Abstract Submitted
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CFD Validation Benchmark Dataset for Natural Convection in Nuclear Fuel Rod Bundles[1] BARTON SMITH, KYLE JONES, Utah State University — The present study provide CFD validation benchmark data for coupled fluid flow/convection heat transfer on the exterior of heated rods arranged in a 2×2 array. The rod model incorporates grids with swirling veins to resemble a nuclear fuel bundle. The four heated aluminum rods are suspended in an open-circuit wind tunnel. Boundary conditions (BCs) are measured and uncertainties calculated to provide all quantities necessary to successfully conduct a CFD validation exercise. System response quantities (SRQs) are measured for comparing the simulation output to the experiment. Stereoscopic Particle Image Velocimetry (SPIV) is used to non-intrusively measure 3-component velocity fields. A through-plane measurement is used for the inflow while laser sheet planes aligned with the flow direction at several downstream locations are used for system response quantities. Two constant heat flux rod surface conditions are presented (400 W/m^2 and 700 W/m^2) achieving a peak Rayleigh number of $\sim 10^{10}$. Uncertainty for all measured variables is reported. The boundary conditions, system response, and all material properties are now available online for download.

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