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CFD modelling of Microdrops Manipulation by Microfluidic Oscillator

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Abstract : Over the last few decades, 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 numerous other functions. For this purpose, several devices were studied, as well as microfluidic oscillator. The latter was obtained from wall attachment microfluidic amplifiers using a feedback loop from the outputs to the control inputs, nevertheless this device have not well used for microdrops applications. In this paper, we suggest a numerical CFD study of a microfluidic oscillator with two different lengths of feedback loop. In order to produce simultaneous microdrops of gasoil on water, a typical geometry that includes double T-junction is connected to the fluidic oscillator. The generation of microdrops is computed by volume-of-fluid method (VOF). Flow oscillations of microdrops were triggered by the Coanda effect of jet flow. The aim of work is to obtain a high oscillation frequency in output of this passive device, the influence of hydrodynamics and physics parameters on the microdrops frequency in the output of our microsystem is also analyzed, The computational results show that, the length of feedback loop, applied pressure on T-junction and interfacial tension have a significant effect on the dispersion of microdrops and its oscillation frequency. Across the range of low Reynold number, the microdrops generation and its dynamics have been accurately controlled by adjusting applying pressure ratio of two phases.

Keywords : fluidic oscillator, microdrops manipulation, VOF (volume of fluid method), microfluidic oscillator
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