A Novel Local Radial Basis Function Collocation Method for Multi-Dimensional Piezoelectric Problems

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The local radial basis function collocation method (LRBFCM), a strong-form formulation of the meshless numerical method, is proposed for solving piezoelectric medium problems. The proposed numerical algorithm is based on the local Kansa method using variable shape parameter. We introduce a novel technique for the determination of shape parameter in the LRBFCM, which leads to greater accuracy, and simplicity. The implemented algorithm is first verified with a 2D Poisson equation. Then, we employed LRBFCM in a numerical simulation for 2D and 3D piezoelectric problems involving mutual coupling of the electric field and elastodynamic equations for the mechanical field. The presented meshless method is verified using corresponding results obtained from the finite element method and moving least squares meshless local Petrov–Galerkin method [2]. In particular, the 2D piezoelectric problem is verified with an exact solution from [1].

References

[1] G. P. Dube, S. Kapuria, P. C. Dumir, *Exact piezothermoelastic solution of simply-supported orthotropic flat panel in cylindrical bending*, International Journal of Mechanical Sciences, (1996), pp. 1161–1177.

[2] P. Stanak, A. Tadeu, J. Sladek, V. Sladek, *Meshless analysis of piezoelectric sensor embedded in composite floor panel*, Journal of Intelligent Material Systems and Structures, (2014), pp. 2092–2107.