HYBRID METHOD BASED ON CURRENT MODES FOR SCATTERING AND RADIATION FROM COMPLEX BODIES

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Abstract:

In this communication, an efficient scheme based on Physical Optics for computing scattering and radiation for large and complex bodies is presented. An iterative procedure has been considered in order to process multiple interactions between different patches that compound the geometric model, so that some special structures (such as cavities) can be analysed together with the rest of the geometry. When possible, current distributions are stored using exponential functions to describe their amplitude and unwrapped phase terms.Great efforts have been made to decrease the huge memory and CPU requirements of numerical rigorous methods like the Method of Moments (MM), where very large and time expensive linear systems have to be solved, and their corresponding coupling matrices need to be stored as well. CPU-time and memory resources can be saved by using the Fast Multipole Method (or its Multilevel implementation). However, even in this case currents must be sampled very densely (typically between 6 and 10 samples per wavelength). High frecuency methods avoid the MM coupling matrix to find the current distribution over the geometry. The PO approach does not need to solve that huge system of equations, although the high sampling rate of the currents required using a numerical evaluation of PO integrals can make this method still inefficient when dealing with electrically large bodies. However, in large and smooth regions of the geometry, it is possible to interpolate the amplitude and phase terms of the currents and store them in an efficient way. An iterative scheme has been implemented to compute N-order effects in scaterring problems avoiding that high sampling density.CPU time spent when computing multiple interactions between several surfaces may be really inadmissible, specially if a pure brute-force scheme is considered. Furthermore, memory storage requirements can be great when calculating high-order effects, so it is crucial to implement criteria that discard active-victim surface pairs quickly and store currents as efficiently as possible. Once the pair of surfaces have been chosen, it is necessary to obtain the current distribution over the victim surface in an efficient way. Its amplitude may change very quickly if some parts of both patches are close to each other. In these regions it is necessary to define current by means of samples. In the rest of the surface the amplitude will be smooth enough to be interpolated accurately by a finite sum of exponential functions which contain smooth amplitude and phase terms.