Abstracts

Finite-Element Solutions within Curved Boundaries

D.J. Richards and A. Wexler. "Finite-Element Solutions within Curved Boundaries." 1972 Transactions on Microwave Theory and Techniques 20.10 (Oct. 1972 [T-MTT]): 650-657.

The paper shows that a curved boundary need not be approximated by a small number of finite-element sides, resulting in a coarse polygonal approximation to the shape of the region and consequent inaccuracies, but may be defined as accurately as desired. An algorithm and associated mathematics are presented for locating the stationary point of a functional by the Rayleigh-Ritz method with a two-variable power series as a trial function. As a particular example, the functional employed is one that is made stationary by the solution of Poisson's equation under mixed, Dirichlet, or Neumann boundary conditions. The technique is based on the fact that the three boundary conditions are natural ones. Results are presented for a problem involving curved boundaries under mixed and Neumann conditions and for the capacitance calculations of a pair of noncoaxial cylinders having specified potentials. Comparisons are made with the finite-difference method. It is concluded that the finite-element method is, in nearly all aspects, superior to finite differences--particularly when curved boundary modeling errors are reduced. It is expected that the method described will be equally useful for, and quite simple to adapt to, the solution of the Helmholtz equation in an enclosed region.

❑ Return to main document.