Deep Science Publishing, 2025
https://doi.org/10.70593/978-93-7185-898-4_14

Chapter 14: Free convective flow through a porous vertical plate in a porous medium with Dufour effect and chemical reaction: A MATLAB-Based Numerical Study

Dr. Kalyan Chamuah[1*], Dilip Kumar Baruah[2]

[1*]Department of Mathematics, Moridhal College, Dhemaji, Assam, India,

Email[1]: kalyanchamuah60@gmail.com

[2]Department of Computer Science, Research Scholar, Sibsagar University, Sivasagar, Assam, India,
E-mail: dlpbaruah5@gmail.com

Abstract: This study examines the steady magnetohydrodynamic (MHD) convective flow past a continuously moving vertical plate embedded in a porous medium, incorporating Dufour (thermal-diffusion) and chemical reaction effects. A uniform magnetic field is applied normal to the plate into the fluid region. The coupled momentum, energy, and species transport equations are solved using an asymptotic series expansion. Parametric impacts on the dimensionless velocity, temperature, concentration, skin friction, and plate temperature are presented graphically, while the mass transfer rate is reported in tabular form. Results highlight the interplay among magnetic field intensity, porous medium permeability, Dufour number, reaction rate, and other key parameters in modulating flow structure and heat–mass transfer characteristics.

Keywords: Mass transfer, porosity, diffusion thermo, chemical reaction, Dufour effect.

AMS subject classification: 76W05

PACS: 44.25+g

Nomenclature

$\vec{q}$, fluid velocity vector ;

ρ , fluid density, $\frac{kg}{m^3}$;

ν , kinematic viscosity, $\frac{m^2}{s}$;

$\vec{J}$, current density vector;

$\vec{B}$, magnetic flux density vector;

$\vec{g}$, acceleration vector due to gravity;

φ , viscous dissipation of energy per unit volume;