

On reliability of averaging techniques for oscillating data

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Averaging techniques, occasionally named after Zienkiewicz and Zhu, are an extremely popular tool in scientific computing to get a post-processed approximation of the discretisation error. The weak interpolation operator owing to Clement is one of the main mathematical tools in the averaging techniques based a posteriori finite element error analysis.

We introduce an approximation interpolation operator to overcome assumptions on oscillating data, the regularity of the exact solution or on a saturation property of the numerical scheme in the a-posteriori error analysis of finite element methods.

In our talk we will discuss a-posteriori error estimates for the finite element computation for second order elliptic partial differential equations based on averaging techniques and weighted residuals. Emphasis is on reliability and efficiency constants, reliability of averaging based estimator on unstructured grids and a ranking of the schemes with theoretical and numerical evidence.

Numerical examples are mentioned for the conforming, nonconforming, and mixed finite element schemes with applications to the Laplace, Stokes and locking-free Lamé problems