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Computational Fluid Dynamics Benchmark Validation Experiment of Plenum-to-Plenum Flow through Heated Parallel Channels[1]
AUSTIN PARKER, BARTON SMITH, Utah State University — Computational Fluid Dynamics (CFD) is an economic alternative to experiments and is becoming increasingly more important for safety, design, and regulatory licensing in complex systems. Benchmark validation experiments provide input and output measurements necessary for a computationalist to determine the uncertainty of their calculations. Sufficient experimental inputs are not normally provided in publications for determining CFD model uncertainty. This project is a CFD benchmark validation experiment of plenum-to-plenum flow through heated parallel channels. The experiment was carried out in a new, triple-channel wind tunnel test section in an existing wind tunnel. The focus is on thermal mixing due to convection in the upper plenum. This flow feature has physics relevant to phenomena found in High Temperature Gas Reactors. Buoyantly driven flows such as these are challenging for CFD models because the physics are highly coupled. For instance, velocity is highly dependent on temperature and mixing downstream indirectly affects the mass flow through the channels. The result of this experiment is a published dataset of tabulated boundary conditions and system response quantities that is vital to understand model uncertainty in computations of similar fluid flows.

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