Integral Representation and the Adaptive Perfectly Matched Layer Method for Time-Harmonic Electromagnetic Scattering Problems

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Abstract: An adaptive perfectly matched layer (PML) method for solving the time harmonic electromagnetic scattering problems is developed. The exponential convergence of the PML method in the rectilinear coordinates is proved by using the Stratton-Chu integration representation formula and the method of complex coordinate stretching. The PML parameters such as the thickness of the layer and the absorbing medium property are determined through sharp a posteriori error estimates. Combined with the adaptive finite element method, the adaptive PML technique provides a complete numerical strategy to solve the scattering problem in the framework of FEM which produces automatically a coarse mesh size away from the fixed domain and thus makes the total computational costs insensitive to the thickness of the PML absorbing layer. Numerical experiments are included to illustrate the competitive behavior of the proposed adaptive method.

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