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Pulsatile flow through the gap between two coaxially rotating 3d cylinders: An exact solution ALI PASHAEE, NASSER FATOURAEE, Amirkabir University of Technology (Tehran Polytechnic) — The exact solution of pulsatile pressure wave propagation in viscose flow at a rigid tube is available from the previous studies. Here a general flow system of pressure wave propagation along a gap between two coaxially rotating 3D cylinders is considered. The Navier-Stokes equations are solved analytically in this domain. Some features such as incompressibility, viscosity, pulsatility and 3D Cartesian flow are obtained from this solution. The results include the angular velocity component and radial pressure gradient which make it complex than the rigid tube flow with only one axial velocity component and one axial pressure gradient. The inner cylinder boundary condition prevents the second kind of Bessel function to be ignored in the solution as did not in the rigid tube formulation. Here the exact spatial and temporal distributions of the velocity domain, the pressure map, the wall shear stress, the volumetric flow rate and the particle trace trajectories are provided. Similar 3D transient flow systems (e.g. the oil well drilling procedure, vascular operations and medical flow image processing) can be modeled using this formulation. This solution can also be used as a bench mark test to evaluate the flow characteristic algorithms (e.g. pathline, streaklines, streamline and wall shear stress algorithms).

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