

Boundary Element Technology XV

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BOUNDARY ELEMENT TECHNOLOGY

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Preface

The Boundary Element Method has reached a high degree of maturity since my first book was published in 1978 (Brebbia, CA “The Boundary Element Method for Engineers”, Pentech Press, London, and Wiley, USA). It was at that time that I organised the first International Conference on the Method in Southampton (Brebbia (Ed), “Recent Advances in Boundary Element Methods” Pentech Press, London, 1978).

The first conferences (Southampton 1978 and 1980, California in 1981 and Southampton in 1982) were particularly fruitful in bringing together some of the best researchers at that time in Boundary Elements such as Shaw, Symm, Jaswon, Wexler, Alarcon, Cruse, Herrera, de Mey, Wendland, Hsiao, Antes, Vable, Ingham and some of my then closest associates like Wrobel, Nardini, Telles, Mansur and Venturini, among others. The Japanese researchers were an important part of this original group, with names like Tanaka, Onishi, Kobayashi and Kamiya becoming closely associated with the work of our Group in Southampton.

The 1978 conference was held barely one year after the first paper bearing the name of the new Method was published in a scientific journal. (Brebbia, CA and Dominguez J, “The Boundary Element Method for Potential Problems”, Applied Mathematical Modelling Journal, Vol 2, No 7, 1977). The rapid development of the new technique was a reflection of its timeliness. There was a need to respond to what was then perceived as the exaggerated claims of early finite element researchers. A more accurate and user-friendly technique was required. The Boundary Element Method with its more robust mathematical background provided the type of accuracy that was difficult to obtain in many cases using finite elements. The generality of the boundary integral formulation introduced in 1978 was such that it took us some time to realise its full potential. The mixed formulation proposed gave origin to new time dependent solutions, mesh reduction techniques, moving boundary formulations, crack propagation and the study of many other problems resulting in the development of highly efficient and professional engineering tools. The basis was also set for many of the meshless techniques that are now being investigated so diligently in many different centres all over the world.

Numerous special purpose BEM programmes now exist for a variety of important engineering problems difficult to solve using conventional finite elements. Areas of particular interest are acoustics, cathodic protection, electromagnetics, crack propagation, soil mechanics, damage mechanics, moving boundary and a variety of

viscous flow applications. The success of Boundary Element methods in their first 25 years is reflected not only in the number of specialised computer codes based on the method, but also in the now routine implementation of boundary element techniques in major finite element systems.

This book presents some of the most interesting and recent developments in the method, including its use to solving a variety of industrial problems. As the method continues to evolve it is a source of great personal satisfaction to see how the range of applications continues to expand. This is highly rewarding for the pioneer developers who started working in the technique in the late 1970s.

Carlos Brebbia
Detroit, May 2003

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