Abstract Submitted
for the DFD13 Meeting of
The American Physical Society

Reducing numerical costs for core wide nuclear reactor CFD simulations by the Coarse-Grid-CFD MATHIAS VIELLIEBER, ANDREAS G. CLASS, Karlsruhe Institute of Technology — Traditionally complete nuclear reactor core simulations are performed with subchannel analysis codes, that rely on experimental and empirical input. The Coarse-Grid-CFD (CGCFD) intends to replace the experimental or empirical input with CFD data. The reactor core consists of repetitive flow patterns, allowing the general approach of creating a parametrized model for one segment and composing many of those to obtain the entire reactor simulation. The method is based on a detailed and well-resolved CFD simulation of one representative segment. From this simulation we extract so-called parametrized volumetric forces which close, an otherwise strongly under resolved, coarsely-meshed model of a complete reactor setup. While the formulation so far accounts for forces created internally in the fluid others e.g. obstruction and flow deviation through spacers and wire wraps, still need to be accounted for if the geometric details are not represented in the coarse mesh. These are modelled with an Anisotropic Porosity Formulation (APF). This work focuses on the application of the CGCFD to a complete reactor core setup and the accomplishment of the parametrization of the volumetric forces.

Andreas G. Class
Karlsruhe Institute of Technology

Date submitted: 01 Aug 2013 Electronic form version 1.4