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Simplicity and complexity of a dripping faucet HAK KOON YEOH, HARIPRASAD JANAKIRAM SUBRAMANI, RONALD SURYO, QI XU, BALASUBRAMANIAN AMBRAVANESWARAN, OSMAN BASARAN, School of Chemical Engineering, Purdue University — Drop formation arises in inkjet printing, arraying, and leaky faucets. Dynamics of dripping are studied in heretofore unexplored ranges of parameters by experiment and computation. Previous studies performed at a moderate Bond number G $\approx$ 0.5 (G=gravitational/surface tension force) and low Ohnesorge number Oh $\approx$ 0.1 (Oh=viscous/surface tension force) show that the dynamics changes from simple period-1 dripping (SD) to complex dripping (CD), where period-n (n$\geq$2) dripping and hysteresis abound, to jetting (J), as Weber number We (inertial/surface tension force) increases. New experiments and computations reveal that lowering G results in a drastic reduction in complexity: when G $\approx$ 0.3 and Oh $\approx$ 0.1, the sole CD response is period-2. Computed phase diagrams in (We, Oh) space reveal that the range of We over which the response is period-2 narrows as Oh increases and ultimately results in a direct transition from SD to J, in accord with experiments. By contrast, new computations at larger Bond number, G $\approx$ 1, with Oh = 0.1 and We = 0.05, predict occurrence of rare period-3 dripping, period-3 intermittence, and chaotic attractors.

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