Boundary Elements XXVI

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Preface

Since 1978, when the first of these conferences took place, it has been very rewarding for me to monitor the development of the mesh reduction ideas that motivated early boundary element research. This work has recently resulted in a whole range of Mesh Reduction Methods (MRM), which are well represented in this book.

The Boundary Element Method in its original form can be interpreted as the first MRM, which was successfully applied in engineering practice. A major milestone was the introduction of the Dual Reciprocity Method (DRM) and Radial Basis functions in 1982, which set up a consistent and elegant procedure for the processing of internal effects. The DRM combines in a clever and original manner a series of localised particular solutions and radial basis functions to define arbitrary distribution of internal loads.

In 1990, a new method, called Multiple Reciprocity (MRM) was developed and this laid the foundations for a more analytical approach to the transformation of domain integrals to the boundary. MRM is essentially an application of Green's identity and has more recently led to the generation of a variety of different approaches in addition to the original MRM.

The MRM and associated Green's identity formulations represent an attempt to solve the problem analytically while the DRM is the basis of many subsequent numerical approaches. Both are equally valid and important developments which enhance the simple evaluation of internal effects using cells or Montecarlo integration.

Many new developments have taken place since those original contributions, adding to the richness of boundary elements. Complex physical problems have been solved with great accuracy, as in the case of many non-linear and time-dependent problems, and a wide range of practical problems can now be solved. Our understanding of the original transformation methods have increased and we can now understand better the relationship between the different techniques, which until recently were considered as independent of each other. Studies of Galerkin, Hormander and Green's identity methods have led to the conclusion that most analytical approaches lead to the same results. The exceptions are methods involving approximations such as the evaluation of domain integrals using numerical integration or the Dual Reciprocity Method, for which many different basis functions have been proposed.

These important studies set the basis for the many new Mesh Reduction Methods

which have recently appeared in the literature. A large body of original research is now available from which sooner or later a practical method will emerge, extending even further the scope of boundary elements.

Research on Boundary Elements and Mesh Reduction Methods in general continues to show a remarkable vitality which is reflected in the contributions published in this book, including those dealing with advanced formulations and new applications of BEM. These papers continue to enhance the BEM and increase its importance as a practical tool for engineering design.

I am grateful to all authors for the quality of their contributions and in particular to those colleagues who helped me to put this book together.

Carlos A. Brebbia
Bologna, 2004

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