Forced convection boundary layer flow over a moving thin needle.

ABSTRACT

In this paper, the problem of steady laminar boundary layer flow of an incompressible viscous fluid over a moving thin needle is considered. The governing boundary layer equations were first transformed into non-dimensional forms. These non-dimensional equations were then transformed into similarity equations using the similarity variables, which were solved numerically using an implicit finite-difference scheme known as the Keller-box method. The solutions were obtained for a blunt-nosed needle. Numerical computations were carried out for various values of the dimensionless parameters of the problem which included the Prandtl number Pr and the parameter a representing the needle size. It was found that the heat transfer characteristics were significantly influenced by these parameters. However, the Prandtl number had no effect on the flow characteristics due to the decoupled boundary layer equations.

Keyword: Forced convection; Boundary layer flow; Moving thin needle; Variable wall temperature.