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Mathematical Physics

Peristaltic flow of a fluid in a porous channel: A study having relevance to flow of bile within ducts in a pathological state

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(Submitted on 28 Jul 2011)

The paper deals with a theoretical study of the transport of a fluid in a channel, which takes place by the phenomenon of peristalsis. A mathematical analysis of the said problem has been presented. The analysis involves the application of a suitable perturbation technique. The velocity profile and the critical pressure for the occurrence of reflux are investigated with particular emphasis by using appropriate numerical methods. The effects of various parameters, such as Reynolds number, pressure gradient, porosity parameter, Darcy number, slip parameter, amplitude ratio and wave number on velocity and critical pressure for reflux are investigated in detail. The computed results are compared with a previous analytical work and an experimental investigation reported earlier in existing scientific literatures. The results of the present study are in conformity to both of them. The study has got some relevance to the physiological flow of bile in the common bile duct in a pathological state. It reveals that in the presence of gallstones, bile velocity increases as the value of the porosity parameter increases, while the critical pressure for reflux decreases as porosity increases.

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