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Computational Investigation of Droplets Behaviour inside Passive Microfluidic Oscillator

T. CHEKIFI, B. dennai, R. Khelfaoui

Abstract: Recently, modeling immiscible fluids such as oil and water have been a classical research topic. Droplet-based microfluidics presents a unique platform for mixing, reaction, separation, dispersion of drops and many other functions. In this paper, we suggest a numerical CFD study of microfluidic oscillator with two different lengths of feedback loop. In order to produce simultaneous droplets of gasoil on water, a typical geometry that includes double T-junction is connected to the fluidic oscillator. Droplets production is computed by volume-of-fluid method (VOF). Flow oscillations of droplets were triggered by the Coanda effect of jet flow. The aim of work is to get a high oscillation frequency in the output of this passive device, the influence of hydrodynamics and physics parameters on the droplets frequency in the output of our microsystem is also investigated, the computational results show that, the length of feedback loop, operating pressure and interfacial tension have a significant effect on the droplets dynamic inside microfluidic oscillator. Across the range of low Reynold number, the droplets generation and its dynamics have been accurately controlled by adjusting applying pressure ratio of two phases.

Keywords : Droplet, microfluidics, fluidic oscillator, CFD and VOF (volume of fluid method).