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Laminar flow in planar Tee joints MARCOS VERA, Universidad Carlos III de Madrid, GUSTAVO A. PATIO, Instituto Tecnolgico Metropolitano, Medellin, IMMACULADA IGLESIAS, Universidad Carlos III de Madrid — We present a numerical investigation of the laminar flow in planar Tee joints, a canonical flow of interest for the thermal-hydraulic design of oil power transformer windings. The steady, constant property flow in planar Tee joints is computed numerically by integrating a non dimensional formulation of the Navier-Stokes equations with fully developed upstream and downstream boundary conditions. The analysis assumes a straight-through configuration in which the straight duct holds flow in the same direction before and after the junction, whereas the flow from the side branch can combine with the incoming flow or divide from it. We present a description of the flow patterns that emerge in both cases for a full range of mass split ratios, $0 \leq \beta \leq 1$, several values of straight duct to side branch width ratios, $1 \leq \alpha \leq 3$, and Reynolds numbers of the common branch in the range $20 \leq \mathrm{Re} \leq 200$. Flow maps for planar Tee joints are presented, showing the existence of different regions in the (Re, β)-plane that exhibit different number and location of recirculation zones. From the pressure distribution, secondary loss coefficients are computed and used to fit pressure loss correlations useful for pipe-network modelling of oil power transformer windings.

Marcos Vera
Universidad Carlos III de Madrid

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