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NUMERICAL INVESTIGATION ON FORCED CONVECTION IN TRIANGULAR CROSS SECTION MICROCHANNELS WITH NANOFLUIDS

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ABSTRACT In this paper a numerical investigation on laminar forced convection flow of a water–Al_2O_3 nanofluid in a triangular microchannel is accomplished. A constant and uniform heat flux on one of the external surfaces has been applied and a single-phase model approach has been employed. The analysis has been performed in steady state regime for particle size in nanofluids equal to 38 nm.
The CFD commercial code Ansys-Fluent has been employed in order to solve the 3-D numerical model. The geometrical configuration under consideration consists in a duct with a triangular shaped crossing area. Results are presented in terms of average wall temperatures, heat transfer convective coefficient, average Nusselt number and required pumping power profiles. Comparison with results related to the fluid dynamic and thermal behaviours are carried out in order to evaluate the enhancement due to the presence of nanoparticles in terms of volumetric concentration. The results have shown the increase of the convective heat transfer coefficients, in particular, for high concentration of nanoparticles and for increasing values of Reynolds number but this is accompanied by a growth of the wall shear stress and the required pumping power. It seems that is not convenient the use nanofluids instead of pure water for volume concentrations higher than 0.5%.