In DF engines, a low-reactivity (such as natural gas) and a high reactivity fuel (such as diesel) is utilized together to minimize emissions while keeping high efficiency. However, the fundamental physics and chemistry of these combustion applications are not well understood through experiments and require numerical simulations via Computational Fluid Dynamics (CFD). In this dissertation, high-performance computing is utilized for 3D modeling of diesel spray assisted methane ignition at low temperatures, for conditions relevant to DF internal combustion engines. The effect of operating parameters such as ambient temperature, injection duration and number of injections on mixture formation, ignition, combustion and heat release rate characteristics are investigated in detail. Furthermore, development of novel models towards faster reactive flow simulations are introduced. The numerical findings may provide useful insight for engine manufacturers with a fundamental understanding of DF ignition and combustion process, and assist in commercial utilization of these novel combustion concepts.
Field of the dissertation	Energy Technology, Computational Fluid Dynamics and Chemical Kinetics
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Time of the defence	14th of May 2021 at 12:00 hours
Place of the defence	Remotely at https://aalto.zoom.us/j/63565975360
Opponent	Professor Francesco Contino, Université Catholique de Louvain, Belgium
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