Abstract Submitted
for the DFD08 Meeting of
The American Physical Society

Direct simulation of a turbulent channel with wire in cross flow REETESH RANJAN, CARLOS PANTANO, University of Illinois at Urbana-Champaign, PAUL FISCHER, ANDREW SIEGEL, Argonne National Laboratory — We present results from a direct numerical simulation study of turbulent channel flow across a thin, cylindrical wire. This model mimics flow through the wire-wrapped fuel pins typical of most fast neutron reactor designs. Mean fow develops both along the wire and across the wire, leading to the formation of a turbulent cross-flow regime in the channel. The friction Reynolds number in the axial direction is approximately 303. Cross-flow friction Reynolds numbers ranging from 0 to 115 are examined for several wire-diameter to channel height ratios. The numerical method uses spectral elements in the plane perpendicular to the wire axis and a Fourier decomposition in the direction of the axis of the wire. The simulations use up to 78 million collocation points and were performed at the Argonne Leadership BG/P supercomputer. The flow field statistics are investigated, including mean flow, turbulence statistics and instantaneous flow structures. Shear stress distributions on the walls, and in particular along the recirculation zones behind the wire, are also investigated. Implications of these results for large-eddy simulation of turbulent flows with recirculation will be discussed.

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Date submitted: 25 Jul 2008 Electronic form version 1.4