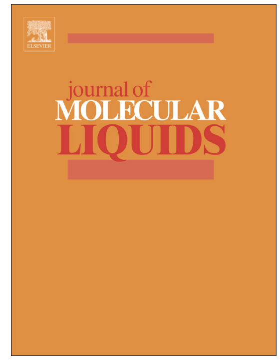
Accepted Manuscript



Unsteady mixed convective flow of Williamson nanofluid with heat transfer in the presence of variable thermal conductivity and magnetic field

Hashim Aamir Hamid, Masood Khan

PII:	S0167-7322(18)30272-1
DOI:	doi:10.1016/j.molliq.2018.03.079
Reference:	MOLLIQ 8853
To appear in:	*Journal of Molecular Liquids*
Received date:	17 January 2018
Revised date:	4 March 2018
Accepted date:	19 March 2018

Please cite this article as: Hashim Aamir Hamid, Masood Khan , Unsteady mixed convective flow of Williamson nanofluid with heat transfer in the presence of variable thermal conductivity and magnetic field. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Molliq(2017), doi:10.1016/j.molliq.2018.03.079

Unsteady mixed convective flow of Williamson nanofluid with heat transfer in the presence of variable thermal conductivity and magnetic field

Hashim, Aamir Hamid[1] *and Masood Khan*

Department of Mathematics, Quaid-i-Azam University, Islamabad 44000, Pakistan.

Abstract

Latest developments regarding thermos-physical features of flow and heat transfer for non-Newtonian fluids in the presence of nanoparticles have been drawing the attention of many engineers and researchers due to their improved heat transfer features. Amongst several available techniques to reinforce the thermal performance of energy systems, one is the dispersion of solid nanoparticles in base fluids like water. Owing to recent developments in this regard, this communication focuses on time-dependent flow of non-Newtonian Williamson fluid driven by a radially stretching geometry with nanoparticles. The analysis is subject to the effects of variable magnetic field, mixed convection and newly proposed zero nanoparticles mass flux condition. The mathematical formulation is presented with the assistance of basic conservation laws and boundary layer assumptions. The leading transport equations for nanofluid flow have been converted into a system of strongly non-linear ordinary differential equations by employing dimensionless variables. The non-linearity numerical scheme known as Runge-Kutta integration scheme has been implemented to obtain the numerical results for velocity, temperature and concentration fields for numerous set of physical parameters. In this review, impacts of developing parameters on flow field variables are visualized through tables and graphs. The obtained results demonstrate that a higher magnetic field reduces the nanofluids velocity as well as momentum boundary layer thickness. We observe an increment in the rate of heat transfer with Schmidt number. Moreover, it is concluded that an increasing trend is seen in nanofluids temperature with greater thermophoresis parameter. In addition, the numerical results acquired by the applied technique are validated with existing data and excellent correlation is noted.

Keywords: Williamson nanofluids; Mixed convection flow; Heat transfer; Variable thermal conductivity; Magnetic field.

[1]Corresponding author: E-mail Address: aamirhameed@math.qau.edu.pk, (Aamir Hamid).