

1020-34-9

**Keith Merrill, Matthew Beauchesne, Joseph Previte and Joseph Paulet\***  
(jep7@psu.edu), School of Science, Penn State Erie, Erie, PA 16563, and **Patrick Weidman.**

*Final steady flow near a stagnation point on a vertical surface in a porous medium.*

This work investigates the large time (final state flow) solutions for unsteady mixed convection boundary layer flow near a stagnation point on a vertical surface embedded in a Darcian fluid-saturated porous medium. This involves a third order nonlinear ODE boundary value problem. Through numerical computations Nazar *et. al.* [Int. J. Heat and Mass Transfer, Vol. 47, pp 2681-2688 (2004)] concluded that for values of the mixed convection parameter  $\lambda > -1$ , the BVP had a unique solution. If  $\lambda_c \approx -1.4175 < \lambda \leq -1$  two solutions were reported, and if  $\lambda < \lambda_c$  then no solutions were found. The purpose of this work is to provide further mathematical and numerical analysis of this problem. We prove existence of a solution to the BVP for all  $\lambda > -1$ . We also present numerical evidence that a second solution exists for  $\lambda > -1$ , thus giving dual solutions for all  $\lambda > \lambda_c$ . It is also proven that if  $\lambda < -2.9136$  no solution to the BVP exists. The mathematical techniques employed include topological shooting and direct analysis of the governing ODE. (Received June 12, 2006)