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Fully Developed Laminar Flow of Heat Transfer Non-Newtonian Flow in Ducts with Arbitrary Cross-Sectional Shape

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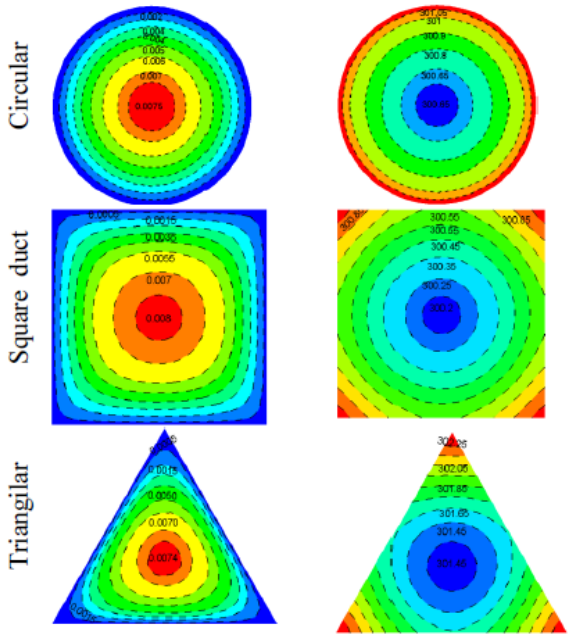
Abstract – The pressure drop and heat transfer properties of a laminar flow with circular, square, and triangular cross sections and a constant heat flux boundary condition are given by a numerical solution. A 3D Navier-Stokes incompressible flow and energy equation serves as the foundation for the numerical model. Results are tabulated and given visually for the velocity field, Poiseuille number, and Nusselt number product for various power-law indices (0.5 n 1.0). One of the analyzed ducts causes a greater heat transfer intensification along with a significant pressure loss. A different type of duct allows for a better balance between pressure loss and heat transfer. In order to verify the accuracy of the numerical codes created in the current study, critical comparisons with earlier findings in the literature are also carried out.

Keywords – Non-Newtonian Fluids, Laminar Flow, The Poiseulle Number, And The Nusslt Number.

Graphical abstract



Contours of magnitude-velocity (left) and static temperature (right) of different geometries at power low idex of n = 0.5