Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Semi-automatic reduced order models from expert-defined transients[1] ANDREAS CLASS, DENNIS PRILL, Areva Nuclear Professional School, Karlsruhe Institut of Technologie, Germany — Boiling water reactors (BWRs) not only show growing power oscillations at high-power low-flow conditions but also amplitude limited oscillations with temporal flow reversal. Methodologies, applicable in the non-linear regime, allow insight into the physical mechanisms behind BWR dynamics. The proposed methodology [1] exploits relevant simulation data computed by an expert choice of transient. Proper orthogonal modes are extracted and serve as Ansatz functions within a spectral approach, yielding a reduced order model (ROM). Required steps to achieve reliable and numerical stable ROMs are discussed, i.e. mean value handling, inner product choice, variational formulation of derivatives and boundary conditions.Two strongly non-linear systems are analyzed: The tubular reactor, including Arrhenius reaction and heat losses, yields sensitive response on transient boundary conditions. A simple natural convection loop is considered due to its dynamical similarities to BWRs. It exhibits bifurcations resulting in limit cycles. The presented POD-ROM methodology reproduces dynamics with a small number of spectral modes and reaches appreciable accuracy.

[1] Prill, D.& Class, A. Semi-automated POD-ROM non-linear analysis for future BWR stability analysis, Annals of Nuclear Energy, 20

[1]Funded by AREVA GmbH

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Date submitted: 29 Jul 2013 Electronic form version 1.4