Modulational instability in some nonlinear one-dimensional lattices and soliton generation

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ABSTRACT

The modulational instability (MI) of some discrete nonlinear evolution equations (DNEE), representing approximations of Davydov's model of α-helix in protein, is studied. In a multiple scales analysis the dominant amplitude usually satisfies the nonlinear Schrödinger equation (NLS), or the Zakharov-Benney equations (ZB) if a long wave-short wave resonance takes place. The MI is studied both from a deterministic and statistical point of view. If the second derivative of the linear dispersion relation is positive (focusing case of NLS) the system is unstable at small modulations of the amplitude. In the statistical approach a new phenomenon, similar to the Landau damping in plasma physics, can appear for a Lorentzian distribution of the unperturbed Fourier transform of the two-point correlation function.

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