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Introduction to nonlinear discrete systems: theory and modelling

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Abstract

An analysis of **discrete systems** is important for understanding of various physical processes, such as excitations in crystal lattices and molecular chains, the light propagation in waveguide arrays, and the dynamics of Bose-condensate droplets. In basic physical courses, usually the linear properties of **discrete systems** are studied. In this paper we propose a pedagogical **introduction to** the **theory of nonlinear distributed systems**. The main ideas and methods are illustrated using a universal model for different physical applications, the **discrete nonlinear** Schrodinger (DNLS) equation. We consider solutions of the DNLS equation and analyse their linear stability. The notions of **nonlinear** plane waves, modulational instability, **discrete** solitons and the anti-continuum limit are introduced and thoroughly discussed. A Mathematica program is provided for better comprehension of results and further exploration. Also, a few problems, extending the topic of the paper, for independent solution are given.

Keywords

Author Keywords: **discrete systems**; lattices; arrays; chains; **discrete nonlinear** Schrodinger equation; **discrete** solitons; Mathematica code

KeyWords Plus: SCHRODINGER-EQUATION; SOLITONS; BREATHERS; LATTICES; CHAIN; MODES

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