ON ANTENNA GEOMETRY SYNTHESIS USING POLE-RESIDUE REPRESENTATION

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The pole-residue representation for antenna synthesis was considered by Miller and Burke using Prony's method [Miller and Burke, 1991] based on the singularity expansion method (SEM) [Baum, Interaction Note 88, 1971]. They investigated dipole and loop antenna structures. They concluded the poles represent the geometrical and electrical properties of the antenna. The oscillatory component relates to the object size while the damping component is more sensitive to the antenna shape and impedance. An array of point source radiators was also considered and the source locations in complex space were related to the pole values.

Licul and Davis demonstrated pattern extraction from pole-residue antenna models [Licul and Davis, 2004] by using the Matrix-Pencil method [Hua and Sarkar, 1981] augmented with a residue amplitude reduction technique. The pattern extraction showed that the poles are the same regardless of the antenna orientation while the residues depend on the antenna orientation as predicted by SEM. The frequency-domain patterns obtained from pole-residue models showed a very good approximation to the measured results. This paper will extend these ideas in order to investigate the relationship between the geometry of wideband planar monopoles and the pole-residue parameters. The approach of defining the antenna radiation characteristics and synthesizing the antenna geometry of wideband planar monopoles is considered. In particular, residue amplitudes, damping coefficients, and oscillatory coefficients will be related to the antenna geometry features. The FDTD method will be used to simulate the antennas. The approach will be based on a systematic study of the parameters to specific geometry variations to identify the relationships of the geometry and the pole-residue model.