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Topic: Granular Materials

Two Dimensional Ripple Behavior of Granular Material Driven by Circular Oscillations

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We study the formation of ripples in sand on an oscillating plate submerged in water. The ripple formation is consistent with one-dimensional experiments performed in an oscillating annulus[1] and in linear shaking[2], but generalizes the ripples to allow for two-dimensional pattern formation. The resulting patterns formed in the sand can be classified into five regions according to physical appearance. Three of the four boundaries between these regions appear to be well defined by simple power laws. Two of the power laws are in agreement with simple physical expectations; we provide a plausible argument for the third. The structure of the boundary between the rolling grain and fully formed vortex ripple regions exhibits characteristics that might provide for long term stability of the rolling grain ripples[3].

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[3] A. Stegner and J. E. Wesfreid, Dynamical evolution of sand ripples under water, *Phys. Rev. E* **60**, R3487-R3490 (1999).