Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Stabilization Approaches for Linear and Nonlinear Reduced Order Models[1] ELNAZ REZAIAN, MINGJUN WEI, Kansas State University — It has been a major concern to establish reduced order models (ROMs) as reliable representatives of the dynamics inherent in high fidelity simulations, while fast computation is achieved. In practice it comes to stability and accuracy of ROMs. Given the inviscid nature of Euler equations it becomes more challenging to achieve stability, especially where moving discontinuities exist. Originally unstable linear and nonlinear ROMs are stabilized here by two approaches. First, a hybrid method is developed by integrating two different stabilization algorithms. At the same time, symmetry inner product is introduced in the generation of ROMs for its known robust behavior for compressible flows. Results have shown a notable improvement in computational efficiency and robustness compared to similar approaches. Second, a new stabilization algorithm is developed specifically for nonlinear ROMs. This method adopts Particle Swarm Optimization to enforce a bounded ROM response for minimum discrepancy between the high fidelity simulation and the ROM outputs. Promising results are obtained in its application on the nonlinear ROM of an inviscid fluid flow with discontinuities.

[1]Supported by ARL

Mingjun Wei
Kansas State University

Date submitted: 28 Jul 2017 Electronic form version 1.4