The Boundary Integral Equation Method (BIEM) is shown in this book to be a powerful analytical tool whose usefulness rivals the finite element method. Concentrating on flow through porous media in order to illustrate the BIEM's versatility in solving a variety of complex problems, the authors take the reader from an elementary introduction through to a demonstration of the method's application to problems with singularities, non-linear free surface problems, well problems, recharge problems, and problems that are inhomogeneous and anisotropic. They show that the BIEM not only shares the advantages of the finite element method but is also easier to use and considerably less expensive in terms of computer time and storage requirements, thereby facilitating the routine solution of large problems. Furthermore, it can be coupled to the finite element method in order to exploit the strengths of both. Finally, the BIEM is developed for solutions in a comprehensive groundwater basin of considerable complexity. Program illustration in the last chapter enables the reader to make a start on his own programs.
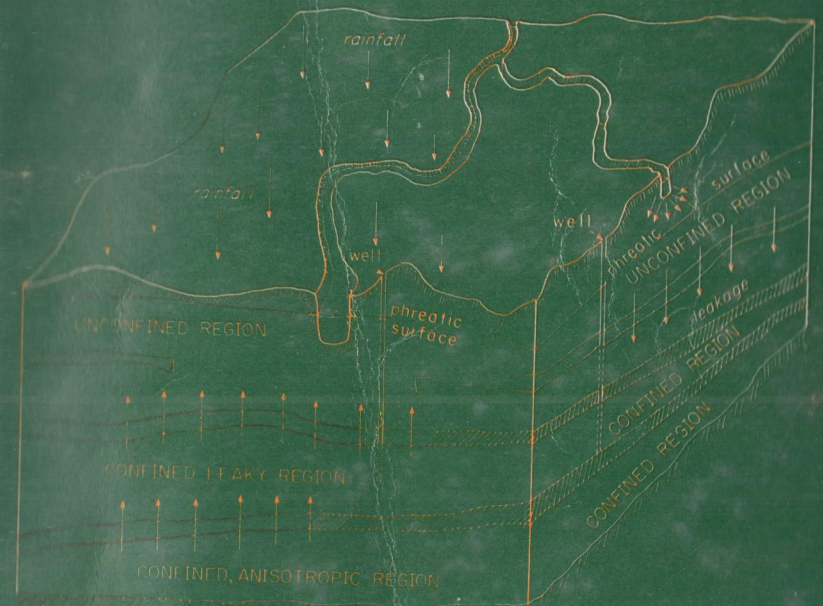
The treatment in the book allows it to serve as a general introduction to the BIEM. It relates the mathematics to physical problems that can be grasped intuitively. On the other hand, calculation in porous media is explored in detail, providing a guide for readers with limited experience in numerical analysis.

Based on four years of research, and tested in the form of a short course given at Cornell University, this book will be useful to hydrologists, numerical analysts and many other engineers faced with the problems posed by porous media.

J. A. Liggett is a member of the faculty of the Department of Civil and Environmental Engineering at Cornell University. His major areas of research have been unsteady flow in open channels, circulation in lakes, and application of the BIEM to problems of flow in porous media and hydrodynamics.

P. L-F. Liu is also at Cornell University as a faculty member. His research interests include water wave theory, groundwater flow problems and numerical techniques.

The Boundary Integral Equation Method for Porous Media Flow

James A. Liggett
Philip L-F. Liu