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Numerical Investigation on Heat Transfer Enhancement in Diverging Microchannel with Al_2O_3-Water Nanofluid

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ABSTRACT The recent interests in high heat flux removal applications in micro power devices and electronic cooling applications have contributed to the development of heat transfer enhancement techniques in microchannel. Passive enhancement methods have been widely used by researchers in improving the heat transfer characteristics of microchannel. The incorporation of multiple enhancement methods in microchannel heat sink has proven to be advantageous in high heat flux removal systems. The present study emphases on application of the improved heat transfer properties of Al_2O_3–water nanofluids when used in conjunction with diverging microchannel with a staggered dimpled surface to improve the overall heat transfer characteristics. Three-dimensional turbulent incompressible internal convection flow field in a diverging microchannel with heat transfer from a dimpled surface has been analysed using SIMPLE algorithm with second-order upwind scheme available in a finite volume solver. Numerical solution procedure has been successfully validated using the experimental data reported for internal convection in a similar diverging microchannel. Extensive computations have been performed to reveal the thermo-hydraulic performance aspects of dimpled diverging microchannel for various heat flux and mass flux conditions. Study has been extended to analyse the performance augmentation achieved when Al_2O_3–water nanofluids is used in such channels.