A hybrid numerical method for composite materials with local defects

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ABSTRACT

We present a new hybrid numerical method for multiscale partial differential equations, which simultaneously captures the global macroscopic information and resolves the local microscopic events over regions of relatively small size. This is particularly suitable for composite materials with local defects. The method couples concurrently the microscopic coefficients in the region of interest with the homogenized coefficients elsewhere. The cost of the method is comparable to the heterogeneous multiscale method, while being able to recover microscopic information of the solution. The convergence of the method is proved for problems with bounded and measurable coefficients, while the rate of convergence is established for problems with rapidly oscillating periodic or almost-periodic coefficients. Numerical results are reported to show the efficiency and accuracy of the proposed method. This is a join work with Yufang Huang and Jianfeng Lu.