Completely conservative difference schemes for nonlinear models that describe the dynamics of materials with shape memory

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Abstract:

The paper provides initial details on a fully conservative difference scheme, recently proposed by the authors for the modelling of strongly coupled models of nonlinear thermoelasticity describing the dynamics of materials with shape memory. One of the challenges lies with the analysis of convergence properties of the scheme. Indeed, the application a standard energy inequality technique would lead to restrictive assumptions on the grid size and/or excessive smoothness assumptions on the unknown solution. This is the first work attempting to address this challenge. It has been followed by a series of publications listed below.

- Computational Aspects of Conservative Difference Schemes for Shape Memory Alloys Applications, Melnik, R.V.N., Wang, L., Matus, P. and Rybak, I., Lecture Notes in Computer Science, Springer, LNCS-2668, Eds. V. Kumar et al, ICCSA-2003, Montreal, 791-800, 2003.

- Analysis of Conservative Difference Schemes for Materials with Memory, Matus, P. and Melnik, R.V.N., Proceedings of Dynamic Systems and Applications, 4, 153--160, 2004.

- Applications of Fully Conservative Schemes in Nonlinear Thermoelasticity: Modelling Shape Memory Materials, Matus, P., Melnik, R.V.N., Wang, L. and Rybak, I., Mathematics and Computers in Simulation, 65, 489--509, 2004.

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MSC:

65M06 Finite difference methods for initial value and initial-boundary value problems involving PDEs
35G30 Boundary value problems for nonlinear higher-order PDEs
74N99 Phase transformations in solids
74S20 Finite difference methods applied to problems in solid mechanics
80M20 Finite difference methods applied to problems in thermodynamics and heat transfer

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