Abstracts

Direct Noniterative Numerical Solution of Field Theory Problems Having Irregular Boundaries Using Network Analogs

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Laplace, Poisson, and more general differential equations may be solved by formulating a network analog, followed by an analytical solution using large-scale network theory. For simplicity the paper treats the Laplace equation in detail, since the network analog for this case contains only resistances. Whereas previous analytical techniques for solving the resistive mesh analog have been restricted to special cases having simple boundaries, it is shown that application of the 2n-port transfer matrix overcomes these restrictions, and results of high accuracy may be obtained without resorting to iterative techniques, i.e., relaxation. A new approach to the formation of the resistive net automatically satisfies the boundary conditions, and simplifies application to boundaries of complicated shape. In the case of simple boundaries, similar results have been obtained in other branches of physics and engineering by methods other than the network analog. These do not appear to apply to problems having arbitrary boundaries, and it is possible that the new technique, which has no restrictions on boundary shape, may be of interest to workers in other fields.

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