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Paper

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Evaluation of Steady Basic Flow in a Spherical Couette System Using a Perturbation Method

In this paper we present the behavior of a viscous, incompressible Newtonian flow between concentric spheres when one of the which is held fixed and the other is rotating at an arbitrary angular velocity, and also when both spheres are rotating. The two control parameters that govern this phenomenon are, the dimensionless gap width between the spheres, and the Reynolds-number. An analytic solution was obtained using a theoretic "regular perturbation" method by means of which we analyze particular cases. The results were obtained through the projection of the meridional streamlines, contours of constant angular azimuthal velocity, and the evolution of secondary flow. This allowed us to show that the steady basic flow is axisymmetric and reflection-symmetric. This kind of flow could be of interest for understanding global astrophysical and geophysical processes that take into account the rotation and spherical geometry.