# ELECTROMAGNETIC IMAGING OF A CONDUCTING TARGET WITH CORNERS

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**Abstract-** In this paper, the electromagnetic imaging of a conducting target with corners is given. The goal is to reconstruct the shape of a two dimensional conducting target with corners by collecting scattered electric fields. For a target with smooth contours, the shape function can be easily expressed as a Fourier series with only a small number of terms. However, as the target contains corners, the Fourier series expansion becomes difficult. This motivates us to utilize the Cubic Spline interpolation in polar coordinates to model the contour of a target with corners. The goal becomes to obtain the polynomial coefficients of Cubic Spline interpolation. In this study, all electric fields are numerically calculated by the Moment method. The target is illuminated by plane waves from different incident directions. For each incident direction, the scattered electric fields are collected in several equiangular and equidistant locations. The true scattered electric fields at these locations can be obtained by practical measurement or theoretical calculation. Each set of polynomial coefficients in Cubic Spline interpolation represents a temporary shape of target and is updated by the Differential Fish Swarm algorithm. For each temporary shape, scattered electric fields at the same measurement locations are calculated. These calculated electric fields are then compared with the true scattered electric fields. Update of temporary shapes will continue until the relative error of scattered electric fields is below a threshold. Thus the target's image is achieved. Numerical simulation results show that the proposed electromagnetic imaging algorithm can successfully reconstruct the shape of a target with corners such as rectangular, triangular and trapezoid contours. The Differential Fish Swarm algorithm is inherently an evolutionary optimization algorithm. It does not require any gradient operation so that it can achieve global optimization of complicated or even black-box systems. This study can be applied to radar detection of complicated targets such as ships.

**Index Terms-** Electromagnetic imaging, Cubic spline interpolation, Moment method, Differential fish swarm algorithm