Invitation à la soutenance publique de thèse

Pour l'obtention du grade de Docteur en Sciences de l'Ingénieur

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Numerical study of multi-dimensional effects in Rapid Compression Machines

Due to the increasingly stringent regulations in terms of pollutant emissions, and to the urgent need to reduce our carbon dioxide emissions, novel combustion techniques are developed. They mostly consist in the use of well-mixed and highly diluted mixtures. In such conditions, the chemical kinetics and the auto-ignition properties of the fuel play a key role in the combustion process. Therefore, the accurate characterization of fuels has become an essential need for the development of next-generation combustion devices. The Rapid Compression Machine (RCM) is one of the most suited experimental apparatus to contribute to the understanding of auto-ignition chemistry. The RCM rapidly compresses a reactive mixture, typically using a piston which remains fixed at the end of the compression; after a certain delay, the mixture auto-ignites. In order to properly interpret experimental data obtained from RCMs, the thermodynamic state of the reaction chamber has to be well-characterized. In this thesis, the main sources of potential misinterpretation of RCM results are studied. Basically, any multi-dimensional effect can affect the auto-ignition process and uniform conditions inside the reaction chamber are therefore pursued. This is essentially achieved through the use of a piston having some crevice on its periphery. The two main contributions of this work are, first, the development of a method allowing to verify that the crevice design is adequate and allows to effectively generate an homogeneous temperature field inside the reaction chamber. Second, the influence of the crevice and of its potential containment on the auto-ignition is quantified, more specifically in the case of two-stage ignition processes.

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