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Description of a nonlinear extension of the Benjamin-Feir instability as a coupled oscillator model

The Benjamin-Feir instability is one of the deterministic processes that lead to large wave amplification. We present a detailed study of the process of the fully nonlinear extension of the BF-instability in the simplified NLS model. For the soliton on finite background we describe the nonlinear spatial evolution as a set of coupled nonlinear oscillators. When written with respect to the background, the oscillations are autonomous at each position while the changing phase determines the coupling. Although this special solution is exceptional in various aspects, the results may be more generally valid. For instance, the amplification seems to be robust for generic perturbations, while details of wave singularities and dislocation are not, as we will illustrate by comparison with some experiments in a wave tank.

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