Rezensionen

Tribikram Kundu
Fundamentals of Fracture Mechanics
CRC Press, 2008, 304 pp., £ 39,99
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Another textbook on fracture mechanics - which need does it satisfy? It is actually the outcome of the author's class notes, and he tells us that his students encouraged him to write this book. He promises that any professor who follows this book closely will be liked by his or her students. What a stimulus! Which professor does not want to be liked by the students? But doesn't every professor believe that the students like his or her course?

How does it differ from existing textbooks? The author claims that his class notes are "*much more organised and easy to understand than the available textbooks*". However, the reviewer, who teaches fracture mechanics himself and is familiar with a number of textbooks, does not at all agree with the author's general downgrading of books other than his own and started to develop doubts with respect to the present one when reading it.

The book starts with the obligatory fundamentals of the theory of elasticity covering nearly 30% of the book and ending with some classical two-dimensional problems like bending of beams, half-plane problems and thick-walled pressure vessels. The student does not yet know what fracture mechanics is, and he will neither be told in the following, when the author starts deriving WILLIAM's solution of stresses at a crack tip, filling 15 pages with equations nearly without any intermediate text. And then, on page 101, the terms *fracture*, *fracture mechanics* and *fracture toughness* pop up for the first time: "*In the fracture mechanics approach, instead of comparing the maximum stress value with a critical stress value, the material failure is predicted by comparing the stress intensity factors K_I and K_{II} with some critical value K_c. This critical value is called the critical stress intensity factor or the fracture toughness of the material*." That is all which is said about the concept of fracture mechanics! Another ten lines are spent for the three fracture modes and a failure curve for mixed mode loading is given. Though it has been IRWIN [1957], who introduced the stress intensity concept, not even a reference is given.

GRIFFITH's energy considerations on crack propagation and the relation of the energy release rate to the stress intensity factor follow. Though the latter is naturally due to IRWIN [1957], as the stress intensity concept has been introduced 36 years after GRIFFITH's pioneering work, no respective reference is given. Instead, GRIFFITH [1921] is addressed as "*father of modern fracture mechanics*", which is a rather strange historical view.

The "*effect of plasticity*" is discussed on 25 pages, restricting to the small scale yielding correction and DUGDALE's model and including the experimental determination of K_c for "*brittle fracture theory*". Again, some fundamental term is introduced casually without any explanation. Finally, on page 171, the term "*linear elastic fracture mechanics*" appears for the first time. The "*theory of plasticity*" is reduced to a reference to HILL's book of 1950 and two equations, namely "*Mises and Tresca's yield criteria*", which "*can be used to calculate the plastic zone size*". Examples apply US units like ksi or kip-in$^{-3/2}$.

A few pages are spent on the *J*-Integral, introduced as "*an integral expression proposed by James R. Rice (1968) can compute the strain energy release rate for a cracked elastic solid in a different and simpler manner*". Its prominent importance in elastic plastic fracture mechanics under the deformation theory of plasticity is not even mentioned. The "*experimental evaluation of critical J-integral value*" refers to "*Begely and Landis*", meaning BEGLEY and LANDES. Likewise cursory is the chapter on fatigue crack growth.

Stress intensity factors for some practical crack geometries, which one might expect to find immediately after chapter 2 on "*the elastic crack model*", follow in chapter 7, and after some 20 pages on the numerical determination of stress intensity factors, WESTERGAARD's solution of the two-dimensional elastic boundary value problem at a crack by the theory of complex analytical functions is presented. Here at the latest, the reviewer's doubts that the present textbook is not that well organised as the author claimed, found their final verification.

The book ends with "*advanced topics*", that is primarily fracture toughness of fibre-strengthened brittle matrix composites, which is obviously the area of expertise of the author.

The reviewer takes the risk that his students will not like him but he will not teach fracture mechanics according to this book. His understanding of teaching is not just presenting a compendium of equations to the students but communicating a motivation for the subject as well as a fundamental understanding of its concepts and, last but not least, leading them to the current state-of-the-art in science and application.

W. Brocks

Paglietti, A.
Plasticity of Cold Worked Metals – A Deductive Approach
WITpress 2007, 192 pp.
ISBN-10: 1845640659, ISBN-13: 978-1845640651
79,99 €, 65,00 £, 125,00 $

The book is addressed to research workers in the field of plasticity. The main concern of the book is to present yield criteria and the hardening behaviour of metals. The framework is linear continuum mechanics, so the applications are limited to small deformations. It turns out, that only isotropic Huber-v.Mises criteria with isotropic and kinematic hardening are considered. Hardening rules for the parameters are given as evolution functions, and the identification of the constants by experiments is shown. Although the anisotropy of plasticity is often mentioned, this is exclusively referred to kinematic hardening, but not to distortional hardening. So the main open questions in plasticity, namely how to describe induced anisotropy in metal forming, is hardly tackled in this book. The different forms of the J2 theory are described in a detailed and perhaps lengthy way, sometimes confusing with all the different rotations. The references to the literature is extremely poor. Only 16 works have been cited, out of a vast offer in this highly important field.

A. Bertram

Slaughter, William S.
The linearized Theory of Elasticity
2002, XVI, 543 pp. 36 illus., Hardcover
ISBN: 978-0-8176-4117-7
89,95 $, 115,56 €

The book presents a careful and detailed introduction to linear elasticity. The notation is direct and modern. The first chapter starts with a brief review of "mechanics of materials" which, however, does not really describe its contents. Instead, one reads some remarks on stresses, elasticity, torsion and bending of beams. To the opinion of the reviewer, this chapter is rather useless and could be suppressed.
The introduction to kinematics starts with the non-linear description and does the linearization rather late, so that the reader gets also informed about what is usually not taught in linear courses.
A careful introduction to the variational calculus helps the student with the understanding of this important item of elasticity. A long introduction to complex variable methods in elasticity is given in the last chapter with applications to antiplain strain and plain stress and strain problems.
The list of references is rather small for such a book, but acceptable for such a classical content. All in all, this is a recommendable textbook for students of all engineering sciences.

A. Bertram