as the sole exposure of engineering students to transport phenomena. There is no treatment of radiation, boiling, natural convection, compressible flow, nonequimolar counterdiffusion, and not much connection between the equations of change and the actual computation of transport rates. Such topics are left to unit operations courses. Rather, the book is intended to be more introductory and fundamental, although a purported senior level course is somewhat late for this. Dr. Theodore reveals a great deal of patience in presenting derivations and numerous examples in much detail; these are very repetitious, however, and the book could be shortened considerably with no loss of content.

After a brief introduction and a chapter on vector analysis, one chapter each is devoted to momentum, energy, and mass transfer. The equations of change are derived with a control volume approach using Gauss' divergence theorem and constitutive relations for constant density fluids, but without reference to kinematics, thermodynamics, or molecular considerations. The derivations are followed by example problems involving the calculation of velocity, temperature, and concentration profiles in slab, cylindrical, and spherical geometries. The next chapter presents similar problems on simultaneous transport and reproduces some poorly identified computer listings. The last chapter, an introduction to turbulence, ends with definitions of friction factor and heat and mass transfer coefficients.

Many deficiencies prevent recommendation of the book, even for its intended purpose and scope. First, a number of concepts are presented incorrectly or inadequately, in this reviewer's opinion, including Newton's second law of motion ("derived" by dimensional analysis in the FMLT system), pressure, internal energy, reference frames for mass and molar diffusion fluxes, and the boundary layer equations.

Second, there are quite a few careless statements and strangely fabricated phrases. For example, throughout the book the expression "rate of momentum" denotes rate of change of momentum (similarly for energy and mass); "shear stress tensor" denotes the negative of the viscous stress (or extra stress) tensor, which includes normal stresses as well; "force gradients," instead of force fields or potential gradients; "average density," when total or global density is meant; "dimensionless analysis," instead of dimensional analysis; "Newtons' second law," meaning Newton's law of viscosity; and so on.

Finally, there are some noticeable omissions. For example, the book contains no reference citations or bibliography, yet such mathematical tools as Bessel functions, Fourier series, Gauss-Jordan elimination, and Gamma functions are used without explanation. There is insufficient emphasis on the constant-density limitations throughout the text, there are no warnings of numerical instabilities or divergences, the definition of dot product involving tensors or dyads is missing, and Stokes' integral theorem is stated but never used.

Unfortunately, these shortcomings obscure the book's merits. An extensively revised and abridged version could be useful in continuing education or refresher courses for those with no previous exposure to vector analysis or the equations of change.

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Theory of Viscoelasticity: An Introduction, R. M. Christensen, Academic Press. New York (1971). 245 pages. $13.50.

The dominant theme in this book is the development of several aspects of the continuum mechanics theory of linear viscoelasticity. Since four of the seven chapters are devoted entirely to the linear theory and the others briefly describe three other areas of viscoelasticity, the word *linear* in the title would have been helpful for guiding the proper readers to this book.

The first four chapters consider the linear theory of viscoelasticity. In chapter one the constitutive equation for the isothermal infinitesimal theory is derived from the fading memory hypothesis, and the behavior of the relaxation function and the creep function are presented. Chapter two consists of a series of solutions to a variety of isothermal viscoelastic boundary value problems. A list of the problems solved is useful for determining the audience to which the author is writing; the examples include: torsional oscillation of a right circular cylinder, pressurization of a spherical cavity, and indentor on a beam. A linear theory of thermoviscoelasticity is developed in Chapter three. Chapter four consists of solutions to several wave propagation problems using both the isothermal and nonisothermal viscoelasticity theories.

Chapter five is a collection of general theorems which the author states "are extensions to viscoelasticity of some of the well-known theorems of elasticity." Included are uniqueness of solution, reciprocal, variational, and minimum theorems. Chapter six presents the development of the nonlinear theory of viscoelasticity in which the stress-strain relationship is derived as an expansion of linear functionals. Finally, Chapter seven describes methods of determining mechanical properties with the major emphasis on those methods used to obtain the linear viscoelasticity functions.

Although this book is subtitled as an introduction, the reader must have sufficient background to understand a rather high level of mathematics and some previous knowledge of the subject of mechanics. To understand the theoretical development presented in this book the reader will need some understanding of the following mathematical terms: Stieltjes convolution notation, Riesz representation theorem, and Fréchet differentials. The reader should also have some introductory work in the area of mechanics since the author defines the concepts of stress and strain only briefly.

Throughout the book the author prefers to keep the theoretical development as general as possible. In the chapters in which problems are solved few comparisons with experimental data are made, and with regard to numerical solutions for the problems, although a few are given, the author's philosophy is that "it is not possible to give detailed numerical solutions and expect the results to have any degree of generality."

With the emphasis on the linear theory and the knowledge that most viscoelastic-fluid processing problems require at a minimum a nonlinear representation of the viscosity function, the reader should place his interest in this book either on solidifying his understanding of the theoretical development of constitutive equations or on understanding the solutions to certain problems arising with viscoelastic solids where the linear theory is applicable.

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