Rezensionen

I-Shih Liu
Continuum Mechanics
Springer-Verlag Berlin Heidelberg New York, 2002
28 figs., 297 pp., 49,95 €
ISBN 3-540-43019-9

It is probably a pleasure for all scientists working in the field of continuum mechanics to have a new book by hand which gives a compact and modern introduction into continuum mechanics and thermodynamics and which is enhanced with numerous examples and exercises. The book by I-Shih Liu, one of the experts in the field of continuum thermodynamics, is written in the tradition of rational thermodynamics as established in the books 'The Non-Linear Field Theories of Mechanics' by Truesdell and Noll and 'Thermodynamics' by Müller. Liu's book gives a rigorous mathematical presentation of the foundations of tensor algebra and tensor analysis, kinematics, balance equations and the principles of constitutive theories. Furthermore, the basic issues of the representation theory of tensor functions are discussed. The main contribution of Liu's book is to give a compact and up-to-date introduction into the entropy principle, the thermodynamics with Lagrange multipliers and the rational extended thermodynamics. All parts of the book contain examples and exercises.
Therefore the book can be recommended to senior undergraduates and graduate students at the master and the PhD level as well as to research scientists and teachers. Unfortunately, constitutive theories which are based on internal variables are not considered in the book. Such theories are of significant importance in engineering and biomechanics, where they are used to describe viscoelastic, viscoplastic, and plastic materials.

T. Böhlke

N. Phan-Thien
Understanding Viscoelasticity
Basics of Rheology
Springer-Verlag Berlin Heidelberg New York, 2002
50 figs., 145pp., 29,95 €
ISBN 3-540-43395-3

In this small textbook a brief introduction into the rheological branch of viscoelasticity is given. After a very brief introduction into tensor notations, the author outlines some typical features of rheological behaviour. This is followed by a listing of the basic kinematical quantities and the balance equations. The main part of the book, however, is dedicated to the constitutive modelling of viscoelastic material behavior. Phan-Thien distinguishes between the non-linear continuum mechanics approach (Rational Mechanics), and the microstructural approach. For the first, he recalls the principles of material theory as being established by W. Noll and others. After giving many examples of such models due to Mooney, Green, Rivlin, Oldroyd, a. o., examples of viscometric flows are described. For the second, materials with chain molecule structures are considered, for which statistical methods are used to model the phenomenological mechanical behavior. The last chapter then deals with suspensions.
In contrast to other monographies in rheology, the present one results from lecture notes of a short introductory course, and is not meant as a comprehensive collections of results in the field. It goes immediately into the non-linear description of kinematics, which will hardly be understandable for readers without a good background in continuum mechanics. The bibliography contains only 52 references, unfortunately without titles of the articles. On the other hand, some interesting historical notes on the pioneers of rheology are given. The book can be recommended as a first introduction into the matter, after which more detailed works should be chosen.

A. Bertram

Willner, K.
Kontinuums- und Kontaktmechanik
Synthetische und analytische Darstellung
Springer Verlag Berlin Heidelberg New York, 2003
560 S., 80 Abb., 26 Tab., € 99,95
ISBN 3-540-43529-8

During the last years considerable effort was devoted to develop numerical simulation techniques based on modern continuum mechanics. In this line of work the treatment of contact problems became also more eminent. This fact is due to the growing computing power which lead to more and more sophistication and detailed technical models within engineering analysis. Due to the more precise modelling within the associated discretization process often unilateral constraints have to be considered. Hence the continuum mechanics background for the description of solids and contact is needed besides discretization techniques. The basic formulations are treated in the book of K. Willner in a modern and concise way.

The book is subdivided in 27 chapters plus two appendices which are assigned to four main topics. The first main topic comprises the classical continuum mechanics which is called in this book synthetic continuum mechanics. The local relations which describe the kinematics, the balance laws and the constitutive equations are described in detail in

five chapters. Before that a chapter containing the basics of tensor calculus provides the necessary background needed to understand the derivations in following chapters. The author selects for the depiction of vectors and tensors an own clear notation which however is a little over-ornate and has the disadvantage that it is not common in the German and international literature. One gets however rapidly accustomed to the notation and then can easily understand the mathematical derivations and the contents of the book due to the consistent use of the notation.

The second main topic comprises basically the variational principles of continuum mechanics which is called in the book analytical continuum mechanics. The author provides in eleven chapters the basic relations and principles for numerical discretization methods. This includes the basics of the calculus of variations, the description of approximate solutions on the basis of principles, the derivation of weak forms of the balance laws of continuum mechanics and the variational principles of the linear and finite elasticity in statics and dynamics.

The next five chapters are devoted to the foundation of modern contact mechanics which denotes the third main topic of this book. Besides the underlying balance laws the author describes in detail the kinematics of contact and discusses the constitutive equations needed at the contact interface. After that the weak forms needed for a numerical treatment of contact problems are presented which includes also the treatment of coupled thermo-mechanical contact problems.

Within the last main topic the author treats discetization methods and discusses numerical examples. In detail a finite element formulation for nonlinear coupled thermo-mechanical problems is formulated. The necessary algorithms for the incremental solution of nonlinear weak forms and the associated linearizations are derived. Within an additional chapter the discretization schemes for contact within the finite element methodology are described as well. A chapter with selected numerical examples involving thermo-mechanical processes finishes the numerical part of the book. The enclosed examples cover different application areas including finite deformations due to temperature gradients and the evolution of heat due to frictional processes.

The book provides a clear overview over the basic formulations in modern continuum- and contact mechanics needed to derive numerical simulation tools and discretization methods. It covers a wide range of the theoretical foundations and serves well for the understanding of simulation methods based on the finite element methodology. The extensive list of references with over 500 citations provides a good starting point for more in depth studies of certain topics. All derivations are written in such a way that they can easily be understood. Due to that the book can be recommended as a good and solid work for master and PhD students as well as for engineers in practice with interest in theoretical background.

P. Wriggers

Strybny, J.
Ohne Panik Strömungsmechanik!
1. Auflage, 239 Seiten, 19,90 €
Friedrich Vieweg & Sohn Verlagsgesellschaft mbH, Braunschweig/Wiesbaden, 2003
ISBN 3-528-03194-8

Das Buch "Ohne Panik Strömungsmechanik!" von Jan Strybny ist als Lernbuch zur Prüfungsvorbereitung, zum Auffrischen und Nachschlagen gedacht. Es beschränkt sich auf den Bereich der Hydromechanik und einige ausgewählte zusätzliche Themengebiete wie Potentialtheorie, Ähnlichkeitstheorie und poröse Medien. Das Buch richtet sich an Studenten in der Klausurvorbereitung und will einfache, knappe Lösungswege vermitteln, die möglichst viele Punkte einbringen sollen. Hierbei wird von einer Grundstudiums-Klausur ausgegangen und eine zeitoptimierte Vorbereitung angestrebt, denn "muss man das vor einer Grundstudiums-Klausur wirklich alles gelesen, geschweige denn behalten und verstanden haben." Der Stil ist schnodderig in der Du-Form geschrieben, Cartoons von Oliver Romberg lockern diese erklärende Aufgabensammlung mit zum Thema passenden Zeichnungen auf. Eine Bedienungsanleitung mit Zeitplan für die verschiedenen Aufgaben und eine kleine Formelsammlung führen in das Buch ein. Die dann abgehandelten Themengebiete richten sich in ihrer Reihenfolge nach einem häufig in Vorlesungen angewandten Schema, wobei einige Teilbereiche sicherlich ausführlicher dargestellt sind als für manchen Studiengang notwendig. Dafür fehlen wiederum Aspekte, die häufig in Prüfungsklausuren abgehandelt werden. Insofern sollte der Leser zuvor überprüfen, inwieweit die Themengebiete dieses Buches für ihn und seine Prüfungsvorbereitung relevant sind. Jedes Kapitel beginnt mit einer Erklärung, wozu die darin abgehandelten Berechnungen dienen. Es folgen dann die zugehörigen Grundlagen und Gleichungen, die jedoch manchmal auch innerhalb einer Aufgabe weitergeführt werden. Die Aufgaben sind sehr ausführlich erläutert und der Lösungsweg bis ins Detail dargestellt. Dies ist wohl das positivste Merkmal dieses Buches, dass es im Gegensatz zu anderen die Studenten bis zur vollständigen Lösung der Aufgaben führt. Eine Gefahr hierbei sind die, zwar auffällig markierten, in die Lösungswege eingebrachten häufig gemachten Fehler, die es zu vermeiden gilt. Dies kann sinnvoll

sein, birgt jedoch die Gafahr der Wiederholung durch den Leser. Die Kennzeichnung, was ist die richtige und was die falsche Lösung, könnte doch etwas expliziter sein.
Insgesamt kann dieses Buch durchaus zu einer guten Prüfungsvorbereitung beitragen, wenn die darin behandelten Themengebiete für die Prüfung relevant sind. Als ausschließliches Lernmittel birgt es jedoch auch etliche Gefahren, wenn man sich ohne tieferes Verständnis zu sehr auf die dargestellten "Rezepte" verlässt.

K. Zähringer

Kemnitz, A.
Mathematik zum Studienbeginn
Grundlagenwissen für alle technischen, mathematisch-naturwissenschaftlichen und wirtschaftswissenschaftlichen Studiengänge
Vieweg Verlag, 2004, 420 Seiten, € 26,90
ISBN 3-528-56990-5

For the recent decade it has been stated that the mathematical skills of most new students have decreased. Therefore, many universities give precourses to improve these basic skills. Some of the courses result in books like this one being suitable as a tutorial for self-studies. It is based on a precourse given at the Technical University of Braunschweig for several years.

The book wants to help to overcome gaps in knowledge and to reduce difficulties at the beginning of studies. It spans the fields of mathematics a student should know. These are arithmetics, equations including systems of linear simultaneous equations, geometry, functions, trigonometry, analytical geometry including a brief overview on vector calculus, differential and integral calculus, probability. The chapters are independent of each other, so one can deal without problems with single chapters of interest.

The book is written in a very comprehensible manner. It contains many illustrations, and important formulae are highlighted. One finds also many examples with solutions.

However, there are some parts, which should be extended (vector calculus) or pointed out more clearly. Section 2.6.1 for example explains the solution of third order equations. The formula of Cardano for the exact solution is mentioned but not shown. Only special cases are taken into account. Chapter 2.9 deals with systems of linear simultaneous equations. Methods to solve systems with two or three variables are shown. But there is no hint how to handle systems with more than three variables. In this context, matrices and determinants are introduced. They can also be used to solve (large) systems of equations. The scheme of Falk and Cramer's rule should be explained in detail and not only be applied. In chapter 8 on differential and integral calculus, Fourier series are shown. Here, we also would add the calculation of Taylor series.

In summary, this book is one of the best we know to improve the basic mathematical skills at the beginning of studies. It can also be used as a book to look up quickly for some forgotten information.

W. Lenz

Continuum. mechanics can be presented by introducing motion, treating the geometry of the. movement, and forces that causes this motion. The conservation principles are the. essential part of the mechanics deï¬ning the laws of nature. The mechanical problem. is a well-posed system if constitutive equations are stated. me338A - continuum mechanics. although the basic concepts of continuum mechanics have been established more than five decades ago, the 21 century faces many new and exciting potential applications of continuum mechanics that go way beyond the standard classical theory. when applying continuum mechanics to these challenging new phenomena, it is important to understand the main three ingredients of continuum mechanics: the kinematic equations... This website presents the principles of finite deformation continuum mechanics with many example applications to metals and incompressible viscoelastic materials (rubber). It can serve as lecture notes for a graduate level course in continuum mechanics for engineers interested in the subject. Fracture Mechanics Website. Visit www.fracturemechanics.org, my new fracture mechanics website, It is under development, but will eventually contain information on linear and nonlinear fracture mechanics, as well as fatigue crack growth. Basic continuum mechanics. Lars H. SÃ¶derholm Department of Mechanics, KTH, S-100 44 Stockholm, Sweden. c Lars H. SÃ¶derholm. Fall 2008.Â 7 The dynamic equations of continuum mechanics. 65. 1 Integral over material domain . . .