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Spontaneous oscillations in simple fluid networks DEBORAH HELLEN, ERIKA WEILER, Olin College, NATHAN KARST, Babson College, JOHN GEDDES, BRIAN STOREY, Olin College — Nonlinear phenomena including multiple equilibrium states and spontaneous oscillations can occur in fluid networks containing multiple fluid phases. Such behavior might be attributed to the complicated geometry of the network, the complex rheology of the constituent fluids, or, in the case of microvascular blood flow, biological control. However, the simplest networks containing two miscible Newtonian fluids of differing viscosities are found to exhibit these non-linear phenomena. We use a combination of analytic and numerical techniques to identify and track saddle-node and Hopf bifurcations through the large parameter space. The model predictions show regions of sustained spontaneous oscillations and we investigate the sensitivity of these oscillations to changes in the viscosity contrast and network geometry. The model predictions are used to guide ongoing experimental which has confirmed the existence of such oscillations.

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