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Meshfree Computations for Flow Pumping in a Microchannel Inspired by Insect Physiological Systems YASSER ABOELKASSEM, ANNE STAPLES, Virginia Tech — The present study is inspired by pumping mechanisms observed in physiological systems in insects that use multiple contractions to transport fluid. A meshfree computational method is used to solve for the 2D viscous flow in a microchannel at low Reynolds number. The channel is assumed to have a large aspect ratio and localized multiple contractions from the upper wall. These contractions are allowed to move with or without time (phase) lags with respect to each other. The flow development and structures induced by these wall contractions are obtained at various snapshots in the collapse cycle. The effect of the contraction amplitudes and time-lags between its individual prescribed motion protocols on the flow variables and on the time-averaged net flow over a complete cycle of wall motions is studied. The meshfree computational approach presented here is based on the method of fundamental solutions (MFS) which is considered to be an efficient numerical technique for solving elliptic boundary value problems (BVP) such as the Stokes equations. This class of numerical methods uses a set of singularized force elements (Stokeslets) which are distributed according to the method of collocations with unknown strengths. The Stokeslets' strengths are then calculated by imposing the appropriate boundary conditions and solving the resulting system of equations. The flow motions induced by these point forces are then computed by the principle of superposition.

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