

A multiscale finite element method for numerical homogenization

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This paper is concerned with a multiscale finite element method for numerically solving second order scalar elliptic boundary value problems with highly oscillating coefficients. In the spirit of previous other works our method is based on the coupling of a coarse global mesh and of a fine local mesh, the latter one being used for computing independently an adapted finite element basis for the coarse mesh. The main new idea is the introduction of a composition rule, or change of variables, for the construction of this finite element basis. In particular, this allows for a simple treatment of high order finite element methods. We provide optimal error estimates in the case of periodically oscillating coefficients. We illustrate our method on various examples.