Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

POD-Based Model Reduction toward Efficient Simulation of Flow in NuclearReactor Components MOHAMMAD AHMADPOOR, GREG BANYAY, SAGNIK MAZUMDAR, University of Pittsburgh, ANIRBAN JANA, Pittsburgh Super Computing Center, MARK KIMBER, JOHN BRIGHAM, University of Pittsburgh — The long-term objective of this research is reduced-order modeling (ROM) to simulate and understand the turbulent mixing inside the lower plenum of a Very High Temperature Reactor, while the present study focuses on confined isothermal jet flow. In general, two steps are required to generate a basis for a ROM: (1) acquisition of an ensemble of possible solution fields for the system; and (2) extracting key features of the ensemble to create the basis. Proper Orthogonal Decomposition (POD) is one approach for extracting features from an ensemble. For this work POD is used to capture the parametric variation of a flow with Reynolds (Re) number and time. Two approaches are considered for model reduction: (1) a regression-based approach, which does not keep the mathematical structure of the modeling, but rather uses interpolation and/or extrapolation to predict flow fields at different Re number or different times and (2) a Galerkin-projection approach in which the Navier-Stokes equations are projected onto the POD modes to obtain low-dimensional ordinary differential equations to represent the fluid flow under conditions outside of the original ensemble.

Mohammad Ahmadpoor
University of Pittsburgh

Date submitted: 02 Aug 2013 Electronic form version 1.4