Development of Divergence Conforming Bases for Plate Corner Singularities

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Hierarchical divergence conforming bases for *edge* singularities in quadrilateral cells were recently developed. These bases permit improved modeling of the unbounded behavior of the induced current and charge in the neighborhood of sharp edges but not in the vicinity of *corners* (such as the tip of a plate or wing). The corner singularity can be modeled in accordance with the analytical solution for the plane angular sector (Satterwhite and Kouyoumjian, 1970), which results in the current density and charge density exhibiting independent dominant singularities at the corner. The literature contains two proposed basis sets for modeling 90 degree corner singularities, those of Andersson (1991) and Ozturk, Paknys, and Trueman (2009). Andersson's approach provides the correct dominant singularities but is not divergence conforming. The basis of Ozturk et al. does not provide both dominant singularities. Neither approach is immediately compatible with hierarchical representations.

This presentation will consider the development of new bases to provide the dominant corner singularities. Issues to be addressed include:

1. the relative importance of the corner singularity and the edge singularity – in what situations does one really need to include the singularity at corners;
2. an assessment of the quality of existing bases for the corner singularity;
3. new basis functions on quadrilateral cells that are compatible with existing hierarchical bases for edge singularities;
4. techniques for integrating over the new singular basis functions to obtain matrix entries for a method of moments solution

Consideration will be limited to a flat infinitely thin conducting rectangular plate with four corners in free space, described by the electric field integral equation, solved using the method of moments, where the basis functions in use are of the additive kind in the sense that regular polynomial basis functions are always added to the singular ones to form the basis. We will also explore a meshing strategy that employs basis functions on triangular cells (superimposed on the quadrilateral cell) to simplify the construction of bases able to model the corner singularity.