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PREFACE

Over the last two decades, several thousand archival journal papers on applications of BEM (boundary element method) have been published, which primarily dealt with problems governed by linear differential equations. It is now an established fact that BEM is a very efficient and accurate method for linear problems. However, in order to qualify as a completely general problem-solving tool, it is essential that BEM must be demonstrably applicable to nonlinear systems. Nonlinearities do occur in almost every realistic idealization of practical problems.

Like any other general numerical method, BEM based methods are fully capable of solving nonlinear differential equations by an incremental or iterative procedure—in this case via a volume integral defined over the region within which nonlinearities occur. The basic integral relations necessary are therefore essentially identical to those for an incremental analysis of a region with a linear differential equation with a nonconservative (state dependent) body force system.

It is, perhaps, important to note that body forces can occur in a medium which may be either conservative, or nonconservative. Conservative body forces, such as those occurring due to self-weight, centrifugal loading, steady state seepage forces and thermal fields etc. can be reduced completely to a boundary integral formulation either via the use of the divergence theorem and utilizing the condition that the body forces are gradients of some potential or alternatively by developing particular solutions for the inhomogeneous differential equation. Both of these methods have been extensively explored in published BEM papers.

For a nonconservative body force system that can either be real or a pseudo body force system resulting from splitting the governing differential equations of the problem into a linear operator, for which a fundamental solution can be constructed, and a part that has to be treated as a body force, one must either retain the volume integral or develop a state dependent particular integral formulation for defining the nonlinear region of the body.

For the vast majority of such problems the nonlinear regions are mainly confined to small subregions of the system and for such cases it has been found that the BEM provides a relatively attractive tool for dealing with nonlinearities. The editors have therefore invited some of the outstanding BEM researchers working in the area of nonlinear BEM analysis to contribute to this volume. These contributions will hopefully show that many of the potentials of BEM for nonlinear analysis are now being realized. It is therefore worthwhile to pursue the use of BEM in nonlinear applications with vigor.

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