EXPERIMENTAL AND NUMERICAL STUDY OF PULSE DETONATION ENGINE WITH ETHYLENE AS A FUEL

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Abstract

This paper presents an insight on the study of transient, compressible, intermittent pulsed detonation engine with one-step overall reaction model to reduce the computational complexity in detonation simulations. Investigations are done on flow field conditions developing inside the tube with the usage of irreversible one-step chemical reactions for detonations. In the present simulations one and two dimensional axisymmetric tubes are considered for the investigation. Studies are also performed with different grid sizes which influence the prediction of Von-Neumann spike, CJ Pressure and detonation velocity. Numerical studies are conducted using 66mm diameter tube and compared with the literature values. The simulation result from the single-step reaction model agrees well with the previous published literature of multi-step reaction models. The present studies shows that one-step overall reaction model is sufficient to predict the flow properties with reasonable accuracy. Experiments are conducted in a 25mm dia. tube with Ethylene/Air mixtures. The reactants are premixed and injected into the detonation tube using solenoid valves. The equivalence ratio of the fuel/oxidizer mixture and the length of the detonation tube are varied to understand their effects on detonation parameters. Finally the results from the present numerical study are compared and validated using NASA CEA and experiments.

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