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Simulation of a valveless pump with an elastic tube SOO JAI SHIN, KAERI, CHEONG BONG CHANG, HYUNG JIN SUNG, KAIST — A valveless pump consisting of a pumping chamber with an elastic tube was simulated using an immersed boundary method. The interaction between the motion of the elastic tube and the pumping chamber generated a net flow toward the outlet throughout a full cycle of the pump. The net flow rate of the valveless pump was examined by varying the stretching coefficient, bending coefficient, the aspect ratio of the elastic tube, and the frequency of the pumping chamber. As the stretching and bending coefficients of the elastic tube increased, the net flow through the valveless pump decreased. Elastic tubes with aspect ratios in the range of $2<l/d<3$ generated a higher flow rate than that generated for tubes with aspect rations of $l/d=1$ or 4. As the frequency of the pumping chamber increased, the net flow rate of the pump for $l/d=2$ increased. However, the net flow rate for $l/d=3$ was nonlinearly related to the pumping frequency due to the complexity of the wave motions. Snapshots of the fluid velocity vectors and the wave motions of the elastic tube were examined over one cycle of the pump. The relationship between the average gap in the elastic tube and the average flow rate of the pump was analyzed.

Soo Jai Shin
KAERI

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