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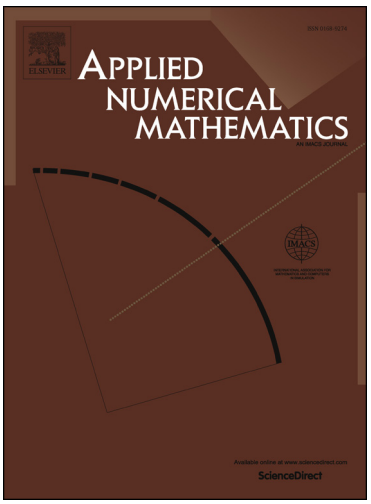

A meshless scheme for Hamiltonian partial differential equations with conservation properties

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A meshless scheme for Hamiltonian partial differential equations with conservation properties[☆]

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Abstract

Based on quasi-interpolation, the paper proposes a meshless scheme for Hamiltonian PDEs with conservation properties. There are two key features of the proposed scheme. First, it is constructed from scattered sampling data. Second, it conserves energy for both linear and nonlinear Hamiltonian PDEs. Moreover, if the considered Hamiltonian PDEs additionally possess some other quadric invariants (i.e., the mass in the Schrödinger equation), then it can even preserve them. Error estimates (including the truncation error and the global error) of the scheme are also derived in the paper. To demonstrate the efficiency and superiority of the scheme, some numerical examples are provided at the end of the paper. Both theoretical and numerical results demonstrate that the scheme is simple, easy to compute, efficient and stable. More importantly, the scheme conserves the discrete energy and thus captures the long-time dynamics of Hamiltonian systems.

Keywords: Meshless schemes; Energy conservation; Hamiltonian systems; Symplectic schemes; Quasi-interpolation

AMS Subject Classifications: 41A25, 65D15, 65D30

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