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Recent Advances in Perfectly Matched Layers in Finite Element Applications

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Abstract: We present a comparative evaluation of two novel and practical perfectly matched layer (PML) implementations to the problem of mesh truncation in the finite element method (FEM): locally-conformal PML, and multi-center PML techniques. The most distinguished feature of these methods is the simplicity and flexibility to design conformal PMLs over challenging geometries, especially those with curvature discontinuities, in a straightforward way without using artificial absorbers. These methods are based on specially- and locally-defined complex coordinate transformations inside the PML region. They can easily be implemented in a conventional FEM by just replacing the nodal coordinates inside the PML region by their complex counterparts obtained via complex coordinate transformation. After overviewing the theoretical bases of these methods, we present some numerical results in the context of two- and three-dimensional electromagnetic radiation/scattering problems.

Key Words: Finite element method (FEM), perfectly matched layer (PML), locally-conformal PML, multi-center PML, complex coordinate stretching, electromagnetic scattering