POLE EXTRACTION IN THE FREQUENCY DOMAIN

J. M. Pond and T.B.A. Senior
Radiation Laboratory
Department of Electrical Engineering
The University of Michigan
Ann Arbor, Michigan 48109

An investigation has been carried out to examine the practicality of extracting the SEM poles for scatterers from measured frequency domain data. The ultimate objective was to determine the poles, coupling coefficients and modes for a B-52G aircraft using data for the surface currents and charges measured using a scale model. The best of three numerical techniques investigated was applied to the measured surface currents for a cylinder under plane wave illumination. Only the lowest order pole (at most) showed the positional invariance in the complex s-plane required to separate the SEM poles from those due to the curve fit and to determine the dependence of the residues. This process was then applied to the surface field at a perfectly conducting sphere for which the poles, residues and fields were calculated to six decimal places from the Mie series. It was found that given data spanning the first N ($N \leq 5$) complex conjugate pole pairs an excellent fit could be obtained and the N poles accurately located if the denominator polynomial is of order approximately equal to 4N. These poles were easily separated from the remaining poles due to their positional invariance. However, the accuracy of the extracted SEM poles, and hence the residues, progressively decreases as the data are reduced in accuracy. Although an excellent curve fit can still be obtained for data accurate to one

percent only the dominant pole pair can be located with sufficient accuracy to determine the behavior of the residues. This noise sensitivity was confirmed when attempts were made to extract the SEM poles from measured surface currents for both a metallic sphere and a scale model B-52G aircraft. In the case of the B-52G not even the lowest order pole could be located with sufficient accuracy to determine the residue behavior.

To be presented at Air Force Weapons Laboratory, Albuquerque, NM., September 22, 1981.