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The valveless impedance pump and the unexpected effect of convection in tight spaces[1] JAMES WOODCOCK, University of Melbourne, JOHN SADER, Department of Mathematics and Statistics, University of Melbourne, IVAN MARUSIC, Department of Mechanical Engineering, University of Melbourne — The valveless impedance pump (VIP) consists of a thin tube, one section of which is elastic and is subjected to rhythmic pinching at some point offset from its centre. This induces travelling waves which propagate back and forth along an elastic section of a tube, which in turn induces a flow within the tube. We have investigated the physics underlying the VIP using a perturbation analysis and found that, contrary to expectations, convection plays an important role despite the thinness of the tube. Using numerical simulations, it has been shown that convection can in fact be the dominant mechanism at work within the flow if the oscillations of the tube are of sufficient amplitude. We propose that convection may generally play an important role, even within thin tubes and channels, where the velocity gradients along the wall are significant.

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