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Microfluidic waves for flow control HOSSEIN HAJ-HARIRI, MARCEL UTZ, University of Virginia, MATTHEW BEGLEY, University of California at Santa Barbara — The propagation of coupled waves in fluidic channels with elastic covers is discussed in view of applications for flow control in microfluidic devices. A theory is developed for pressure waves in the fluid coupled to bending waves in the elastic cover. At low frequencies, the lateral bending of the cover dominates over longitudinal bending, leading to propagating, non-dispersive longitudinal pressure waves in the channel. The theory addresses effects due to both the finite viscosity and compressibility of the fluid. The coupled waves propagate without dispersion, as long as the wave length is larger than the channel width. It is shown that in channels of typical microfluidic dimensions, wave velocities in the range of a few 10 m/s result if the channels are covered by films of a compliant material such as PDMS. The application of this principle to design microfluidic band pass and band stop filters based on standing waves is discussed. Characteristic frequencies in the range of a few kHz are readily achieved with quality factors above 30.

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