identifying the source conditions via selective acoustic intensity method.

The final section speaks about impedance-absorption transmission. The first set of papers relates the measurement of absorption coefficient of acoustical materials using sound intensity methods, use of acoustic intensity measurements in investigating flanking transmission of timber frame construction and in-situ measurement of acoustic impedance of materials for various incidence angles. The next set of papers determine the transmission of saddle roof construction and sound absorption characteristics of acoustic materials by a new two-microphone technique. The next set stresses the application of sound intensity techniques in measuring impedance, absorption and transmission plus the determination of specific normal impedance of a material by phase gradient and experimental study of power-flow in light partitions. The concluding set of papers closes this session by considering (*a*) meaning of real measurement by intensity of room-to-room transmission, (*b*) use of acoustic intensity method in measuring absorption coefficient, and (*c*) determining sound reduction indices in presence of flanking transmission via sound intensity method.

This is an excellent symposium. The new subject has increased in importance and the method of testing has been greatly improved in the last decade. This is attended by the proceedings of this symposium. The combination of modal analysis and acoustic intensity entitled "Structural Energy Flow Analysis" should emerge with a greater position of importance in future years. The reviewer recommends this symposium procedures to those interested in acoustic intensity measurements and allied subjects of structural testing.

Digital Signal Processing, 2nd Edition, W. D. Stanley, G. R. Dougherty, and R. Dougherty, Reston Publishing Co. (a Prentice-Hall Co.), Reston, Va., 1984, 514 pages.

Digital processing of data has become a household word. Formerly, analog processing was king, but now most of its functions have been supplanted by digital means. The trend is expected to continue in the future years. As stated by the authors, "A major objective of the book is to provide an introductory treatment of the concepts of digital signal processing, with suitable supporting work in linear system concepts and filter design. A further objective is to present a survey of many of the current applications of these techniques, including a consideration of available hardware and software." In order to accomplish their aims, the authors present enough basics in order to prepare the readers possessing little or no background in discrete signal theory. This further permits them to comprehend some of the number of references published in this field. The authors have done an admirable job with this book.

The book consists of two parts contained in 15 chapters.

Chapter 1 introduces Part I which deals with the theory and principles of digital signal theory. It consists of the general concepts of digital signal processing. It includes block diagrams of the digital processing system, A/D and D/A conversion, sampling and digital conversion processes and mention of fast Fourier transform (FFT). Chapter 2 continues with continuous time series analysis. This covers the continuous-time, linear, time invariant (CTLTI) series analysis. Solutions of CTLTI can be accomplished by Laplace transform. This leads to the concept of transfer function, poles, zero, stability, and steady frequency response concepts. Chapter 3 reports on Fourier analysis and sampled-data systems. Beginning with a discussion of the former, this follows with the Fourier transform. Having this introduction under our belt, the chapter continues with sampled data systems, sampling, Nyquist frequency, and ideal impulse sampling. It concludes with the concept of holding circuits applied to the recovery of continuous time-signal data from sampled-data forms.

Chapter 4 speaks about discrete time signal analysis. The reader is introduced to the solution of discrete time series by use of Z and inverse Z transforms. The authors apply this in determining the transfer function. The chapter ends with interesting applications of response forms and stability of the discrete-time, linear, time invariant (DTLTI) systems. Chapter 5 continues with the realization and frequency response of discrete-time series. The realization of a DTLTI system involves hardware and/or software. The latter includes (*a*) unit delay, (*b*) addition/subtraction, (*c*) constant multiplier, (*d*) branching operation, and (*e*) signal multiplier. The actual realization diagrams for discrete time series, the direct form of synchronization, and the transfer function results from the quantization by parameters. Other forms of the decomposition technique of the transfer function are (*a*) cascade form (series) and parallel canonic form, i.e., decomposing the transfer function into the sum of several transfer functions. The chapter concludes with a brief discussion of the steady state frequency concept and properties of the amplitude response of a discrete time series. The next chapter focuses upon the properties of analog filters. Starting with the ideal frequency domain filter model, the primary attention of this chapter is directed toward the problem of relating the prescribed amplitude and/or phase characteristics to the transfer functions. This takes in the Butterworth (maximally flat) approximation, Chebychev (equiripple amplitude) approximation and maximally flat time delay approximations. This extends to a short deliberation on the design of band pass filters and this involves the use of a low-pass geometric transformation. Then it follows with low-pass to band rejection and low-pass to high-pass transformations. The finishing sections of this chapter discuss the amplitude response of the previously mentioned filters.

Retracing our steps, Chapter 7 devotes itself to infinite impulse response digital filter design. Beginning with the digital filters of the DTLTI nature, this is resolved into the infinite impulse response (IIR) or finite impulse response (FIR). The former is easily implemented by recursive realization, i.e., crest value of output depends upon both the input and previous values of the output. The FIR factor can be easily complemented by the FFT or nonrecursive realization. Stepping ahead, we encounter the bilinear transformation model for designing IIR filters with its nominal interpretation, the impulse variance method, step-invariant method and the band pass filter designs. Chapter 8 develops the basic properties of the FIR digital filter. The prime advantages of the latter are the possibility of achieving ideal linear phase characteristics and less susceptibility of the actual implementation to parameter quantization effects. The major disadvantages are long time delays and the necessity of using higher order filters to obtain the prescribed filtering requirements. The FIR filters can be achieved by (*a*) proper implementation by nonrecursive or direct convolution type of realization, (*b*) use of high speed convolution via FFT, (*c*) errors stemming from quantization, rounded off and coefficient inaccuracies are less than the IIR filters, (*d*) transfer function has all the poles at the origin and is always stable, (*e*) FIR filters may be designed with ideal linear phase characteristics, (*f*) higher order FIR filter is usually required to obtain some sharpness of amplitude response control as compared with IIR filter, and (*g*) overall approximation problem is somewhat more difficult than IIR filter. The chapter continues with a more detailed discussion of Fourier series, Fourier transforms, window functions, i.e.,

rectangular Hanning, triangular, Blackman-Dolph, Chebychev, Hamming, and Kaiser. The next chapter considers the discrete Fourier transforms and its many constituents. This includes even and odd properties and its operational pairs. This leads into an interesting discourse on the FFT accompanied by a number of its important algorithms (signal flow graphs, computer flow charts).

Chapter 10 concludes the discussion of DFT by presenting some of the approximation of continuous time transforms and solutions of DFT or FFT parameters. An important aspect of FFT is high speed convolution, i.e., simplicity of corresponding relations in the transfer domain. The concluding sections consider the statistical aspects of power spectrum and correlation, both auto and cross. The reviewer feels that the statistical analysis aspect is too short and should be expanded.

The next chapter furnishes an overview of the general application of digital signal processing. Initiating this chapter is the application of filters to analog and digital signal processing. This continues with the present composition of a modern FFT analyzer. The latter are applied to ultrasonic analysis, doppler-radar of blood vessel occlusion and seismic analysis. Additional uses include modem, frequency synthesizer and use of a microcomputer for digital signal processing. Chapter 12 covers selected topics in industrial signal processing, i.e., discrete time analog systems, correlation concepts, digital filter configurations, and high speed FFT processes. The chapter ends with an interesting discussion on things that the FFT can do in vibration analysis, harmonic analysis, and modulation measurements.

Chapter 13 reports on selected topics on image processing applications. Examples are earth's surface being viewed from an orbiting satellite, internal composition of a complex metallic or organic structure with aid of X-rays, chromosomes viewed through a microscope and schematic line drawings of machine elements plus computed tomography imaging. Chapter 14 covers speech diagnostics and focuses upon applications ranging from aircraft instrumentation, banking systems, computer data base access to consumer electronic products. The marriage of digital technology with the human voice offers the greatest challenge to D/A conversion techniques. This is very useful in data acquisitions during tests. The concluding chapter recounts the various digital signal processing (DSP) chips. Starting with the use of the earliest, INTEL 2920 chip, the authors proceed to the latest and more advanced types. They point out the differences between DSP chips and the ordinary microprocessor.

The authors of this book have fulfilled their goal plus more. Besides the basic and more advanced analysis in digital signal processing, the description of the digital signal equipment is most impressive. The reviewer would have liked additional sections on cepstrum analysis and time series analysis applied to signal processing. The reviewer recommends this book to those interested in digital signal analysis and analysis of dynamic type data.