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Abstracts of Plenary and Invited Lectures

Section:

15. Numerical Analysis and Scientific Computing

1991 MS Classification:

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Wavelet Based Numerical Homogenization

Wavelet Based Numerical Homogenization
In homogenization a differential equation and its solution with multiple scales are replaced by an approximating equation and its corresponding solution with fewer scales. The scales related to the shortest wavelengths are eliminated. This reduction of scales may be needed in order to prepare a problem for a numerical approximation. The analytical homogenization technique is, however, only applicable to a small class of problems.
We shall start from a discretization of the original differential equation, which includes all the scales. The solution and the difference operator will be represented in a wavelet basis and the homogenized discrete operator will correspond to a particular form of an approximative projection onto the coarser scales. We shall show that this new operator inherits many of the properties of the original discrete operator, including sparseness. Comparisons with the analytic homogenization process and different convergence results will be given. We shall also present computational examples and discuss direct coarse grid approximation.