

# Spectral Projection Model of Electromagnetic Scattering and Radiation

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This dissertation presents two new methods for analyzing electromagnetic scattering from perfect electrically conducting surfaces. The Spectral Projection Model and Direct Spectral Projection Model are spectral techniques for analyzing the scattering patterns from two-dimensional objects. The methods evolved from prior work done on analyzing scattering from perfect electrical conducting surfaces in two-dimensions in the sinusoidal spatial frequency domain using the Spatial Frequency Technique. By employing the addition theorem for Hankel and Bessel functions, the Spectral Projection Model represents the incident and scattered electric fields in the electric field integral equation and magnetic field integral equation as projections of spectral signatures. Using the addition theorem, the incident fields and the scattered fields are decomposed into the product of two matrices whose columns and rows are the spectral signatures of current sources that are projected onto the spectral signatures of the observation points. The Direct Spectral Projection Model, which evolved from Spectral Projection Model, identifies a set of virtual sources that are the eigenfunctions of the scattering problem. The currents induced on the surface are calculated by decomposing the spectral signature of the incident fields in terms of the spectral signatures of these virtual sources.