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 chapter goes into further detail of data testing and concerned with (*a*) visual averaging, (*b*) running average, (*c*) baseline offset correction, (*d*) single point correction, (*e*) subtraction of signal average as in step signal, and (*f*) sloping baseline correction. The author shows how to analyze a step signal which contains 1/f noise and again points out that noise error is independent of measuring time. This occurs when response of MTA is applied to stress-strain curve measurement.

Chapter 7 shows how the PSD method can eliminate the 1/f error. This is strongest in the frequency domain. The simplest type of PSD is the analog multiplier when applied to the strain gage circuit. Additional PSD's are the reversing type and chopping type. This follows with the analysis of a reversing PSD with sine wave signal and analog mutiplier. The latter has a square wave signal. The distortion of the strain function only occurs if the bridge balance is transversed. This can be avoided by applying a large initial unbalance. Should the signal be submerged in noise, the PSD is able to resolve such a signal by reducing the bandwidth of the output filter. The bandwidth of the inner acceptance is narrowed in a similar fashion. If the signal-to-noise ratio is too low to be resolved, the output noise level can be reduced by narrow band pass filtering at the PSD input.

Chapter 8 brings out the concept of digitization and noise. The author goes to great pain to show that noise increase can be avoided. Additional noise occurs due to digitization. The book deals with 3 most commonly used ADCs. They are (*a*) counting ADC, (*b*) successive approximation in ADC, and (*c*) dual range ADC (considered to furnish very high accuracy at a modest cost). The final section in this chapter concerns itself with aliasing. This is extremely important when strong high frequency interference components are present. The anti-aliasing filter is necessary to decontaminate the useful data by extreme limiting of the high frequencies. The aliasing section is too short!

Chapter 9 deals with the measurement of a continuous pulse train. When the pulse shape and timing are known, it is required to ascertain any gradual alteration in the amplitude of the pulse. A number of different types of arrangements can be used for measure of the filter. They are (*a*) flash spectrometer (optical equivalent of a tuneable narrow band filter), (*b*) transversal running average filter if white noise is present for purposes of digitization, (*c*) integrate and hold circuit (analogue integrator instead of transversal filter), and (*d*) low pass filter (smears the pulse and furnishes the last few pulses). In order to further degrade the noise error, the integrate and hold, transversal filter and analog multiplier (equivalent to PSD) could be employed. For more complex signal transients, an op-amp differentiator circuit could be used. Note, one uses only single sampling instead of multitude of sampling events. The "box car" circuit produces true unweighted sampling between limits and has a minor disadvantage. The book reveals the procedure for modifying the pulse sampling in a complicated situation. This can be applied to nonwhite noise. If the maximum or minimum value of signal is regarded, a number of peak and valley detectors come into play. They could be simple and feedback circuits, or filter approximation.

The last chapter reports on the measurement of occurrences of a signal transient. In order to avoid the hazard of effectively point sampling the signal, it is necessary to employ two stages rather than one. Should CR filtering be used, one must take it from the "running average." The book shows how offset, drift, and 1/f noises can be improved by following the required practices. The book concludes with the "autocorrelation method" which shows how one can measure the repetition period of a periodic waveform.

In summary, this is a good book. The author points out a number of interesting items. The reviewer believes that a more detailed section on aliasing is in order, plus how to use the various windows to downgrade the aliasing effect. In addition, some data processing should have been included. This would point out the effects due to good instrumentation. The reviewer recommends this book to all interested in instrumentation and methods of effectively reducing noise in dynamic measurements.

Structural Analysis on Computers,
C. K. Wang,
MacMillan Publishing Co., New York,
1986, 457 pages.

Structural analysis has come a long way. From the old time approximation schemes to the present-day computer programs, we accomplish a great deal in understanding the various ramifications of structural analysis other than simple beams. The author intends this book to act as a supplement text to the standard books on structural analysis. Present-day computer programs play important roles in analyzing structures, regardless of the size and complexity. Present-day analysis employs stiffness matrices subjected to matrix manipulations. Beginning with matrix analysis, the author provides a good explanation of its ability and capability and applies it to structural studies. As stated by the author, "This book is neither an introduction to structural theory nor an advanced text on matrix methods. It is assumed that the readers are already knowledgeable in such subjects as moment area/conjugate beam theorems, virtual work method and moment distribution method . . . . For those structural engineers who want to write their own computer programs, this book provides a vehicle by which they can learn the basic method through line by line explanation of the model computer programs." The author writes the programs in BASIC and claims it is easier to debug. Appendix B contains a FORTRAN listing of the 12 computer programs stressed in this book. Each computer program is explained in great detail, accompanied by a typical problem. Again, they are explained thoroughly and each has its checks based on statics and deformation analysis.

The book contains 12 chapters, each with its computer programs and 2 appendices.

Chapter 1 introduces the fundamentals of matrix multiplication. This includes linear transformation, matrix multiplication, and the computer program entitled, "PROGA" (Matrix Multiplication). Chapter 2 reports on matrix inversion and solution of banded equations. The Gauss-Jordan elimination method, inversion by in-place and longhand computation, initiates the subject. Solution of simultaneous equations and Gauss elimination method usher in the subject of the solution of banded equations. "PROGB" is on inversion and "PROGB1" is the solution of the banded equations.

Chapter 3 covers truss analysis by method joints. Introducing the definition of the statics matrix, we build up the truss geometry from the former. This follows with inverse static matrix and its application to joint analysis. The chapter concludes the use of "PROGC" (truss analysis by method of joints). Chapter 4 continues with displacement method. The force method is initially considered but due to ease of the displacement method, the former is rarely considered. The global stiffness matrix is unveiled with methods of computing it. The principle of virtual work is exposed. This follows with the procedure in obtaining the global stiffness matrix from the compilation of the local stiffness matrices. A discussion of the