## ABSTRACT

We carry out asymptotic analysis for eccentric Taylor Couette flow of Newtonian fluids in low Reynolds number regime. The system under consideration consists of two long eccentric rotating cylinders whose axes are parallel to each other. We assume that both cylinders rotate with fixed angular velocities. As a result of eccentricity, the inner cylinder would experience a net force, because of which it will undergo translation, while the outer cylinder rotates around a fixed axis. We neglect the inertial effects in the fluid motion and therefore solve the Stokes equation to characterize the motion of the fluid lying in the space between the cylinders. From the velocity field thus obtained, moment and forces of the cylinders are computed, which are used to probe into the motion of the inner cylinder. Although the motion of the fluid is sufficiently slow allowing us to neglect the inertial effects in the fluid, we do not place any other restrictions on the size and radius of the cylinders. We employ domain perturbation to carry out the asymptotic analysis, which remains valid for small eccentricities.

We compare our results for forces and moments with solutions available in the literature, derived using bipolar coordinates as well as with numerical solutions to the governing equations under identical configurations. Our final aim is to analyze the inner cylinder's motion, namely, deduce its migration velocity as a function of the angular velocities of the cylinders as well as the physical and other geometrical properties of the configuration. Our results reveal that net moment, net forces along y direction and second angular velocity varies linearly with angular velocities of inner and outer cylinder whereas, net moment and net force along x and y direction each and second angular velocity show non-linear variation with the radius of the inner and the outer cylinder.