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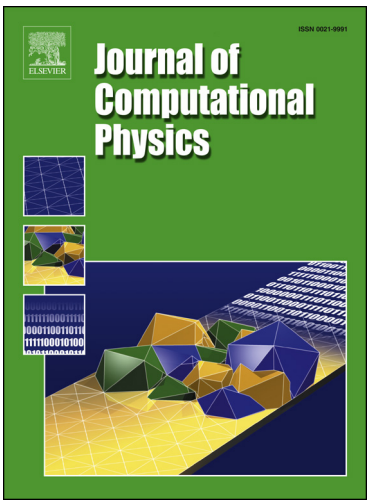


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# A Conservative Fully Implicit Algorithm for Predicting Slug Flows

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**Abstract**

An accurate and predictive modelling of slug flows is required by many industries (e.g., oil and gas, nuclear engineering, chemical engineering) to prevent undesired events potentially leading to serious environmental accidents. For example, the hydrodynamic and terrain-induced slugging leads to unwanted unsteady flow conditions. This demands the development of fast and robust numerical techniques for predicting slug flows. The presented in this paper study proposes a multi-fluid model and its implementation method accounting for phase appearance and disappearance. The numerical modelling of phase appearance and disappearance presents a complex numerical challenge for all multi-component and multi-fluid models. Numerical challenges arise from the singular systems of equations when some phases are absent and from the solution discontinuity when some phases appear or disappear. This paper provides a flexible and robust solution to these issues. A fully implicit formulation described in this work enables to efficiently solve governing fluid flow equations. The proposed numerical method provides a modelling capability of phase appearance and disappearance processes, which is based on switching procedure between various sets of governing equations. These sets of equations are constructed using infor-

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