a large dynamic bandwidth. Forging ahead, we encounter periodic frequency spectrum and a simple but meaningful description of frequency resolution. The chapter concludes with an interesting discussion of the meaning of spectra, errors and methods of determining analysis time plus the manner in locating a sinusoidal in a random signal. An interesting chapter that should be read carefully.

Chapter 4 covers the preliminary aspects of digital frequency analyzers. Starting with the time sampling process, this marches forth into double Fourier transforms and convolutions, aliasing of data and use of window functions (rectangular and Hanning) as a filter. The Fourier series is the foundation. Employing this, we next encounter spectrum averaging, periodic time histories, transient time histories (rectangular window must be used). The latter section describes a number of suggestions as to RPM rotating machine, proper display of calibration setting and means of deleting background noise. The concluding chapter mentions very briefly the modal analysis employing a uniform beam and free-free beam (showing mode shapes). The author reports on examples showing how one could solve field problems of equipment by proper interpretation of the frequency spectrum. This includes vibration measured on a boiler feedpump, motor in a coal pulverizer, excessive vibration in a 120 ft. chimney, balancing of rotating equipment and oil whip in journal bearing. The little tome concludes with a short discussion of the Mathieu equation and its application to slight nonlinear problems in mechanical systems.

In summary, this is an excellent little volume. It is fascinating and yet simple to comprehend. However, the reviewer believes that the following topics should have been included (*a*) Fast Fourier Transform and its application to data processing, (*b*) an introduction to filter theory, (*c*) coherence and partial coherence, and (*d*) cross spectrum and cross correlation. The reviewer does recommend this book to the neophyte as well as one versed in some aspects of data processing.

Fundamentals of Noise Control Engineering,
A. Thumann and R. K. Miller,
Fairmount Press, P. O. Box 14227, Atlanta, GA 30324,
1986, 287 pages, $36.00.

"Unwanted" noise abounds within our midst. It is ever prevalent; this book attempts to develop the skill of the reader. Here, one begins and puts in place a meaningful program to control noise. If the noise engineer is a novice, the book's intention is to elevate his basic knowledge to a high enough degree. This grants one an understanding of noise control in the workplace. It allows one to begin more advanced study in books on noise control. This permits him to understand the available periodicals dealing with noise control. As stated by the authors, "Much of the noise control referenced in the text was legislated in the 1970's. Today, OSHA no longer enforces engineering controls to meet the law . . . . We are aware of the detrimental impact of excessive noise on their health. Communities are also demanding an acceptable acoustic environment." With the authors intent in mind, the book fulfills most of the major goals but slips in other ways.

The book contains 10 chapters.

Chapter 1 stresses the importance of noise control. Undesired noise can cause hearing loss, workmen's compensation and "environmental noise." The Williams-Steiger Occupational Safety and Health Act of 1970 refers to protection of workers from potentially hazardous occupational noise. The stipulated maximum noise level is 900 dbA for a continuous 8 hour exposure during a working day. Noise control in new plant design is extremely important and care must be taken. They are (*a*) cost consideration, (*b*) technical proficiency, and (*c*) adherence to schedule.

Chapter 2 explains propagation of sound, its intensity and power expressed in decibels. The book explains the various noise formulas in either English or metrical systems. Noise levels may be stated in either octave or 1/3 octave bands. Present day practice considers 3 weighing networks, i.e., *A*, *B*, *C*. Community noise may be stated by a formula for equivalent sound level (L_{eq}) or day-night sound levels (L_{dn}). An interesting example determines the sound pressure level of a specific property containing various pieces of noise producing equipment.

Chapter 3 focuses upon noise control criteria in occupational areas with resultant employee exposure, interior spaces (offices, conference rooms) and communities near the plant. OSHA noise standard permits higher noise levels at different times. The noise dose is based on (S noise level/specified time) and must not be greater than one. As stated in the previous chapter, loss of hearing can result in cost considerations plus money awarded to the individual with this deficiency. A hearing conservation program is in order and the acceptable noise control (*NC*) curves can act as a good guide. A number of government agencies promulgated various noise standards applied to their particular forté. In addition, all states but Alaska have enacted noise control regulations. The community reaction to noise plays an important role and has been plotted in graphs. The most prominent symbol is dbA.

Chapter 4 reports on noise source criteria. The various noise sources are (*a*) various types of fans, (*b*) cooling tower, (*c*) pumps and hydraulic systems, (*d*) motor and/or gears, (*e*) compressors, (*f*) chiller, (*g*) transformers, (*h*) gas control valve, (*i*) vent, (*j*) air (fluctuating pressures), and (*k*) machine vibrations. Each has its particular quirks and mathematical expressions. The next chapter explains outdoor sound propagation. The equivalence of total surface area receiving the noise plus directivity factors are derived. This is employed in determining the h_p (increase/decrease). In continuing, we determine the sound pressure level due to the effect of near and far atmospheric conditions, directivity due to exhaust stack, fans, transformers, and vents. This is combined in a resulting sound pressure level by summing up all sources. Chapter 6 continues with propagation of sound indoors. The sound absorption coefficient, a, is determined and use is made of absorption coefficient test standards. The room constant, R, is stated in terms of a and the respective area. It is then related to sound pressure levels indoors. The next topics consider sound transmitted through ducts, effect of turning vanes on duct noise, and sound radiated through fan casing and duct. The chapter concludes with the determination of noise levels of indoor transformers utilizing NEMA transformer rating.

Chapter 7, the lengthiest, covers acoustical barriers and enclosures. The sound transmission loss of partitions, respective transmission coefficient, and statement of ASTM sound transmission class opens the chapter. Noise reduction coefficient (NRC) is the single number rating description of absorption materials. The well known mass low of acoustics is stated with relation to stiffness controlled and resonance section plus the octave coincidence controlled section. The book jogs along in estimating the transmission loss for single and double panels and the respective air space sound absorption of double panel construction. The next topic determines the average transmission loss coefficient (t) for composite walls. The book applies this to the design of an employee enclosure and methods of calculation. This includes machine enclosures, partial enclosures, complete enclosures with application to a typical enclosure design. The chapter terminates with a short discussion on free field barrier and indoor barrier analysis.

Chapter 8 considers vibration control in a very hasty fashion. The well-known transmissibility curves for various damping factors and vibration isolation are the opening topics. To prevent vibration problems, the authors state 5 ways in locating machinery and equipment. Vibration isolation mounts are mentioned but neglect the proper design method for large fans, transformers, or machinery. The chapter concludes by outlining possible ways of reducing noise.

Chapter 9 considers mufflers and silencers. There are 6 basic types of silencers with due consideration of ducts having straight sections. This construction could be without bends and labyrinth paths. The Sabine formula for estimating a lined duct is presented for acoustically testing an air plenum. Then, we consider reactive mufflers and its equations with mention of acoustic impedance. The authors apply this to an adjacent inlet containing muffler, pipe resonators, conical connectors plus a short finite tail pipe. The concept of noise from pneumatic jets created by "eddies" and its relationship to Strouhal number is identified and guided by a simple exhaust muffler. The chapter concludes with mention of ways of silencing the following (*a*) cooling tower, (*b*) control valves, (*c*) vents, (*d*) motors, and (*e*) fans. An informative chapter!

The concluding chapter covers noise measurement techniques. Based on OSHA requirements and hearing conservation, the instruments employed are sound level meters, frequency analyzers and their respective calibration methods. The processes employed in measuring noise are stated with reference to noise dosimeter and proper ways of calculating noise dose values. This is too short a chapter for its importance.

In summary, this is a good book with a number of shortcomings. The good points of this book are the extensive calculations of resulting noise using the stated formulas. A number of graphs are difficult to read plus a number of typographical errors in both equations and calculated values are noticed. Some of the references in Chapter 7 were omitted. The reviewer would prefer seeing a table of nomenclature, more up-to-date references, computer programs for noise calculations, and a more detailed explanation of reverberation time. The section on vibration isolation should be expanded. Despite the shortcomings, the reviewer feels that the tyro, as well as experienced noise control engineer, could glean knowledge of this subject.

Signal Recovery From Noise in Electronic Instrumentation,
T. M. Wilmshurst,
International Publishers Service, Inc.,
P.O. Box 230, Accord, MA 02018,
1985, 193 pages.

This is a "whopper" of a book. Although this volume contains a limited number of pages, it covers a wide area. Electronic instrumentation was formally a wholly owned study of electronic engineers. The importance of data processing of dynamic data forced mechanical engineers to learn and understand their function. Noise, an unwanted signal, covers the gamut of offset and drift random noise. This comprises white and 1/f noise and interference. Reducing the errors due to unwanted signals requires good judgment and intelligence and necessitates the use of low-noise amplifier design, screening, decoupling, etc. Another important approach is to employ "signal recovery" techniques which tend to distinguish the required signal from the unwanted signal. Essentially, this is the heart of the book. The mechanical engineer involves himself with strain gages, laser anemometry (measurement of fluid velocity), random signals in aeronautics, dynamic analysis of structures, and heat measurements in a dynamic sense. The author's style is to introduce topics early in the book, show their relationship to data processing, expand it with greater detail in later sections of the book. This little volume consists of 10 chapters plus an appendix containing an exposition of Fourier analysis.

Chapter 1 initiates the subject by presenting an overview of the entire book. Here, the classes of unwanted signals and procedures are introduced as used in signal recovery. The resistor strain gage bridge is used as an example and discussed. This provides with a brief "touch upon" of low pass filtering of white noise, visual averaging, drift, and offset. The two main methods of reducing drift error are (*a*) multiple time averaging (MTA), and (*b*) phase sensitive detector (PSD). These are expanded in later chapters of the book. The main class of unwanted noise is "1/f" noise. Additional introductory topics are (*c*) digitization, (*d*) preload signals, (*e*) signal timing, (*f*) low pass filtering of shot noise, (*g*) thermal noise, (*h*) filter response, (*i*) weighted running average, and (*j*) probability density function (PDF) and standard deviation (R) RMS value. We next meet methods of dealing with effect of data, i.e., visual averaging and baseline subtraction.

Chapter 2 expands upon MTA and drift. The former can be used to advantage in strain gage curve type of measurement for drift and 1/f noise. MTA averaging may be either of the following (*a*) overlay average, and (*b*) computer averaging (more sophisticated). One needs to reduce drift which arises from changes in ambient temperatures, draughts, etc. This can be accomplished by (*c*) sloping baseline correction, (*d*) drift reduction by MTA (repeating scan and averaging results), and (*e*) MTA by either oscilloscope or computer. It can be a continuous display or continuous time averaging.

Chapter 3 reports on phase sensor detector (PSD) methods. As previously mentioned, this is an alternative to MTA. It can be employed to prevent drift and 1/f noise from frustrating the low white noise error obtained during a long period of measurement. PSD can be used in resistor bridge strain gage circuits. Drift can be rejected by utilizing an AC coupled amplifier and/or PSD. The latter tends to reject drift. AC amplifier repulses offset and also has little effect on square wave signal response and sine wave. If a DC signal is used, this can be converted into AC by utilizing either a vibratory switch contact (vibratory) or a scanning monochrometer (optical type). If the intensity of the broad band light drifts, this can be overcome by derivative modulation. There is no significant loss in signal-to-noise ratio but some distortion has to be accepted. Due to mechanical inertia of the monochrometer, a magnetic resonance spectrometer can be used.

Chapter 4 opens up the area of spectral view of signal recovery. The nonsinusoidal waveform can be resolved into series of sine wave components. A low pass filter can be employed and is sufficient to regard the latter as a device which transmits with little attenuation in the pass band below the cut-off. It totally rejects step band above the cut-off. A signal can be recovered from white noise in both the spectral and time domain.

Chapter 5 continues with 1/f noise. It has a tendency to "walk away" from the mean. It presents an increase in measurement time from furnishing a reduced noise error. 1/f can originate from imperfections in the manufacturing process of an electronic component. Also, it is independent of time.

Chapter 6 focuses upon frequency response calculations. The simplest frequency response to calculate is that of the single-section low pass filter. The running average is a reasonable approximation to actual filter response. This