Watcharakorn Thongchuay 2012: Wavelet-Galerkin Method for Partial Differential Equations. Master of Science (Mathematics), Major Field: Mathematics, Department of Mathematics. Thesis Advisor: Assistant Professor Montri Maleewong, Ph.D. 131 pages.

In this thesis, the wavelet-Galerkin finite element method is presented for solving the one-dimensional heat equation, the singularly perturbed boundary value problem and the singularly perturbed parabolic problem. The multilevel augmentation method with wavelet bases is demonstrated to show as the fast technique for solving the problems. We consider two types of basis functions which are the Lagrange and wavelet bases for constructing the full form of matrix system. We consider both linear and quadratic bases in the Galerkin method. Our numerical results show that the rate of convergences for the linear Lagrange and wavelet bases are the same in order 2 while the rate of convergences for the quadratic Lagrange and wavelet bases are approximately in order 4. It also reveals that the wavelet basis provides an easy treatment to improve numerical resolutions that can be done by increasing just its desired levels in the multilevel process. We also applied the multilevel augmentation method with wavelet bases for the singularly perturbed problem. It is found that the multilevel augmentation method is faster than the standard multilevel method in the same accuracy for high multilevel basis applied.

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