Abstract Submitted
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Thermal striping in nuclear reactors: POD analysis of LES simulations and experiment[1] ELIA MERZARI, ANL, ANDRES ALVAREZ, MIT, OANA MARIN, ALEKSANDR OBABKO, STEVE LOMPERSKI, SHASHI AITHAL, ANL — Thermal fatigue caused due to thermal striping impacts design and analyses of a wide-range of industrial apparatus. This phenomena is of particular significance in nuclear reactor applications, primarily in sodium cooled fast reactors. In order to conduct systematic analyses of the thermal striping phenomena a simplified experimental set-up was designed and built at Argonne National Laboratory. In this set-up two turbulent jets with a temperature difference of about 20K were mixed in a rectangular tank. The jets entered the tank via 2 hexagonal inlets. Two different inlet geometries were studied, both experimentally and via high-fidelity LES simulations. Proper Orthogonal Decomposition (POD) was performed on the turbulent velocity field in the tank to identify the most dominant energetic modes. The POD analyses of the experimental data in both inlet geometrical configurations were compared with LES simulations. Detailed POD analyses are presented to highlight the impact of geometry on the velocity and thermal fields. These can be correlated with experimental and numerical data to assess the impact of thermal striping on the design of the upper plenum of sodium-cooled nuclear reactors.

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