Recent Advances in Discontinuous Galerkin Boundary Element Methods for Maxwell's Equations

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We consider in this work the discontinuous Galerkin boundary element method (DG-BEM) for time-harmonic Maxwell's Equations. Compared with classical Galerkin methods, the DG-BEM employs square-integrable trial and testing functions without continuity requirements across element boundaries. It permits the use of non-conformal surface discretizations, allows mixing different types of elements, and facilitates the mesh generation task for high-definition objects. In this talk, we will present several recent advancements including: (**i**) a new skew-symmetric DG weak form and an a-priori mathematical analysis to determine the asymptotic behavior of the interior penalty stabilization function. Quasi-optimal convergence measured in $\mathbf{L^2}$ norm is validated through numerical experiments; (**ii**) a hybrid DG boundary element approximation including both piecewise linear basis functions and plane wave basis functions. The goal of this study is to develop an accurate yet efficient approximation of surface currents for a desired level of accuracy. The oscillatory nature of solutions is incorporated into the construction of trial spaces; (**iii**) an adaptive and scalable domain decomposition solver for the parallel and robust solution of the DG-BEM matrix equations. The preconditioned system exhibits a uniformly bounded eigenspectrum with regard to a range of numerical experiments. The merits of proposed method are justified through different types of emerging electromagnetic applications ranging from high-definition jet aircrafts to radar stealth objects to semiconductor quantum dots and plasmonic nanoantennas.