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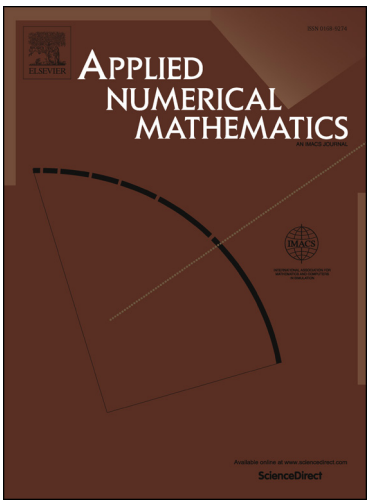


An Adaptive Meshfree Spectral Graph Wavelet Method for Partial Differential Equations

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# AN ADAPTIVE MESHFREE SPECTRAL GRAPH WAVELET METHOD FOR PARTIAL DIFFERENTIAL EQUATIONS

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**Abstract**

This paper proposes an adaptive meshfree spectral graph wavelet method to solve partial differential equations. The method uses radial basis functions for interpolation of functions and for approximation of the differential operators. It uses multiresolution analysis based on spectral graph wavelet for adaptivity. The set of scattered node points is subject to dynamic changes at run time which leads to adaptivity. The beauty of the method lies in the fact that the same operator is used for the approximation of differential operators and for the construction of spectral graph wavelet. Initially, we have applied the method on spherical diffusion equation. After that the problem of pattern formation on the surface of the sphere (using Turing equations) is addressed to test the strength of the method. The numerical results show that the method can accurately capture the emergence of the localized patterns at all the scales and the node arrangement is accordingly adapted. The convergence of the method is verified. For each test problem, the CPU time taken by the proposed method is compared with the CPU time taken by a traditional method (spectral method using radial basis functions). It is observed that the adaptive meshfree spectral graph wavelet method is highly efficient.

*Keywords:* Multiresolution analysis (MRA), spectral graph wavelet, adaptive node arrangement, radial basis function, meshfree methods.
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