

Flow of couple stress fluid in partially filled porous medium through the annular region of coaxial cylinders

Shaik Shafi¹, Ramana Murthy J.V², and Ram Prakash Sharma^{3,*}

¹Department of Basic & Applied Science, National Institute of Technology Arunachal Pradesh, Jote, Papum Pare District, Arunachal Pradesh-791113, India.

Email: shaik.phd20@nitap.ac.in

²Department of Mathematics, National Institute of Technology Warangal, Warangal, Telangana - 506004, India.

Email: jvr@nitw.ac.in

ORCID: 0000-0002-8017-3651

^{3,*}Department of Mechanical Engineering, National Institute of Technology Arunachal Pradesh, Jote, Papum Pare District, Arunachal Pradesh-791113, India.

Email: ramprakash0808@gmail.com

ORCID: 0000-0002-3359-1316

ABSTRACT

The current paper considers the flow of couple-stress fluid past a partially permeable region within two concentric circular cylinders. Traditional boundary conditions on two cylindrical surfaces are 1) no-slip condition and 2) Type A condition i.e., no couple stresses on the boundary are used. Velocity expression has been obtained by using the analytical technique. The consequences of different physical parameters like the thickness of porous region r_0 , a ratio of couple stress coefficients e , Couple stress parameter s , pressure gradient parameter p_0 and Darcy parameter Da on the flow are analysed through graphs. The results are in good agreement with the case of viscous fluid flow in the limiting case of a couple stress fluid. The volumetric flow rate and skin friction on the surface of the cylinder are also shown through graphs.

Key words: Couple stress fluid, porous medium and two coaxial cylinders.