Abstract Submitted
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Shape Optimization of Peristaltic Pumping[1] SHAWN WALKER, MICHAEL SHELLEY, New York University — Transport is a fundamental aspect of biology and peristaltic pumping is a fundamental mechanism to accomplish this; it is also important in many industrial processes. We present a variational method for optimizing peristaltic pumping in a two dimensional periodic channel with moving walls to pump fluid. No a priori assumption is made on the wall motion, except that the shape is static in a moving wave frame. Thus, we pose an infinite dimensional optimization problem and solve it with finite elements. Sensitivities of the cost and constraints are computed variationally via shape differential calculus and L^2-type projections are used to compute quantities such as curvature and boundary stresses. Our Optimization method falls under the category of sequential quadratic programming (SQP) methods. As a result, we find optimized shapes that are not obvious and have not been previously reported in the peristaltic pumping literature. Specifically, we see highly asymmetric wave shapes that are far from being sine waves. Many examples are shown for a range of fluxes and Reynolds numbers up to Re = 500 which illustrate the capabilities of our method.

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