

# Exact solutions for a rotational flow of generalized second grade fluids through a circular cylinder

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**Abstract.** In this note the velocity field and the associated tangential stress corresponding to the rotational flows of a generalized second grade fluid within an infinite circular cylinder are determined by means of the Laplace and Hankel transforms. At time  $t = 0$  the fluid is at rest and the motion is produced by the rotation of the cylinder, around its axis, with the angular velocity  $\Omega t$ . The velocity field and the adequate shear stress are presented under integral and series forms in terms of the generalized  $G$ -functions. Furthermore, they are presented as a sum between the Newtonian solutions and the adequate non-Newtonian contributions. The corresponding solutions for the ordinary second grade fluid and Newtonian fluid are obtained as particular cases of our solutions for  $\beta = 1$ , respectively  $\alpha = 0$  and  $\beta = 1$ .

**Keywords and phrases:** Generalized second grade fluid, velocity field, tangential stress, cylindrical domains.