MARTIN COSTABEL

costabel@univ-rennes1.fr

Approximation of Maxwell singularities by higher order nodal finite elements

Near reentrant corners of a perfectly conducting boundary, electromagnetic fields have strong singularities that are not in H^1. The standard regularized variational formulation of the time-harmonic Maxwell equations, when discretized using nodal (C^0) finite elements, leads to non-convergent Galerkin methods. The weighted regularization method [1,2] is a simple modification of the variational formulation that leads to convergent nodal finite element methods.

In its hp version, the WRM is particularly efficient. For 2D problems, exponential convergence can be shown. The method works well for 3D problems, too. In the talk, some points from the proof of exponential convergence in 2D will be presented.

The convergence behavior will be illustrated by the the results of computations in 2D and in 3D. From the numerical computations in 3D, in particular for the "Fichera corner", we learn several interesting lessons:
• Polynomials of moderate degree (4, for example) are quite capable of approximating even very singular functions if the right variational formulation is used.
• It is advisable to use extremely strong refinements near the edges and corners, even though this leads to strongly anisotropic meshes.

References

[1] M. COSTABEL, M. DAUGE. Weighted regularization of Maxwell equations in polyhedral domains. *Numer. Math.* Online publication **DOI** 10.1007/s002110100388 (2002)

[2] M. COSTABEL, M. DAUGE, D. MARTIN, G. VIAL. Weighted regularization of Maxwell equations – computations in curvilinear polygons. *Proceedings of ENUMATH01*, Springer 2002.

[3] D. MARTIN. The finite element library MÉLINA.
http://www.maths.univ-rennes1.fr/∼dmartin/melina/www/homepage.html

Address:
IRMAR (UMR CNRS 6625), Université de Rennes 1,
Campus de Beaulieu, F-35042 Rennes Cedex