Accepted Manuscript

Magnetohydrodynamic peristalsis of variable viscosity Jeffrey liquid with heat and mass transfer

S. Farooq, M. Awais, Moniza Naseem, T. Hayat, B. Ahmad

PII: S1738-5733(17)30354-6

DOI: 10.1016/j.net.2017.07.013

Reference: NET 395

To appear in: *Nuclear Engineering and Technology*

Received Date: 12 June 2017

Revised Date: 5 July 2017

Accepted Date: 9 July 2017

Please cite this article as: S. Farooq, M. Awais, M. Naseem, T. Hayat, B. Ahmad, Magnetohydrodynamic peristalsis of variable viscosity Jeffrey liquid with heat and mass transfer, *Nuclear Engineering and Technology* (2017), doi: 10.1016/j.net.2017.07.013.

Magnetohydrodynamic peristalsis of variable viscosity Jeffrey liquid with heat and mass transfer

S. Farooq [a, 1], M. Awais [b], Moniza Naseem [b], T. Hayat [a,c] and B. Ahmad [c]

[a] Department of Mathematics, Quaid-I-Azam University 45320, Islamabad 44000, Pakistan

[b] Department of Mathematics, COMSATS Institute of Information Technology, Attock 43600, Pakistan

[c] Nonlinear Analysis and Applied Mathematics (NAAM) Research Group, Department of Mathematics, Faculty of Science, King Abdulaziz University, Jeddah 21589, Saudi Arabia.

Abstract: Herein the mathematical aspects of Dufour and Soret phenomena on the peristalsis of magnetohydrodynamic (MHD) Jeffrey liquid in a symmetric channel are presented. Fluid viscosity is taken variable. Lubrication approach has been followed. Results for the velocity, temperature and concentration are constructed and explored for the emerging parameters entering into the present problem. The plotted quantities lead to comparative study between the constant and variable viscosities fluids. Graphical results indicates that for non-Newtonian materials pressure gradient is maximum, whereas pressure gradient is slow down for variable viscosity. Also both velocity and temperature in the case of variable viscosity are at maximum when compared with results for constant viscosity.

Keywords: Jeffrey Fluid; Soret and Dufour effects; Variable viscosity; Magnetohydrodynamic;

Introduction

Peristaltic transport of fluid frequently occurs in the physiological and industrial applications. In particular, peristalsis play a critical role in urine passage from kidney to bladder, in food bolus transport in the gastrointestinal tract, in lymph transport in lymphatic vessels, spermatozoa in the duct afferents, in finger and roller pumps, in sanitary fluid transport, in corrosive fluids transport, in locomotion of worms and in several other areas. Latham [1] and Shapiro et al. [2] initially addressed the peristalsis of viscous material in a channel. Afterwards the peristaltic transport of viscous and non-Newtonian fluids in flow configurations under different aspects and assumptions was studied extensively. Information on the topic is quite reasonable and researchers mention a few recent representative attempts and several useful references in their investigations [3-15]. It is also found that heat and mass transfer effects have significant role in peristalsis. Mention has been made of oxygenation, hemodialysis, cancer therapy and blood flow processes. Keeping these ideas in mind, the peristaltic transport of fluid has been examined in the presence of heat and mass transfer (see [16-25] and some attempts therein).

It is found from the previous literature that much past attention to peristalsis has been accorded to constant viscosity fluid. Such information can be further narrowed down when viscoelastic fluids of variable viscosity are taken into account. Further the peristaltic motion of viscoelastic fluids with variable viscosity and heat and mass transfer has scarcely been analyzed. To our knowledge, the peristaltic transport of variable viscosity Jeffrey fluid in the presence of Soret and Dufour effects has not been addressed so far. The purpose here is to make an attempt at such an analysis of

[1]Tel.: + 92 51 90642172.
e-mail address: sfarooq@math.qau.edu.pk