GENERALIZED HYBRIDIZATION WITH ITERATIVE FIELD REFINEMENT

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When applying computational simulation techniques to scattering or radiation problems, it is often possible to decompose a complicated geometry into simpler elemental structures (i.e. a helicopter rotor system into its individual blades). It is then desirable to simulate each element separately, allowing a given problem to be decomposed into smaller and more manageable ones as long as coupling between each component is accounted for. To implement this coupling, we propose and employ in this paper an Iterative Field Refinement (IFR) method. Using IFR, it is then possible to accelerate simulation of geometries made up of rotated, translated, reflected, or replicated versions of a given structure. It is shown that the IFR approach not only reduces total computation time, but also allows for combining different analysis methods in treating each of the separate components comprising the structure.

Our approach differs from previous works by incorporating additional generality to decompose the geometry into a discrete set of smaller problems. One is then free to apply any method(s) of choice to model each of these components. Therefore, with careful selection of the fastest and most suitable method for each structure, the total simulation time can then be significantly reduced. IFR serves to include the coupling interactions among these structures, a process that normally requires interaction matrices (i.e. "coupling" matrices) to be incorporated into a large system matrix along with each of the individual structure matrices.

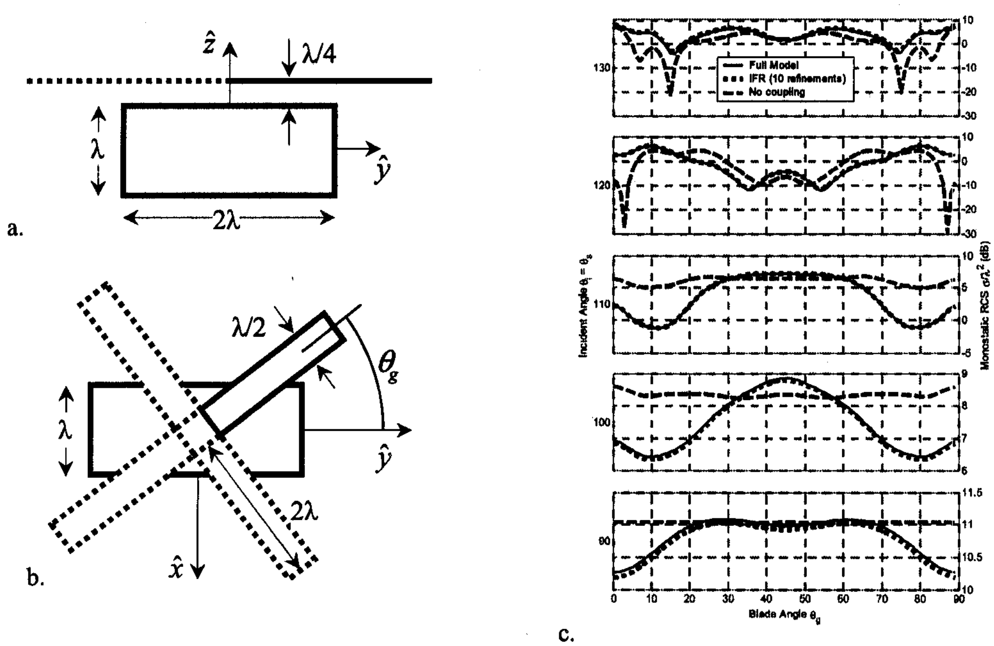

Figure 1. Side (a) and top (b) views of four rotated helicopter blades in the presence of a fuselage, where three of the blades are replicas of the first; (c) Monostatic RCS vs blade angle (θ_g) for several incidence angles for θθ-polarization. Results are shown for simulation of the full model, with IFR, and with no higher-order interactions.