The book "Finite Element and Boundary Element Methods in Structural Acoustics and Vibration" is a hardback book by Nouredinne Atalla and Franck Sgard. The book has 432 pages plus a list of symbols used (9 pages) and an index (6 pages). It is published by the CRC Press, a member of the Taylor & Francis Group, with ISBN 978-1-4665-9287-2.

The authors have compiled a book that gives an overview of some of the numerical solution methods available today to the practicing engineers in structural acoustics and vibration. Drawing from the authors' extensive experience and knowledge in the field, the text material is derived from graduate-level classes taught at l'Université de Sherbrooke in Quebec. The aim is to present basic concepts related to the two methods treated and through this give a platform for using these in e.g. commercial software available on the market. The book contains a number of solved examples, illustrating the various concepts. It also contains several code excerpts, both using Matlab as well as Fortran. It recapitulates a number of different shape function families used in the discretisation of complex problems, tabulates different numerical integration schemes and discusses particular aspects of the boundary element method, e.g treatment of singularities and problems associated with uniqueness in the solution.

The first chapter gives an overview of computational vibroacoustics (used as a synonym to structural acoustic), with a particular emphasis on the interaction between vibrating structures and the sound waves in surrounding fluids. It distinguishes between Interior, Exterior and Hybrid problems, as a classification for choosing proper solution methods, but adds to this the particular aspects related to low frequency, medium frequency and high frequency behaviour of the structure and the fluid. Chapter two continues with an introduction of the fundamental equations governing the linear propagation of sound in fluids, structures and poro-elastic media. In addition, the coupling conditions necessary to describe the interaction between these are reviewed. The third chapter presents the integral formulations that form the basis for the numerical methods, linking these to variational principles commonly used in engineering analysis. In this chapter, strong and weak integral formulations are reviewed together with well-known variational models, such as the Principle of Virtual Work, Hamilton's Principle, Lagrange Equations, etc. The fourth chapter introduces the concepts underlying the finite element method (FEM) for a one-dimensional problem, including all the steps related to the derivation of the integral form, the meshing, the choice of approximations used in the elements and the calculation of the element matrices, the assembly of the element matrices into the global system matrix, different methods for introducing the constraints (coupling and boundary conditions), the solution of the problem and the convergence of the solution. The fifth chapter takes the reader through the same steps, but now for three-dimensional problems. Here also the aspects related to the approximation of the geometrical details are reviewed and the calculation of the so-called acoustic and vibratory indicators is presented. In chapter six, the interior coupled fluid-structure interaction problem is reviewed, including various alternative approaches developed over the last decades for the solution of such problems. Chapter seven establishes the basis for the boundary element method (BEM). Several alternative methods for formulating and solving such problems are discussed, e.g. Direct Integral and Indirect Integral formulations, their implementations and numerical solutions. Also the uniqueness problems related to BEM solutions are discussed together with aspects of the convergence of the numerical solution. In the final chapter, chapter 8, the problem of a vibrating structure in an unbounded fluid domain is reviewed with an emphasis on combined FEM-BEM approaches for its solution.

As mentioned above, the book aims to introduce the basic concepts of both the FEM and BEM solution approaches, and the first chapters include some basics of acoustics and vibration. This wide scope poses a challenge in terms of depth vs coverage and some details are by necessity not covered in depth. The book has a distinct value as a point of entry to the covered computational methods and the various aspects involved in their application. However, to be really useful, the reader should have, or be prepared to acquire, a quite thorough understanding and background knowledge in engineering mechanics, mathematics, linear algebra, acoustics and elastodynamics.

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