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www.elsevier.com/locate/ijmecsci

PII: S0020-7403(16)30279-X
DOI: http://dx.doi.org/10.1016/j.ijmecsci.2016.09.026
Reference: MS3431

To appear in: *International Journal of Mechanical Sciences*

Received date: 4 April 2016
Revised date: 4 June 2016
Accepted date: 24 September 2016

Cite this article as: Dulal Pal and Prasenjit Saha, Influence of nonlinear therma radiation and variable viscosity on hydromagnetic heat and mass transfer in a thi liquid film over an unsteady stretching surface, *International Journal o Mechanical Sciences,* http://dx.doi.org/10.1016/j.ijmecsci.2016.09.026

Influence of nonlinear thermal radiation and variable viscosity on hydromagnetic heat and mass transfer in a thin liquid film over an unsteady stretching surface

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Abstract

This paper describes the influence of nonlinear thermal radiation on magnetohydrodynamic heat and mass transfer in a thin liquid film over a permeable unsteady stretching surface with temperature-dependent viscosity with convective boundary condition in the presence of heat source/sink and chemical reaction. The momentum, energy and mass-diffusion equations are highly non-linear. Thus the problem is solved numerically using Runge-Kutta-Fehlberg method with shooting technique. The shooting technique is essential to convert the boundary value problem to a initial value type. The results reveal that increase in the unsteadiness parameter leads to increase in the velocity distribution, temperature gradient and concentration gradient due to reduction in the thin film thickness. Further, increase in the value of magnetic parameter results in a decrease in the velocity profile and increase in the temperature and concentration gradient. Also, increase in the thermal radiation parameter decreases the temperature gradient. But there is decrease in the value of the concentration gradient by increasing the value of the Schmidt number.

Keywords: Magnetohydrodynamic, Stretching sheet, Thermal radiation, Thin liquid film, Variable viscosity.

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