A complete "dynamic environment" surrounds this book. The volume evolves from notes used in the annual Advanced Course in "Noise and Vibration" held each year for the past 20 years and presented by the Institute of Sound and Vibration of the University of Southampton. The initial book in the early stages of this course was published in "Noise and Acoustic Fatigue in Aeronautics" (1968). During the last 15 years, the course has been expanded to include noise and vibration control, vehicle noise control, signal processing, and health monitoring.

The book consists of 31 chapters and a section on symbols. Chapters 1 and 2 cover the theory of acoustics by introducing the acoustic terminology and methodology. This includes wave motion, ray acoustics, reflection of sound from passive bodies and vibrating surfaces as a source of sound.

Chapter 3 discusses fundamentals of vibration including single degree-of-freedom, response to transient forces, forced vibration, and joint acceptance function. The latter is usually employed in acoustic fatigue analysis. Chapter 4 continues with random processes. Beginning with probability, it continues with stationarity and ensemble averages, time averages, spectral density (power and cross), correlation (auto and cross), and interpretation of data. This is a good introductory chapter.

Continuing, we next encounter the more applied aspects of random vibration, i.e. response of a single degree-of-freedom and continuous systems to random excitation. This also includes partial coherence and multiple input-output systems. Again, a good chapter!

The next chapter delves into Fourier methods, aliasing, discrete Fourier Transform (DFT), Fast Fourier Transform (FFT), and methods of determining the important random parameters. It concludes with a short section on digital filtering. The reviewer feels the section on digital filtering is too short and should be expanded. Chapter 7 treats statistical energy analysis (SEA) which draws some of its elementary aspects from room acoustics. The important factors include coupling loss factor, power flow energy difference relationship, system modeling, and modal density. This is a good introductory chapter which should be read by all.

Chapter 8 dwells upon nonlinear acoustics and its application, and a discussion of plane waves (free and shocks), their criteria and limitations is included. Chapter 9 considers structural wave motion, natural modes of vibration of a rectangular plate, forced and random vibration of uniform flat plates. This leads directly into the structure of turbulence and touches upon statistical relationships. This encompasses correlation and spectra, statistical measurements of turbulent jet structure and alternative methods of jet structure.

Chapter 11 continues with structure-fluid interaction and the relationships between sound radiation and response to acoustic excitation. Forging ahead, we encounter sound radiation and bending wave propagation on fluid-loaded plates. Chapter 12 discusses fundamental duct acoustics and the next chapter considers response of periodic structures to noise fields.

Chapter 14 exposes the various constituants of jet noise. This includes jet mixing noise, Lighthill theory, and associated shock noise. The next chapter treats finite element techniques for structural vibration including the various types of elements. Using this as a basis, Chapter 16 focuses upon finite element techniques for acoustics. The chapter concludes with a brief account of boundary element method.

With fundamentals considered, we can skip into the field of applications. Chapter 17 discusses the current state of the art and future prospects in noise from industrial plants and the next chapter treats road vehicle noise, its sources and legislation. The chapter continues with a detailed explanation of engine noise, design and operating parameters. The concluding portion explains the origin and mechanics of tire noise. Again, an excellent chapter!

Chapter 19 focuses on fan noise. This includes source mechanisms, fluctuating blade loads, boundary layer/vortex noise, broadband noise prediction and noise control. Chapter 20 contains the fundamental aspects of linear elastic fracture mechanics. The next chapter probes into the many aspects of sound absorbent duct design. This includes sound propagation, influence of major design parameters on attenuation, practical design conditions, and pressure losses.

Chapter 22, the most extensive in the book, contains 110 pages and reports upon noise from industrial machines. This includes the various aspects of mechanical and acceleration noise, its prediction, control of ringing noise, radiation of plates, beams and rods in flexure, prediction of $L_{eq}$ in any frequency range. Progressing from theory to application, we next meet prediction of noise radiation from measurement of sound velocity, case studies of pulse factoring, and noise from conveyor systems. A very "meaty" chapter!

Continuing in the same vein, the next chapter informs us about signal processing techniques applied to machinery health monitoring. This is a straightforward chapter and includes inspection of bearings, detection of simple bearing faults, inspection of rotors, and concludes with a description of signal processing equipment.

Chapter 24 presents measurements and diagnosis of machinery noise plus a number of ways of identifying noise sources in practice. The next chapter probes deeply into vibration control and means of utilization. This includes factors affecting vibration levels, proper structural design, good material selection, tuned dynamic absorber, and properly applied artificial damping. Continuing, we encounter the various aspects of mobility measurements power transmission, and structural vibration.

Chapter 27 delves into the broad topic of vibration testing. This comprises structural testing, mode shape measuring plus its various techniques, structural modeling and vibration transmission path identification. The reviewer believes that modal testing should be greatly expanded to include the newer aspect of single and multi-input excitations.

The next chapter broaches upon subject hearing. This includes perceived noisiness, annoyance, phon, perceived...
levels, equivalent continuous sound level, and formulation of annoyance criteria. Chapter 29 treats the various aspects of occupational hearing loss and hearing conservation. This leads directly into the effect of noise on people. The concluding chapter reports upon human response to vibration.

In summary, this is an excellent book. Due to the broad contents of the various subjects, the authors can only provide highlights but the references are numerous. In reality, this is a handbook. The reviewer believes that discussion on acoustic intensity and finite elements should be expanded. The table of contents should be expanded to include subsections. Due to the cost, the reviewer recommends that the book should be published in a paperback edition. Furthermore, due to its size, the book should be divided into two parts, i.e., fundamental theory and applications. The 23 authors should be commended for their prodigious efforts. Except for the minor criticisms, this book will assume the exalted role of a much sought-after reference book.


**Reviewed by H. Saunders**

Structures that are able to resist the imposed loads and are attractively appealing would probably be considered the most suitable. Several designs may be in existence and it would be apropos to select the most economical one. In aircraft design, economy may be instituted in aeronautical structures by ensuring that weight is a minimum. This is directly proportional to cost. In designing a structure incorporating optimization concepts, this usually leads to improved techniques. This text discusses design techniques applied in obtaining optimisation structural design.

The book consists of eight parts and 17 chapters. Part I (Chapter 1) elucidates the necessity of applying optimization techniques in deterministic and probabilistic design.

Part II consists of six chapters applied to structural design. Chapter 2 consists of design applications of buckling of columns. Among the topics treated are derivation of equilibrium and energy approach. The former is then applied to buckling of open sections and torsion flexure buckling. Finite elements and finite differences explanations conclude the chapter. Chapter 3 continues with buckling of plates. Beginning with small deflection theory applied to plates, this progresses into the derivation of buckling by equilibrium and energy approach applied to stiffened plates. Finite difference and finite element applications finish the chapter.

Chapter 4 introduces the reader to vibration of beams. Continuous systems and energy approach are discussed. We continue on to (combined) bending and torsional vibration of beams.

Chapter 5 focuses on vibration of plates. The same pattern considered in Chapter 3 is followed in this chapter. Chapter 6 treats random vibration. Introducing random processes, it continues with correlation functions, spectral decomposition of random processes plus an introductory section on response to random excitation. This applies to multi- and single degree-of-freedom systems. The concluding section consists of a short discourse on expected frequency of crossings of a narrow band process. The reviewer believes this chapter is too short. A computer program should have been included continuing with further discussions applied to cross correlations and spectra.

Part III treats optimization techniques. Chapter 7 deals with the various aspects of linear programming. This includes solution procedures and sensitivity analysis. Chapter 8 continues with nonlinear programming. This proceeds into the role of convexity, Kuhn-Tucker conditions, linearization techniques and multi-variable search. The chapter concludes with constrained optimization (penalty function approach). Continuing, we encounter geometric programming, i.e., unconstrained and constrained geometric programs. Chapter 10 considers dynamic programming which includes multi-stage decisions.

Part IV concludes the book and consists of seven chapters. Each chapter follows the same topics, i.e., formulation of the equations, objective functions, behavior and side constraints, methods of solution, and finally results and discussions. Chapter 11 recalls optimal design of thin-walled columns under axial loading. Chapter 12 continues with minimum weight design of multicell box beams in bending. Chapter 13 treats numerous weight design of multicell wings for strength and frequency requirements. Chapter 14 broaches the subject of minimum cost design of grid floors. Throughout these chapters, computer programs are not furnished but flow charts are prominently included.

Chapter 15 handles nonlinear vibrations of beams. The authors stress the material stress-strain load, continuing with minimization techniques including results and discussions. Chapter 16 dwells on optimizations of wing structures. This includes formulation, analysis and methods of solution. The concluding chapter deals with optimization under random vibrations environment. The technique of Fiacco-McCormick, together with Fletcher-Powell algorithm solves the nonlinear problem for unconstrained optimization. The initial example solves the problem of a cantilever beam with tip mass due to stress and accelerations constraint. The second solved problem considers elevated water tank staging due to earthquake loads. Expressing the optimization statement, this leads to sequence of unconstrained optima. The same structure is applied to wind loads. The resulting random response variances are calculated. The latter part of the chapter considers sheet-stringer panels under random loading. The well-known fatigue damage constraint of narrow band loading is derived. This in turn is applied to optimum design of the sheet-stringer panel.

Optimization is the scheme of the book and the authors do present it in an interesting fashion. However, the reviewer feels that it is too abbreviated. Discussion on the applications to layered and honeycomb structures would be an asset. In addition, single degree-of-freedom equation derivation is omitted and sheet vibration is not mentioned. The reviewer feels strongly that computer programs should have been included. Interested parties in optimization techniques applied to structures would benefit greatly.

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