Numerical Solutions of Forced Convection Boundary Layer Flow on a Horizontal Circular Cylinder with Newtonian Heating

Mohd Zuki Salleh, Roslinda Nazar, Norihan Md Arifin and Ioan Pop

Faculty of Industrial Science and Technology, Universiti Malaysia Pahang, 26300 UMP Kuantan, Pahang, Malaysia

Faculty of Science and Technology, Universiti Kebangsaan Malaysia, 43600 UKM Bangi, Selangor, Malaysia

Faculty of Science, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

Institute for Mathematical Research, Universiti Putra Malaysia, 43400 UPM Serdang, Selangor, Malaysia

Faculty of Mathematics, University of Cluj, R-3400 Cluj, CP253, Romania

E-mail: zukikuj@yahoo.com

ABSTRACT

This study considers the steady forced convection boundary layer flow over a horizontal circular cylinder, generated by Newtonian heating in which the heat transfer from the surface is proportional to the local surface temperature. The governing boundary layer equations are first transformed into a system of non-dimensional equations via the non-dimensional variables, and then into non-similar equations before they are solved numerically using a numerical scheme known as the Keller box method. Numerical solutions are obtained for the skin friction coefficient and the local wall temperature as well as the velocity and temperature profiles.

Keywords: Forced convection, horizontal circular cylinder, Newtonian heating, numerical solution