

## **Investigation of the Use of a Novel Meshless Technique in the Determination of Electromagnetic Fields in Two-Dimensional Regions**

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In recent years there has been a significant amount of research on the use of radial basis functions (RBF's). These functions have very good interpolation qualities, and their use has been primarily in inverse methods. For example, in electromagnetics research, the focus has been primarily on the use of RBF's in the solution of inverse scattering problems. On the other hand, RBF's have not been widely used in partial differential equation (PDE) techniques except in the context of meshless algorithms employing RBF's. While a number of the resulting algorithms have been highly accurate in determining the fields in homogeneous regions, many have also required the use of fully populated matrices that are quite ill-conditioned. In this paper, the use of a novel meshless method inspired by F.A. Fernandez and L. Kulas (Proceedings MIKON-2004, pp. 585-588, 2004) is investigated. Unlike the meshless methods employing RBF's, this method results in a sparsely populated matrix. In general, this matrix has a much lower condition number than does the corresponding matrix resulting from the use of a meshless method employing RBF's. Another advantage of this technique is that when it is used, the field components themselves are the unknowns in the matrix equation under consideration. Thus, the field components are determined directly in the process of solving the matrix equation. On the other hand, in the meshless methods employing RBF's, the unknowns are the coefficients of the RBF's. After these are determined, the additional step of computing the field components from the RBF's and their coefficients is required. In this paper, the formulation of this new method will be discussed in detail and numerical results for several cases will be presented. Comparisons with results obtained using RBF's will be presented and discussed. The condition numbers of the matrices resulting from the two different approaches will also be presented and discussed.