Two-Equation Two-Fluid Model for Bubbly Flow in a Vertical Channel

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The one-dimensional two-fluid model is widely acknowledged as the most detailed and accurate macroscopic formulation of the thermo-fluid dynamics in nuclear reactor safety analysis. Several thermo-fluid dynamics codes have sprung up based on the one dimensional two-fluid model, such as RELAP5, TRAC, RETRAN, CATHARE, etc. However, these codes are quasi-steady because they lack the short wavelength models that are necessary to make the models well-posed; therefore they must rely on excessive numerical viscosity. Not utilizing short wavelength models causes small wavelength waves to grow quickly to infinity. The project objective is to develop a drafting force model for a one dimensional two-fluid model for vertical bubbly gas-liquid flow. The purpose of this objective is to obtain a more dynamic representation by including a short wavelength correlation that is not considered in industrial two-fluid models. Adding this short wavelength model will allow for the solution to be well-posed. The project involves adding a subroutine with the drafting force equation to an existing FORTRAN computer program and comparing the results of the new model with available experimental data for validation. Furthermore the code will be verified performing convergence analysis. It has been found that the existing two-fluid model for stratified gas-liquid flow can be used to model bubbly flow in a vertical channel with changes derived by Dr. Bertodano highlighted in this paper. This model is able to be utilized for initial gas void fractions greater than 0% and less that 25%.