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On the influence of initial geometry on the evolution of liquid filaments[1] LOU KONDIC, NJIT, KYLE MAHADY, University of Tennessee, SHAHRIAR AFKHAMI, NJIT — Recent developments in nanofabrication allow for thin liquid films on substrates whose initial conditions can be specified with an unprecedented degree of precision. In recent work (Roberts etal., ACS Appl. Mater. Interfaces, vol. 5, 4450 (2014), it was demonstrated experimentally that the breakup of nanoscale strips with rectangular-wave perturbations can result in controlled arrays of nanodroplets, offering a means for bottom-up directed assembly of nanoparticle arrays. We present a computational study of the breakup of these rectangular-wave structures by means of direct simulation of the Navier-Stokes equations using the volume of fluid interface capturing method. By varying the parameters of the initial geometry, we find that the rectangular-wave structures can also undergo a range of different instabilities, leading to diverse structures consisting variously of droplet arrays, filaments, and combinations of the two. In particular, we show that structures can rupture into arrays of droplets even for wavelengths which are stable for sinusoidal perturbations. The short wavelengths for which this breakup occurs mean that his process can yield droplet arrays with center to center spacing smaller that what is expected based on Rayleigh-Plateau instability mechanism.

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