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Long-time nonlinear dynamics of perturbed traveling and standing water waves

We present a unified method of computing the spectral stability of traveling and standing water waves to harmonic or subharmonic perturbations. We explore the long-time dynamics of these perturbations as they grow in amplitude beyond the realm of linear theory, which we find can lead to Fermi-Pasta-Ulam recurrence. To track the growth of subharmonic perturbations, we develop a framework to compute and study fully nonlinear spatially quasi-periodic water waves, which are represented as periodic functions on a higher-dimensional torus evaluated along irrational directions.