Numerical analysis of the dynamic aspects of flow through a microchannel with sudden expansion

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ABSTRACT

In the present work the results were reported of numerical simulations of the dynamic aspects of a water flow through a circular microchannel with a sudden expansion. The hydraulic diameter was 0.1 mm with inlet velocity ranging from 0.01 to 10.1 m/s corresponding to Reynolds numbers that varied from 1 to 1,000 for three expansion ratios R_p = 1.51, 2 and 3. The numerical resolution of the configurations was performed using the calculation code ANSYS CFX 19.2, based on the finite volume method. The simulation results obtained were compared with theoretical ones stated for conventional sized channels and experimental studies with microchannels. The comparison was made in terms of reattachment length and friction factor as well as the singular coefficient due to the expansion. Good agreement was observed with the experimental results in microchannels but a slight deviation was obtained compared to the theory of conventional channels.

Keywords: Numerical analysis; Microchannels; Water flow

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