Abstract Submitted
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Three-dimensional simulation of a valveless pump[1] SOO JAI SHIN, HYUNG JIN SUNG, Department of Mechanical Engineering, KAIST — An immersed boundary (IB) method for simulating a three-dimensional valveless pump is described. The valveless pump is treated as an elastic tube connected at its ends to a rigid tube. The governing equation for the motion of the elastic tube is derived by using the variational derivative of the deformation energy. Our method is based on an efficient Navier-Stokes solver that uses the fractional step method and a staggered Cartesian grid system. The fluid motion defined on an Eulerian grid and the structure motion defined on a moving Lagrangian grid are independently solved, and their interaction is formulated by using momentum forcing. A net flow is generated inside the valveless pump through the periodic pinching of the elastic tube at a position that is asymmetric with respect to its ends. Two valveless pumps are chosen, a single valveless pump and a double valveless pump. The effects on the average flow rate of varying the pinching frequency and the pinching position were investigated. The interaction between the wave dynamics and the inertia of the returning flow was examined for a closed loop system.

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