MODELING OF THE TURBULENT COMBUSTION IN A MACHINE WITH FAST COMPRESSION

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Combustion is a complex field, because it simultaneously involves several disciplines such as the heat transfer, the chemistry, the turbulence, the transport of mass etc. In this work we tried to model an experiment having a combustion chamber with a geometry close to that of spark ignition engine. This modeling based on the approach of calculated probability density function (pdf). In fact, we used a transport equation for the probability density function similar to the modeling case of the physical and chemical species. Indeed, theoretical study of this pdf is very developed, but its applications remain very limited for the several reasons. This pdf method was coupled with a simplified chemistry and introduced into the KIVAII code in order to simulate the combustion process in a rectangular combustion chamber which is very similar to that of spark ignition engine (SI). The results found by this model of combustion are compared with the experiment at different operating conditions such as the propane/air equivalence ratio, temperature and pressure. The final results and the conclusions are satisfactory. In this paper, we present only the results relating to a given operation conditions with a study of the sensitivity of the flame radius on the equivalence ratio.

Key words: *turbulent combustion, chemistry, reduced mechanisms*

1. Introduction

One of the most important aspects of combustion theory and its applications is the knowledge of its fundamental mechanisms, i.e. the set of elementary chemical process, which occur in the course of a chemical reaction. When we use a detailed kinetics mechanism, we can establish the principal stages of a combustion process for any particular conditions. Unfortunately, the use of these detailed mechanisms remains quasi-impossible due to the large required computing time. To overcome this problem, one generally uses simplified chemistry whose integration in numerical codes remains feasible. In the present work, we have chosen single global reaction for propane (one of the greatest source of energy). In order to take into account the interactions between chemistry and turbulence, the method involving a balance equation for the probability density function (pdf) was used. This coupling between the method of calculated pdf and simplified chemistry is used to predict combustion in the case of a rectangular combustion chamber (also called 'ARC' combustion chamber). The validation of this simulation is done by comparing the followings:

– on the one hand, the pressure profiles (the calculated and the experimental) in the combustion chamber;

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