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Domains of attraction for volume-scavenging among N coupled capillary droplets HENRIK VAN LENGERICH, PAUL STEEN, MIKE VOGEL, Cornell University — A large number of capillary droplets protruding from a surface can be made to adhere or detach to a substrate by manipulating the volume of the droplets so that they form or break liquid bridges with the substrate. Because such a device is easiest to manufacture with a single liquid reservoir, we are motivated to study the dynamics of N coupled droplets. Experiments and numerical simulations show that the droplets exchange volume in a complicated manner until one droplet has scavenged the volume from all the others. Which of the N droplets becomes largest is sensitive to the total droplet volume, initial droplet volume perturbation, and topology of the coupling; it can be very intuitive, exhibit patterns, or become disordered. To explain these findings we find a Lyapunov function, characterize the fixed points, and find the invariant manifolds using a combination of local and global methods. We show how to combine this information to obtain the domains of attraction for small N and explain phenomenon observed by the numerical computations.

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