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How the form of the forcing function determines Faraday wave instabilities in shallow viscous fluids CRISTIAN HUEPE, YU DING, PAUL UMBANHOWAR, MARY SILBER, Northwestern University — We investigate the relationship between the linear surface wave instabilities of a shallow viscous fluid layer and the shape of the periodic, parametric-forcing function (describing the vertical acceleration of the fluid container) that excites them. We find numerically that the envelope of the Arnold resonance tongues only develops multiple minima when the forcing function has more than two local extrema per cycle. Using an analytic WKB approximation, we explore the origin of this relationship and show that, as in the usual sinusoidal case, the envelope has only one minimum for any case with square or triangular forcing. With this insight, we construct a forcing function that generates a non-trivial harmonic instability at onset, which is distinct from a subharmonic response to any of its forcing frequency components. We measure the corresponding surface patterns experimentally and verify that small changes in the forcing function causes a transition (through the calculated bicritical point) from the predicted harmonic short-wavelength pattern to the much larger, standard subharmonic pattern.

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