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Nonlinear Wawe Processes in a Bi-Layer

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Combinations of two materials are commonly used to obtain a structure with the properties better than those of the parent constituents. Coupled nonlinear Klein-Gordon equations can be used to study the properties of wave processes in a bi-layer, where the parameters depend on the materials forming the bi-layer, and the coupling depends on the properties of the glue bond. It is shown that heterogeneity can result in the apperance of a gap in the velocity spectrum of solitary waves (kinks). The influence of a delamination zone on the propagation of these solitary waves is studied numerically. Next, it is shown that heterogeneity makes possible energy exchange between the layers. We consider the structure and stability of solutions involving two waves or two pairs of counter-propagating waves describing periodic energy exchange between the layers. Using both asymptotic analysis and numerical simulations, we show that these solutions may be modulationally unstable. These instabilities may lead to the formation of localized structures, and to a modification of the energy exchange between the components.

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