Abstract Submitted
for the DFD14 Meeting of
The American Physical Society

Parametrized mode decomposition for bifurcation analysis applied to a thermo-acoustically oscillating flame TARANEH SAYADI, PETER SCHMID, Department of Mathematics, Imperial College London, FRANCK RICHECOEUR, DANIEL DUROX, EM2C Laboratory, Ecole Centrale Paris — Thermo-acoustic systems belong to a class of dynamical systems that are governed by multiple parameters. Changing these parameters alters the response of the dynamical system and causes it to bifurcate. Due to their many applications and potential impact on a variety of combustion systems, there is great interest in devising control strategies to weaken or suppress thermo-acoustic instabilities. However, the system dynamics have to be available in reduced-order form to allow the design of such controllers and their operation in real-time. As the dominant modes and their respective frequencies change with varying the system parameters, the dynamical system needs to be analyzed separately for a set of fixed parameter values, before the dynamics can be linked in parameter-space. This two-step process is not only cumbersome, but also ambiguous when applied to systems operating close to a bifurcation point. Here we propose a parametrized decomposition algorithm which is capable of analyzing dynamical systems as they go through a bifurcation, extracting the dominant modes of the pre- and post-bifurcation regime. The algorithm is applied to a thermo-acoustically oscillating flame and to pressure signals from experiments. A few selected mode are capable of reproducing the dynamics.

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Date submitted: 29 Jul 2014 Electronic form version 1.4