of digital computer in transitory acoustic data, measurement of transfer noise and transfer matrix methods of hydraulic piping systems plus measurement of uncertainty in sound power levels. Data processing covers sound field analysis, comparing sound intensity measurements between real time analyzer and FFT, and coherence techniques for sound measurement in an industrial environment. Additional papers covered coherence measurement in medium diesel engines, experimental modal analysis of acoustic cavities, and use of FE in identifying fluctuating noise sources in mechanisms plus measurement of L_{eq} statistics in random noise.

Progress is being made towards an international standardization of aircraft contour calculations. Technical standards for office noise levels have been put in force in a number of countries as well as machinery noise standards. The ever present noise abatement in different countries is a topic of great importance. Aircraft noise abatement is another subject of heated activity. Ways of reducing construction noise by the contractor has been pushed in a number of countries. Reviews are being made of different business equipment so as to either lower the levels or have a steady bearable noise level. In general, most of the major countries here and abroad are developing standards for quietness.

The symposium like the previous ones contains a great deal of information. Some of the papers could be expanded into "full blown" papers. The reviewer feels that an index of the papers would be extremely helpful. This would alleviate the problem of going through the book or trying to match authors to papers. INCE's in the various countries have been doing a good job.

Introduction to Applied Mathematics, G. Strang, Wellesley Cambridge Press, P.O. Box 157, Wellesley, MA 02181, 1986, 758 pages.

This book reads like a "romantic novel." It has the luster and charm of good companionship. The prime purpose of this book is to update applied mathematics and make it more compatible with modern-day ideas or algorithms. The great changes in recent years stem from the universal use and appeal of small and large size computers. This prime force compelled the author to have serious thinking on the subject. As stated by the author, "Applied mathematics is alive and very vigorous. That ought to be reflected in our teaching. In my own class, I am convinced that the textbook is crucial. It must provide a framework into which the applications will fit . . . . It is a pleasure to teach a subject when it is moving forward . . . but the book has to share in that spirit and help establish it." The subject matter covers a vast field. Beginning with the simple symmetric systems, it extends to the more complicated initial value problems and optimization. Students should be entranced by reading this book. The author shows how applied mathematics may be presented in a lively fashion rather than the somewhat boring episodes of previous years. The book contains 8 chapters.

Chapter 1 reports on symmetric linear systems. It begins with Gaussian elimination, Cholesky method, positive definite matrices, and minimum principles. This proceeds with least squares solution, minimum potential energy, and introduction to stiffness matrix. All are in matrix form. The next topics are eigenvalues and an excellent review of matrix theory. Chapter 2 speaks about equilibrium equations and minimum principles. The initial topics are equilibrium equations, constraints, and Lagrange multipliers, duality with a brief divergence into electrical networks (Kirchoff's and Ohm's laws). The problems of statics require structural equilibrium plus a good explanation of the physical meaning of Lagrange's multipliers. The principle of virtual work, total potential energy, and kinetic energy are important factors in static equilibrium. Their relationships are explained in a very clear fashion. The chapter continues with least squares weighted and recursive estimation, normal or Gaussian distribution, and definition of other statistical quantities. The concluding section probes into the Kalman filter with its smoothing and filtering action. An excellent chapter!

Chapter 3 covers equilibrium in the continuous case. Beginning with one dimensional problems, this follows with Sturm-Liouville problems, differential equations of equilibrium and associated minimum principles, interpolation of displacements, slope of beams, and use of cubic splines. The next topics are Laplacian equations and potential flow, Green's formula, Poisson equation and vector calculus in three dimensions. This includes line integrals, definitions of divergence, gradient and curl. Progressing ahead, we encounter the topic of equilibrium of solids and fluids. The definitions of stress and force are promulgated. Fluid mechanics contain Navier-Stokes equations, Euler and Bernoulli's equations with their proper explanation. The final section in this chapter explains the various facets of calculations of variations with direct application to two dimensional and nonlinear problems, dynamics, principle of least action, and Hamilton's equations.

Chapter 4 informs us that a number of phases of analytical methods would be covered. Starting with Fourier series, associated Fourier coefficients, and delta functions, this ventures forth into the solution of Laplace's equation, Bessel functions, and equations employing Fourier integrals. Our next topics are complex variables, conformal mapping, and an interesting discourse on two-dimensional fluid flows. The final sections in this chapter delve into complex integration, Cauchy's integral formula, singularities and residues with a proper explanation of Fourier and Laplace transforms.

Chapter 5 dwells upon numerical methods. The initial subjects are linear and nonlinear equations wtih an introduction to finite difference (FD) and finite elements (FE). This continues with the various aspects of Newton's method in solving nonlinear equations, methods of steepest descent, and orthonormal vectors. Our next subjects are least square, modified Gram-Schmidt, QR algorithms, Householder and other powerful methods employed in solution of eigenvalue problems. The other important methods located in the semidirect and iterative method family are (*a*) Jacobi's method, (*b*) Gauss-Seidel, (*c*) power method, (*d*) Rayleigh's quotient, (*e*) Lanczos method, and (*f*) conjugate gradient method. The important FE now occupies the podium. The important steps in FE method formulation are based on Rayleigh-Ritz and Galerkin's weighted residual methods. The triangular and rectangular elements are briefly explained with direct application of the assembly of stiffness matrix and computations. The concluding section explains Fast Fourier Transforms (FFT), its derivation, and its solution of Poisson's equation and time dependent problems. Care is necessary when using FFT in spectral analysis due to aliasing.

Chapter 6 focuses upon initial value problems. Commencing with ordinary differential equations consisting of variant coefficients, nonlinear coefficients, and proceeds into second order equations (over, under and critically damped) plus utilization methods of undetermined coefficients (damped and damped free oscillations). Stability and phase plane have always been intriguing topics in solutions of differential equations. The author covers the concept of saddle point and Vander Pol's equation. We next encounter Laplace transforms and relationships between Fourier transforms and Laplace transforms. They are applied to solutions of differen-

tial equations and use of "Table of transforms." The solution of difference equations can be solved by Z transforms but not Laplace transforms. The book goes to great lengths in describing illustrative examples explaining the use of these transforms. The author continues with initial value problems of PDE and goes into great detail concerning derivation and application of first and second order wave and heat equations. Difference methods start the solution of initial value problems and excellent examples are (*a*) Runge-Kutta, (*b*) Euler equation (forward and backward), (*c*) multi-step methods, and (*d*) Lax-Wendroff method. The concluding section studies nonlinear conservation laws and covers Burger's equation (applied to shock waves) and Lax equation.

Chapter 7 concerns networks and graphs, spanning trees and shortest paths, algorithm and maximal flow in a network. The chapter concludes with a detailed analysis of the transportation problem. This is the oldest of all linear programs.

The concluding chapter introduces and delves into linear programming. This continues with the simplex method, Karmarker and duality in linear programming. The saddle points (minimax), game theory and optimization plus nonlinear programming complete the book. We analyze the Kuhn-Tucker optimality condition, quadratic programming, convex and convex conjugate functions.

This excellent book makes no apologies to the reader. This explicit volume should occupy an elevated post among applied mathematic tomes and should be of universal appeal. The reviewer would have preferred these additional topics (*a*) transfer matrix, (*b*) more extensive analysis of FE including isoparametric elements, (*c*) subspace iteration method, and (*d*) Hankel's transforms. Nevertheless, the reviewer highly recommends this book to those interested in learning or furthering their knowledge in the modern version of applied mathematics applied to engineering.

Advanced Mechanics of Materials, 4th Ed., A. P. Boresi and O. M. Sidebottom, John Wiley & Sons, New York, N.Y., 1985, 763 pages.

This is a "peach" of a book. It has lost none of the gist of the previous editions. In a previous issue, the reviewer wrote a review of the 3rd edition. Computers dictate changes from the previous edition. Problems thought to be difficult in prior years now become easy to solve. New to this volume is a thought-provoking and comprehensive chapter on elementary aspects of finite elements (FE) supplemented by a number of computer programs. The authors foster good judgment by carefully marrying analytical approximations and astute wisdom in employing practical and experimental experience. Beginning with the elementary facets of the theory of stress and strain, it forges ahead and employs the more advanced aspects of mechanics of materials. The book contains a fountain of information and is well-coordinated with modern thinking in mechanics of materials. As stated by the authors, "The present edition is an integration of both traditional methods and innovations in the field of engineering. The sometimes gradual, sometimes explosive developments in engineering are reflected in the forms and treatment of materials in this book." This tome contains 15 chapters and 2 excellent appendices (integration formulas for FE and second moment of a plane area).

The initial chapter introduces the basic considerations of stress-strain and temperature relations. This includes definition of stress and its notation, transformation of stress and principle stresses. This follows with the differential equations of a deformable body and its deformation, strain theory and principle strains for line and volume elements. The chapter concludes with the theory of small displacements.

Chapter 2 progresses ahead with stress-strain temperature relationships. Opening this chapter is the elastic and nonelastic response of a solid, first law of thermodynamics and Hooke's law (isotropic and anisotropic elasticity). This covers the equations of thermoelasticity for isotropic materials and yield criteria applied to metal plasticity.

Chapter 3 introduces the subject of failure criteria. The initial topic is the different modes of failure (excessive deflection, failure by yielding and fracture). The authors journey ahead with yield inclination (stress-strain curve, extensive yield, significance of failure criteria for general yielding) and failure criteria residing in the fracture mechanics of materials. The final sections focus upon various relations in high cycle fatigue and the buckling fatigue criteria. The section on low cycle fatigue is too meager and should be expanded to include additional applications of Coffin and Landgraf equations.

Chapter 4 reports on applications of energy methods. Starting with the principle of stationary potential energy, it proceeds with Castigliano's first and second theory with applications to deflections of statically determinate and indeterminate straight and curved beams plus trusses. Chapter 5 follows with torsion of cylindrical bars of circular cross section, St. Venant's semi-inverse method, linear elastic theory applied to elliptical and equilateral triangular cross section. We delve further into the Prandtl elastic-membrane with and without end restraints and fully plastic torsion acting on square sections, I beams, channels, and angular sections. Chapter 6 voices the nonsymmetrical bending of straight beams. Starting off with the definition of shear center, this is applied to beams of various cross sections. Our next topic subjects a beam to nonsymmetric bending with various sections. The authors apply it directly to different types of straight beams. The concluding section employs fully plastic load to unsymmetrical bending of beams of general cross section.

Chapter 7 continues with shear center of thin wall beams of different cross sections. The illustrative topics are (*a*) shear flow in thin wall beam cross sections, (*b*) shear center for channel section, (*c*) composite beams formed from stringers and thin webs, and (*d*) box beams. Combined loads (axial, bending and twisting moments) conclude the chapter. The next chapter focuses upon curved beams. Introducing the various types of loadings, this is applied to curved beams of various cross sections. Calculated radial stresses in curved beams with proper correction of circumferential stresses based on Bleich. The final sections consider correction factors, deflection of curved beams of various cross section and fully plastic loads for curved beams. A new feature in this book describes statically indeterminate curved beams with applications to a closed ring subjected to a concentrated load. Chapter 9 roars ahead into beams on elastic foundations. After introducing the general theory, this extends to an infinite beam subjected to a concentrated load with various boundary conditions. Our next topics are (*a*) infinite beam subjected to a distributed load segment, (*b*) semi-infinite beam subjected to loads at its end and concentrated load near its bend, and (*c*) short beams and thin-walled circular cylinder on elastic foundation.

Chapter 10 follows with flat plates. Introducing stress resultants, this leads to the strain-displacement relations and equilibrium equations for small displacement theory. Next on the agenda is the stress-strain relations for isotropic elastic plates, strain energy, and boundary conditions for plates plus the solution of a rectangular plate subjected to different loadings and boundary conditions. The chapter concludes with solution of circular plates possessing various edge conditions. Chapter 11 covers thick-walled cylinders. Basic relations