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Bifurcation and Stability of a System of n Coupled Droplet Oscillators with S_n symmetry DAVID SLATER, PAUL STEEN, Cornell University — The dynamics of a large array of interacting droplets is of interest in a variety of applications and, on its own, as a nonlinear dynamical system. A network of n spherical-cap droplet oscillators are coupled via a central reservoir such that the system has S_n symmetry. Under a constant-volume constraint, the inviscid case is modeled as a system of $n-1$ second order differential equations. Surface tension resists the inertia of deformations from the spherical shape. The symmetry of the system is important. In particular, independent of the equations, equilibrium solutions can be categorized by symmetry group into families, each with some p large and some $q = n - p$ small droplets. Within each family stability is invariant, which greatly reduces the number of cases to consider. Equilibrium curves and their stability are calculated analytically for an arbitrary number of droplets in the preferred coordinate space. For small volumes, the only equilibrium state is stable and corresponds to all identical droplets. For larger volumes, a multitude of equilibrium states exist, each having the property that all droplets have equal radius of curvature. Nearly all these equilibrium are unstable, the only stable configuration being one droplet large and the rest small. The nonlinear dynamics of the three droplet case is examined numerically and exhibits quasiperiodic, periodic and chaotic dynamics.

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