This symposium consists of a distinguished lecture series plus nine other sections.

The distinguished lecture series consists only of abstracts on flow-induced vibration and flow noise. The reviewer feels that due to its importance in noise generation and control, the complete talks plus illustrations should have been included and published.

The second section deals with valves and orifices. This centers on a review of control valve and regulator noise generation, propagation, and prediction. It also treats coefficients and factors relating to aerodynamic sound level generated by throttling valves plus acoustical studies of low-noise control valve and lower type orifices. This is a chapter well worth reading.

The third section discusses the noise induced by printers and machines with similar mechanisms. This includes noise sources and noise reduction in printers, office machines, and noise produced by linkage mechanisms. It concludes with a novel damper design for reducing percussive tool noise and the mechanism of piston slap noise.

The next section, containing the largest number of papers, treats several different aspects of structural design and approaches to quieting the unwanted noise. This is a most informative section and focuses on developing acoustic criteria for noise control engineering design, structural modification of noise/vibration control, the role of dynamic stiffness in vibration isolation and the impact of advanced composite material or panel-radiated noise. The concluding papers examine the engine noise mechanism caused by engine blocks, development of a quiet jumbo drill, and source noise control technology for the work place.

The fifth section, which is one of the most interesting, covers the noise generated by fans and turbomachines. The initial papers review rotor-stator interaction noise and sound propagation through radial passages in turbomachines plus the axial fan acoustics with a view toward noise control. The concluding papers deal with discrete frequency noise and its reduction in small axial-flow fans, noise reduction in centrifugal blowers using a flow resistive scroll, and quieting the engine cooling system.

The next section continues with air conditioners and their fans. The initial papers review ARI sound rating and certification of residential outdoor air conditioning units plus the publication of the ARI certified sound rating program. The following papers delve into noise control for roof-mounted air conditioning condensing units, centrifugal fan noise control, and tonal fan casing noise case histories. The concluding papers speak about sound power radiated by round spiral ductwork, acoustical performance of a reentrant axial fan intake silencer, and sound power levels of a 36-in. diameter plug fan.

The seventh section deals with motors and transformers and their source diagnostics. This consists of noise sources in electrical motors, sound-proofing of high power transformers, determining source signatures from vibration measurements and transfer functions, and deconvolution of signals propagated through machine structures. The concluding papers talk about acoustic intensity spatial sampling techniques and a general theoretical formulation for acoustic intensity method using two microphones. This is an excellent section which includes the more recent aspects of acoustic intensity method.

The eighth section reports on the noise mechanism of cross groove tire treads and a new tool for controlling traffic noise via poroelastic road surface. The next set of papers report on combustion noise sources, prediction and control of noise from large turbulent diffusion flames, and noise control in combustion systems. The concluding paper presents the reduction of combustion-driven acoustic oscillations in a high-pressure steam generation boiler using the Helmholtz resonator decoupling concept. The reviewer considers the papers on combustion noise to be very informative.

The ninth section details a great deal of information on industrial forming machines. They have always been sources of unwanted noise. The papers in this section consider the source and control of noise from impacting type machinery, reduction of impact noise in mechanical presses, plus identification of components of power press noise. Included is an interesting paper on the overview of the noise emission event analysis in power presses. This tends toward "practicability" and states the mathematical relationship of single event noise exposure level (SENEL), OSHA exposure level in the A-weighted scale, daily noise exposure level, and potential noise due to noise radiation over the period of a workshift. The tests and analysis were conducted by a select taskforce in tackling the job. A section well worth reading!

The last section is a product application workshop where the various instrument and manufacturers of vibration and noise control material explained the virtues of their products.

In summary, this is an excellent symposium. The reviewer found some of the papers were too concise. A standard table of nomenclature (TON) for the entire symposium or individual TONs would be of great advantage to the reader. The reviewer does recommend this volume to all those interested in the various aspects of noise and vibration control.

Acoustics: An Introduction to Its Physical Principles and Applications. by A. D. Pierce, McGraw-Hill, New York, 1981, 642 pages. Price: $28.95

Reviewed by H. Saunders

The acoustic environment surrounds us. Some aspects of acoustics constantly envelope us. It plays an important role on the ground, in the air and below the sea. Only in recent years has it become noticeable. Acoustics reposes in a number of different disciplines. The most notable are noise control, architectural acoustics, audio engineering, nondestructive testing, remote sensing, and medical ultrasonics. As stated by the author, "This book is suitable as a text or as supplementary reading for senior and first-year graduate students in engineering, physics, and mathematics." The author's main objective is to develop the physical principles of acoustics. The text is intended to be at a level of mathematical sophistication and intellectual challenge comparable to other graduate texts in basic engineering sciences (fluid dynamics, thermodynamics, and electromagnetic theory).

The book consists of eleven chapters.

Chapter 1 introduces a history of acoustics and then progresses to Euler's equations of motion of a fluid, pressure density relationships, and acoustic wave equations. The chapter concludes with an interesting discourse on acoustic energy, intensity and source power, and plane traveling waves. This is an excellent introductory chapter.

Chapter 2 treats quantitative measures of sound. The author reveals this subject by introducing frequency bands, acoustic power, and energy density levels. This also includes decibel definition of sound pressure level and spectral density (white and pink noise). The chapter ends with Fourier series, Dirac delta function, transfer function, and Weiner-Khintchine theory. A good chapter, but not meant for casual reading.

Chapter 3 delves into reflection, transmission, and excitation of plane waves. The author develops the necessary equations for plane wave reflection, acoustic impedance, and plane traveling waves. The text progresses to theory of impedance tube, sound radiation by traveling flexural waves, and transmission through slabs, plates, and porous blankets. The reviewer would have preferred seeing more experimental data. This is another good chapter.

Chapter 4 considers radiation from vibrating bodies, namely radially and transversely oscillating spheres. The concept of point source (acoustic monopole) is next on the agenda. By introducing Green's function, dipoles and quadrapoles can then be discussed. The author continues by deriving the Kirchhoff-Helmholtz integral theorem. This tends to clear up a number of points in sound radiation theory. The chapter concludes with sound radiation from small vibrating bodies, the reciprocity aspects in acoustics, and the relationship of transducers to the latter. Another good chapter!

Chapter 5 continues with radiation from sources near and on solid surfaces. This includes sources near rigid bodies, low frequency radiation from sources mounted in walls for field and transient radiation impedance of baffled piston radiators. The author presents a good section on the Fresnel-Kirchhoff theory of diffraction by an aperture. A chapter containing a great deal of "meat."

Chapter 6 treats room acoustics. Many books, some good and some of average quality expound upon this subject. The author relaxes us and explains the well-known Sabine equation for reverberation time, diffuse sound fields, Norris-Eyring reverberation time equation, and measurements of absorption coefficients and reverberation times. Additional important topics consider the transmission of reverberant sound through a panel, absorbing power of objects and persons, measurement of sound power, plus the important modal theory of room acoustics. The chapter concludes with high frequency approximations, namely Schroeder cutoff frequency, modal sums by integrals plus statistical aspects of room acoustics. This is described in terms of finite frequency bandwidth, frequency correlation, spatial averaging, and frequency averaging. This reviewer feels that although an excellent chapter, it is too abbreviated.

Chapter 7 considers the low frequency models of sound transmission. The author introduces the subject with a short discourse on guided waves and then continues with a cross section of rectangular and circular ducts. He exposes the important lumped-parameter models (or elements) which are similar to mechanical and electrical analogies. In addition, guidelines are furnished in the proper selection of lumped parameter models. Continuing, we encounter Helmholtz resonators and their various applications and forms plus the estimation of acoustic inertances and end corrections. The chapter concludes with mufflers and acoustic filters which are explained by transmission matrices. This then leads to horns and Webster horn equation. The reviewer feels that the section on transmission matrices is too concise and should be expanded.

Chapter 8 considers ray acoustics or geometrical acoustics. Ray paths in a moving medium leads to the well-known Fermat's principle. Among the other topics are rectilinear sound propagation, caustics, i.e. given ray proceeding out from an original wavefront, refractions in a homogeneous medium and amplitude variation along rays. The chapter concludes with wave amplitude in moving media which is described in terms of the linear equation for acoustic media. This leads to the well-known Blokhentzev invariant, the source above an interface and reflection from curved surfaces.

Basic scattering and diffraction occupy the theme of Chapter 9. The scattering scheme encompasses incoherent scattering, volume scattering delineated by electroacoustic transducers, mono- and bistatic scattering measuring configurations, and resonant and higher frequency scattering. The well-known Doppler effect (frequency shift with motion) of a moving source and acoustic fields near caustics concludes the chapter.

Phenomena that can't be explained within the strict confines of the ideal fluid dynamic equations include attenuation of sound, radiation caused by flow past obstacles, acoustic streaming, and finite amplitudes of resonating systems. Chapter 10 includes the foregoing plus the effects of viscosity and dissipative processes. The Navier-Stokes model equation leads to consideration of viscosity and thermal gradients. Continuing, one encounters dispersion relations for component modes and the acoustic boundary layer theory, which includes boundary conditions on the acoustic mode field. This leads to attenuation and dispersion in ducts and tubes.

The concluding chapter reports on nonlinear effects in sound radiation. Beginning with the ideal fluid equations, this progresses into plane waves in homogeneous media and the generation of harmonics via a Fourier series representation. Rankine-Hugoniot equations for weak shocks are next proposed and we enter the realm of N waves and anomalous energy dissipation, nonlinear dissipative waves and the well-known Burger's equations. The gradual rounding of shocks in a sawtooth wave form results in a sinusoidal waveform. Employing a version of Burger's equation, this reduces to the linear diffusion equation. The concluding sections of this chapter broach the subjects of nonlinear effects in converging and diverging waves, N waves in homogeneous media (spherical waves), ballistic shocks (sonic booms), and nonlinear modification of the equations due to a pressure wave generated by a projectile moving at supersonic speed.

In summary, this is both a unique and excellent book. It covers a great deal of ground and contains good explanations and derivations. As stated by the author, "the pedagogical objectives of the book and the constraint that the book be of manageable length precluded the inclusion of some of the more important topics in modern acoustics (jet noise, acoustic emissions, cavitation, streaming, radiation pressure, combustion noise, propagation through turbulence, sound-structure interaction, surface waves and accelerated imagining)." The reviewer agrees with the author's lament but feels that a second volume containing the deletions plus a rearrangement would be a most welcome addition. A number of the deleted subjects are of current interest. The inclusion of more experimental information plus data processing of acoustics would be a definite plus. Having mastered this text, the reader will possess most of the necessary tools required in understanding modern problems in acoustics.