INDIAN INSTITUTE OF TECHNOLOGY GUWAHATI
SHORT ABSTRACT OF THESIS

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SHORT ABSTRACT

The present research is a step put forward to extensively explore the detailed in-sight of flow of immiscible liquids inside a channel. A lattice Boltzmann Shan-Chen model is implemented to carry out the study because of its ability to capture multi-fluid physics including phase-change and interfacial dynamics with relative ease. The objective of the present work is to study the effect of surface characteristics of channel wall. on the droplet displacement and spreading behavior in different scenarios and to investigate the dynamics of droplet deformation through a partially obstructed pore confinement as well as to analyze the behaviour of two-phase flow passing through a porous domain under different conditions. Firstly, the numerical analysis of the dynamic behavior of sliding droplets on a wall of a rectangular channel considering wetting effects has been investigated. The study includes the coalescence of two equal size droplets placed on a channel wall along its length under the action of gravitational force. An investigation has also been conducted to study the dynamic droplet behavior on a grooved wall of a rectangular microchannel. The primary aim of this study was to analyse the entrapment of droplet fluid inside groove and sweeping of entrapped fluid out of the groove. It is to be noted that in a wide-range of industrial applications, the phenomenon of droplet dynamics past solid obstacles can be found very frequently and thus, the study of the droplet past a solid target has recently been an active field of research for its great importance in many fields. The present work also carried out analysis of droplet dynamics due to the capillarity-wettability interaction through a partially obstructed channel confinement. To explore the dynamic behavior of droplet motion past an obstruction, the effect of capillary number and surface wettability, including obstruction size and architecture, are elucidated. In this work, single spherical obstruction, and different spherical agglomerate structures are considered. The fundamental study of fluid flow inside porous media being an important topic of research has attracted many researchers to explore the physics. The flow through porous media is critically important to many scientific and engineering applications such as petroleum engineering, groundwater hydrology, carbon capture utilization and storage and specifically in fuel cells. Therefore, the aim of the present problem is to analyse the advancement of fluid front through pores created between porous beds and drainout the other fluid. The effects of pressure difference, porosity and different wetting conditions have been explored.