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Numerical investigation of turbulent heat transfer enhancement via modified internal tube profiles JOSHUA BRINKERHOFF, SHAHAB ZERAATI DIZJEH, The University of British Columbia - Okanagan Campus —

Abstract

The convective heat transfer of a highly-turbulent single phase gas flow is numerically studied inside three pipes equipped with patterned surface textures. The Reynolds and Prantl numbers of the flow are 90,000 and 0.836, respectively. The selected enhancement methods are ellipsoidal inward-facing dimples, inserted coil and spiral corrugations. Wall adapting local eddy viscosity SGS turbulence (WALE) is used, which is a subgrid scale model based on the square of the velocity gradient tensor that accounts for behaviour near the wall. The incompressible mass and momentum equations are solved on three-dimensional grids with the finite volume method using second-order temporal and spatial schemes. The averaged friction factor and Nusselt number of the flow are calculated for the three enhancement techniques, showing that the heat transfer enhancement of the dimpled tube is considerably higher than the other two. The reasons for this observation are discussed along with the effects of the surface texture on velocity and temperature fields, turbulence kinetic energy and Reynolds stresses, and the transient temperature-velocity interactions near the wall.

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