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A two-chamber model of valveless pumping using the immersed boundary method. (English)

Zbl 1163.76011

Appl. Math. Comput. 206, No. 2, 876-884 (2008).

Summary: We present a new mathematical model of valveless pumping for a tube with two elastic chambers, which is motivated by the Liebau two-tank model [*G. Liebau*, *Naturwissenschaften* 41, 327–328 (1954)]. The tube is partially soft and partially (almost) rigid, and the periodic pumping is applied at the asymmetric location of the soft tube. The immersed boundary method is used to investigate the important characteristics of valveless pumping as the previous experiments and mathematical models have been discovered. We observe the existence of a unidirectional mean flow and the dependence of mean flows on the frequency and on the compression duration of periodic pumping. We are able to explain the occurrence of local maximum or minimum mean flows due to the resonances of the system.

MSC:

- 76D05 Navier-Stokes equations for incompressible viscous fluids
- 76Z05 Physiological flows
- 76M25 Other numerical methods (fluid mechanics) (MSC2010)
- 76M20 Finite difference methods applied to problems in fluid mechanics
- 74F10 Fluid-solid interactions (including aero- and hydro-elasticity, porosity, etc.)
- 92C10 Biomechanics

Cited in 2 Documents

Keywords:

Liebau two-tank model; unidirectional mean flow; resonances

Full Text: [DOI](#)

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