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Nonlinear transient heat conduction analysis of functionally graded materials in the presence of heat sources using an improved meshless radial point interpolation method. (English)

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Summary: An improved meshless radial point interpolation method, for the analysis of nonlinear transient heat conduction problems is proposed. This method is implemented for the heat conduction analysis of functionally graded materials (FGMs) with non-homogeneous and/or temperature dependent heat sources. The conventional meshless RPIM is an appropriate numerical technique for the analysis of engineering problems. One advantage of this method is that it is based on the global weak formulation, and also the associated shape functions possess the Kronecker delta function property. However, in the original form, the evaluation of the global domain integrals requires the use of a background mesh. The proposed method benefits from a meshless integration technique, which has the capability of evaluating domain integrals with a better accuracy and speed in comparison with the conventional integration methods, and therefore a truly meshless technique is attained. This integration technique is especially designed for the fast and accurate evaluation of several domain integrals, with different integrands, over a single domain. Some 2D and 3D examples are provided to assess the efficiency of the proposed method.

MSC:

74F05 Thermal effects in solid mechanics
74S25 Spectral and related methods applied to problems in solid mechanics
65M60 Finite element, Rayleigh-Ritz and Galerkin methods for initial value and initial-boundary value problems involving PDEs

Keywords:

nonlinear; transient heat conduction; meshless radial point interpolation method (RPIM); functionally graded materials (FGMs); meshless integration

Full Text: DOI

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