Analysis of convective heat transfer in a fluid flow over an immersed axi-symmetrical body with curved surfaces

Duncan Kioi Gathungu

A thesis submitted in partial fulfilment for the degree of Master of Science in Applied Mathematics in the Jomo Kenyatta University of Agriculture and Technology

2011

ABSTRACT

Convective heat transfer in a homogeneous fluid flow Reynolds number of order less than 2000 over an immersed axi-symmetrical body with curved surfaces has been investigated. The fluid flow in consideration was unsteady and of constant density .This study analysed the extent to which convective heat transfer has on drag and lift on bodies submerged in fluid. The different temperature profiles which were as a result of temperature gradients, caused the convective heat transfer. These different temperature profiles were brought about by frictional forces on and within the surface of the body when fluid flowed over it. Velocity variations were also determined and were used to evaluate these temperature profiles. To obtain these profiles, various flow parameters were varied in the equations governing the fluid flow. These equations were non-linear and there exists no analytical method of solving them, hence a suitable numerical method in this case finite difference method was used. Results of the velocity variations and temperature variations were obtained followed by graphical representation of the results. It was however noted that increase in the Reynolds number leads to an increase in the heat dissipation. The heat dissipation increases with increase in surface curvature. These results have major application in designing devices requiring high manoeuvrability and less resistance to the motion e.g. aerofoil, spray atomizers and cooling fans.