Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Numerical forcing of an M-flame: linear analysis MATHIEU BLANCHARD, LadHyX - Ecole Polytechnique, PETER J. SCHMID, LadHyX, CNRS - Ecole Polytechnique, DENIS SIPP, ONERA, THIERRY SCHULLER, SEBASTIEN CANDEL, EM2C, CNRS and Ecole Centrale Paris — Direct numerical simulations of a high Mach number (Ma=0.1), low Reynolds number (Re = 1000), premixed, lean M-flame have been studied with the goal of characterizing and quantifying the response of this generic flame to acoustic modulations. This response is essential to a description of thermo-acoustic instabilities. The flame is submitted to energy disturbances introduced in the injection tube of reactants using random binary signals. The unit impulse response of the flow variables in the burnt gases is computed. It features disturbances of acoustic and hydrodynamic nature. The short time response of this function is controlled by acoustic disturbances, while large hydrodynamic perturbations dominate the long time response of the unit impulse function. The mechanisms controlling the short and long time responses of the flame are examined. A sensitivity analysis is then conducted for selected characteristic frequencies and the structures of the linear optimal forcing are determined.

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Date submitted: 30 Jul 2013 Electronic form version 1.4