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Numerical analysis of drop-on-demand (DOD) drop formation: dynamics due to a square wave inflow boundary condition HAIJING GAO, QI XU, MICHAEL HARRIS, OSMAN BASARAN, Purdue University — Applications of drop-on-demand (DOD) ink-jet technology are legion and include fields as diverse as graphic arts, micro-arraying, and printing flexible electronics. Despite the importance of the subject, a fundamental understanding of the mechanisms of drop formation from a DOD nozzle is still in its infancy. Complicating matters is the fact that in piezoelectrically-driven nozzles, diverse waveforms are used to cause the formation of drops. Simplest among the waveforms is tantamount to imposing a transient inflow rate upstream of the nozzle that has the form of a square wave with or without rising/falling ramps. The dynamics are analyzed by solving the governing equations with a method of lines that uses the Galerkin/finite element method for spatial discretization and adaptive finite differences for time integration. Regions of the parameter space are identified over which drops can be successfully formed from DOD nozzles. Moreover, the dynamics are followed beyond the first breakup to determine whether primary drops can be produced without the formation of undesirable secondary or satellite droplets.

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