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INTER-BELT ANALYSIS OF NONLOCAL LINEAR ELASTIC THEORY

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This paper develops the Hamilton theory for the nonlocal linear elasticity originally proposed by Eringen [1]. The nonlocal continuum theory shows special advantages in solving the small-scale problems; it has widely research potential in the mechanics problems of nanodots, nanowires and nanobelts. In order to avoid the difficulty in solving the integro-differential equations of nonlocal theory, Eringen presented different differential forms of nonlocal theory by introducing special kernel functions. Up to now, many research efforts have been made in this area. By introducing the inter-belt theory [2-3], the integro-differential equations of integral form nonlocal theory can be solved in high-precision. The inter-belt theory is firstly applied in the analysis of discrete system and achieves succeed, which demonstrates the veracity and feasibility of the theory. By presenting an algorithm named ‘step-increase’, the inter-belt theory can deal with the integral problem of continuous system with arbitrary inter-belt width (domain of influence). Accordingly the dual equilibrium equations and relevant boundary conditions of nonlocal elasticity are derived from the variational equation in duality form. The fundamental theory and computational algorithm are applied in dynamic problems of rod vibration, and numerical experiments are carried out to demonstrate the validity of the theory and algorithm developed in this paper. The present study shows the potential of the symplectic-mathematical theory for nonlocal mechanics.

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