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AXISYMMETRIC FLOW OF A GENERALIZED NEWTONIAN FLUID IN A STRAIGHT PIPE USING A DIRECTOR THEORY APPROACH

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The aim of this talk is to analyze the axisymmetric unsteady flow of an incompressible generalized Newtonian fluid in a straight, rigid and impermeable tube with circular cross-section of constant radius. To study this problem, we use an approach based on the Cosserat theory (also called director theory) related to fluid dynamics which reduces the exact three-dimensional equations to a system depending only on time and on a single spatial variable. From this ODE system we obtain for a flow without swirling motion the relationship between mean pressure gradient and volume flow rate over a finite section of the pipe for the specific case of the power law viscosity function. Moreover, we compare the 3D exact solution for steady volume flow rate with the corresponding solution obtained by the Cosserat theory using nine directors.

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