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Research Article

Effect of Rotation and Magnetic Field through Porous Medium on Peristaltic Transport of a Jeffrey Fluid in Tube

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This paper is concerned with the analysis of peristaltic motion of a Jeffrey fluid in a tube with sinusoidal wave travelling down its wall. The effect of rotation, porous medium, and magnetic field on peristaltic transport of a Jeffrey fluid in tube is studied. The fluid is electrically conducting in the presence of rotation and a uniform magnetic field. An analytic solution is carried out for long wavelength, axial pressure gradient, and low Reynolds number considerations. The results for pressure rise and frictional force per wavelength were obtained, evaluated numerically, and discussed briefly.

1. Introduction

The dynamics of the fluid transport by peristaltic motion of the confining walls has received a careful study in the literature. The need for peristaltic pumping may arise in circumstances where it is desirable to avoid using any internal moving parts such as pistons in a pumping process. The peristalsis is also well known to the physiologists to be one of the major mechanisms of fluid transport in a biological system and appears in urine transport from kidney to bladder through the ureter, movement of chyme in the gastrointestinal tract, the movement of spermatozoa in the ductus efferentes of the male reproductive tract and the ovum in the female fallopian tube, the locomotion of some worms, transport of lymph in the lymphatic vessels, and vasomotion of small blood vessels such as arterioles, venules, and capillaries. Technical roller and finger pumps also operate according to this rule. The behavior of most of the physiological fluids is known to be non-Newtonian. Several models have been proposed to explain the non-Newtonian behavior of fluids.