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Simulation of Flow Excursion Using a Numerical Method

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ABSTRACT

This research is aimed towards accurately modeling and predicting the onset of the two-phase flow excursion instability using the code TFIT (Two Fluid Interfacial Temperature). In order to do this we first had to show that the numerical diffusion of the code's finite difference equations could be reduced to an insignificant level by decreasing the mesh size.

Understanding and being able to accurately model flow excursion can help us understand how to prevent the potential negative effects of this instability. We are using a two-fluid model with physics-based closure relations. The results will be validated against the experimental data available in the literature. This research could give us a better understanding of the transition between instabilities and would contribute to the safety measures used in the coolant systems of nuclear power plants to prevent fuel rod burnout.

But first it is necessary to test the effect that the mesh size has on the error. We ran a mesh independence test. The results from the independence test showed that decreasing the mesh size did drastically decrease the error but after a certain mesh size, further reduction caused no further decrease in artificial diffusion.

KEYWORDS

Simulation, two-phase flow, TFIT, two-fluid model, numerical method