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Experimental investigation on elastic and plastic regimes in Rayleigh-Taylor instability with soft materials[1] AREN BOYACI, ARINDAM BANERJEE, Lehigh Univ — Rayleigh Taylor instability (RTI) is a hydrodynamic instability that can also be observed in materials that have significant resistance to yield. The majority of the past studies have focused on estimating the instability threshold as it is critical to several high energy density applications. The elastic to plastic (EP) transition threshold is also of significance in those applications and has received limited attention in the scientific literature. We explore the EP threshold and the stable regimes of RTI under complex acceleration profiles using the rotating wheel RTI experiment. The test section with the soft-solid (mayonnaise) is placed on the wheel such that the free surface of the soft material is driven radially (outwards) by the centrifugal acceleration. The growth of the perturbation is recorded using a high-speed camera for the entire experiment. In the current study, we explore the initial perturbation geometry and the acceleration rate effects on the EP threshold. Additionally, stable EP regimes are investigated in detail by employing four different acceleration profiles. The perturbation amplitude response and the mass ejection data as a function of the instantaneous driving accelerations will be discussed. Finally, the results for the EP thresholds will be compared to the existing analytical formulations for RTI in solids.

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