The Effects of Slip Conditions and Viscous Dissipation on the Stagnation Point Flow over a Stretching Sheet

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Abstract. The stagnation point flow of a vicous fluid towards a stretching sheet with slip conditions and viscous dissipation is studied. With the help of similarity transformation, the govering equations are converted to nonlinear ordinary differential equations and then solved numerically by Runge-Kutta-Fehlberg (RKF) technique. Numerical results for the local Nusselt number and skin friction coefficient as well as the temperature and velocity field are elucidated through tables and graphs. The influence of Prandtl number, stretching parameter, Eckert number, thermal and velocity slip parameter on the flow and heat transfer characteristics are analyzed and discussed.

***Keywords**:* Numerical solution; Slip Condition; Stagnation point flow; stretching sheet; Viscous Dissipation.

INTRODUCTION

During the last few decades, heat transfer flow in boundary layer region due to a stretching sheet has attracted attention for many researchers. In fact, it has many theoretical and technical applications both in industries and engineering processes such as, in electronic gadgets, paper production, computer power supply, polymer sheets as well as heatsink in the radiator of cars (Mohamed [1]).

The flow near the stagnation point when the vertical flow hit on the horizontal stretching surface and generated the stagnation line is referring to the boundary layer flow on stagnation point over a stretching sheet. The external velocity is employed in the negative y-direction perpendicular to the flat plate while the stretching velocity is applied along the horizontal surface (Wang [2];Salleh et al. [3]). According to Wang [2], the utmost pressure, utmost heat transfer and the utmost rates of mass deposition are encountered by the stagnation region. Problem associated with boundary layer flows on stagnation point and stretching surface has fascinated many researchers.

Hiemenz [4] was the first who proposed the problem involved stagnation point and managed to solve exact value for Navier-Stokes equations. Next, Chao and Jeng [5] investigated the unsteady stagnation point heat transfer. After that, Mahapatra and Gupta [6] was also investigated the stagnation point flow with heat transfer and solved using finite difference method known as Thomas algorithm.Then, Nazar et al. [7] extended the same problem of Mahapatra and Gupta [6] by consider micropolar fluid. The Keller-box method is being used to solve the system of nonlinear ordinary differential equations and as a matter of fact, increadible concurrence with Mahapatra and Gupta [6] for resultant Newtonian fluid. In addition, Ishak et al. [8] considered the mixed convection stagnation-point flow towards a vertical stretching sheet. The transformed ordinary differential equations are solving numerically by using Keller-box method. Furthermore, Bachok et al. [9] investigated