Abstract Submitted
for the DFD12 Meeting of
The American Physical Society

Numerical simulation of turbulent stratified flame propagation in a closed vessel CATHERINE GRUSELLE, CORIA CNRS UMR 6614 / Renault, GHISLAIN LARTIGUE, CORIA CNRS UMR 6614, PERRINE PEPIOT, Cornell University, VINCENT MOUREAU, YVES D'ANGELO, CORIA CNRS UMR 6614 — Reducing pollutants emissions while keeping a high combustion efficiency and a low fuel consumption is an important challenge for both gas turbine (GT) and internal combustion engines (ICE). To fulfill these new constraints, stratified combustion may constitute an efficient strategy. A tabulated chemistry approach based on FPI combined to a low-Mach number method is applied in the analysis of a turbulent propane-air flame with equivalence ratio (ER) stratification, which has been studied experimentally by Balusamy [S. Balusamy, Ph.D Thesis, INSA-Rouen (2010)]. Flame topology, along with flame velocity statistics, are well reproduced in the simulation, even if time-history effects are not accounted for in the tabulated approach. However, these effects may become significant when exhaust gas recirculation (EGR) is introduced. To better quantify them, both ER and EGR-stratified two-dimensional flames are simulated using finite-rate chemistry and a semi-detailed mechanism for propane oxidation. The numerical implementation is first investigated in terms of efficiency and accuracy, with a focus on splitting errors. The resulting flames are then analyzed to investigate potential extensions of the FPI technique to EGR stratification.

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Date submitted: 03 Aug 2012 Electronic form version 1.4