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A NUMERICAL STUDY OF HEAT TRANSFER AND PRESSURE DROP IN NANOFLUIDS FLOW BETWEEN PARALLEL PLATES

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ABSTRACT The paper presents a numerical study of heat transfer and pressure drop in steady, laminar nanofluids flow between parallel plates, using a homogeneous flow model at 1%., 3% and 5% volume fractions of nanoparticles. The nanofluids are: Alumina-Water, Titania-Water, Copper-Water and MWCNT-Silicone Oil. The present investigation is carried out for five different sets of boundary conditions such as equal wall heat fluxes, unequal wall heat fluxes, equal wall temperatures, unequal wall temperatures, and, upper wall insulated and lower wall at constant heat flux, for the case of constant thermophysical properties and, only equal constant wall heat fluxes and equal constant wall temperatures for the case of temperature-dependent thermophysical properties of the nanofluids. Heat transfer coefficient increases with volume fraction of nanoparticles for all four nanofluids. For all types of thermal boundary conditions at the walls, Al_2O_3-H_2O nanofluid gives rise to largest enhancement in heat transfer coefficient as compared to other three nanofluids. On the other hand, Cu-H_2O is the most effective nanofluid if the heat transfer coefficient per unit pumping power is taken as the performance criterion. The study with respect to MWCNT-Silicone oil nanofluid reveals that its enhancement factor is less than that of Alumina-Water nanofluid but more than that of other two water-based nanofluids. However, it is the least effective nanofluid among the four. When the temperature-dependent properties are considered, the computer model predicts higher enhancement factor near the inlet without any change in its value in the thermally fully developed region as compared to that in the constant property case. The effectiveness, however, is found to be higher than that in the constant property model throughout the channel.