Book Reviews

Reviewed by Janez Grum

E-mail: janez.grum@fs.uni-lj.si

1   Thermal Fatigue Tool Life and Cracking Prediction for Direct Tooling
   by: C. Huat Ng
   Published 2012
   by Shaker Verlag GmbH, P-O- BPX 101818, D-52018 Aachen, 212 pp
   ISBN: 978-3-8440-0635-3, ISSN: 1615-7192

The book presents a strain life analysis involving various prediction methods of the thermal fatigue tool life for the direct tooling which are produced using laser additive material. Different tool life prediction methods composed of computational, theoretical and experimental are given. The assumptions and possible solutions that are especially viable for the predictions of tool life and cracking in the direct tooling models are presented. The mechanism of the thermal fatigue tool life ant the fracture mechanics differ depending upon its geometrical designs, structural materials, process parameters and fatigue behaviours. It is thus important to understand the inherent architecture and the process of tool life model, the fracture prediction which is associated with the various laser additive materials in the structural model design, and the applied research applications of industrial case studies.

   Tool life prediction and crack length of the direct tooling in thermal fatigue analysis can be made using various methods. The utility of such models for the predictions of direct tooling in the case of laser additive material in the die casting and fatigue tool parameters is required. An emerging field of applied research in the industry shows that the predicted results are practically feasible. From the fracture mechanics analysis, strain life method with stress concentration location in the Coffin Manson calculations is presented. The stress concentration is analysed using the computational simulation. The thermal strain and stress concentration factor are considered in the thermal fatigue tool life analysis.

   The process for analysing the stress distribution at the stress concentration location through stress intensity factor and J integral are performed using the Griffith theory. Thermal fatigue crack accounting for the conditions of critical crack length is demonstrated. Hence, the Paris law calculations are made and the stress intensity results of ANSYS Workbench simulation and many publications data are analysed. The fracture model parameters are assumed to be representative of typical practical situations as shown by the experimental test results. Based on the fracture mechanics, the stress intensity factor and the J integral values are predicted.

2 Manufacturing Technology Materials, Processes and Equipments
by: H.A. Youssef, H.A. El-Hofy and M.H. Ahmed
Published 2012
by CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway
NW, Suite 300, Boca Raton, FL 33487-2742, USA, 985 pp
ISBN: 987-1-4398-1085-9 (hardback)

This textbook provides comprehensive knowledge and insight into various aspects of manufacturing technology, processes, materials, tooling and equipment. Its main objective is to introduce the grand spectrum of manufacturing technology to individuals who will be involved in the design and manufacturing of finished products, to provide them with the basic information on manufacturing technologies. The next material is presented mainly in descriptive manner, where the emphasis is on the fundamentals of the process, its capabilities, typical applications, advantages and limitations. Mathematical modelling and equations are used only when they enhance the basic understanding of with which the material deals.

The book has been written specifically for undergraduates in mechanical, industrial, manufacturing, and materials engineering disciplines of the second of forth levels to cover complete courses of manufacturing technology taught in engineering colleges and institutions all over the world. It also covers the needs of production and manufacturing engineers and technologists participating in related industries where it is expected to be part of their professional library. Additionally, the book can be used by students in other disciplines concerned with design and manufacturing, such as automotive and aerospace engineering.

The book is a fundamental textbook that covers all of the manufacturing processes, materials, and equipment used to covert raw materials to final product. It presents the materials used in manufacturing processes. The book also presents heat treatment processes, smelting of metals, and other technological processes such as casting, forming, powder metallurgy, joining, and surface technology. Manufacturing processes for polymers, ceramics, and composites are also covered.

The book also covers traditional, non-traditional, and advanced manufacturing technologies and applications. It sheds light on modern manufacturing technologies. In this regard, numerical control, industrial robots and hexapods are covered. Product quality control, automation in manufacturing, and health, safety, and environmental aspects in manufacturing are also discussed.

3 Research Methods for Science
by: M.P. Marder
Published 2011
by Cambridge University Press, The Edinburgh Building,
Cambridge CB2 8 RU, UK, 227 pp
ISBN: 978-0-521-14584-8 Paperback

A unique introduction to the design, analysis, and presentation of scientific projects, this is an essential textbook for undergraduate majors in science and mathematics.

- Gives an overview of the main methods used in scientific research including hypothesis testing, the measurement of function relationships, and observational research.

- Describe important features of experimental design, such as the control of errors, instrument calibration, data analysis, laboratory safety, and the treatment of human subjects.

- Discusses important concept in statistics, focusing on standard error, the meaning of *p*-values, and use of elementary statistical tests.

- Introduces some of the main ideas in mathematical modelling, including order-of-magnitude analysis, function fitting, Fourier transformations, recursion relations, and difference approximations to differential equations.

- Provides guidelines on accessing scientific literature, and preparing scientific papers and presentations.

4   ASM Handbook, Volume 23: Materials for Medical Devices
by: Roger J. Narayan, University of North
Published 2012
by ASM International, Materials Park,
Ohio 44073-0002, USA, 384 pp
ISBN: 978-1-61503-827-5

Resent research efforts have involved the development of biodegradable materials and artificial tissues. For example, physicians and researchers have sought to create biodegradable implants, including stents, out of magnesium and magnesium alloys. In addition, efforts have been underway since the 1970s to develop artificial tissues and organs, including substitutes for cartilage and skin. These artificial tissues and organs involve seeding of cells and incorporation of bioactive factors within scaffold materials such as bioactive ceramics, biodegradable polymers, carbon nanotube-containing composite materials, and natural materials. Significant research efforts are underway to optimised the properties of the scaffold materials. As noted by Agrawal, scaffold materials must be porous, biocompatible, and biodegradable. In additional, these materials must encourage cell growth and exhibit appropriate mechanical properties. In recent decades polymers have also been used for controlled release of pharmacologic agents. For example, polymer-coated stats and pegylated interferon alpha have been translated to clinical use.

The ASM Handbook of Materials for Medical Devices describes the properties of metals, ceramics, polymers and composite materials used in medicine and dentistry. Degradation of biomaterials and cell-material interactions are also considered. These chapters indicate that many biomaterials operate under very demanding and highly corrosive conditions. Above all, improving cell-material interactions and tissue-material interactions is necessary to enhance the performance of conventional medical devices and enable the development of medical devices with novel functionalities.

5 The Advanced Smart Grid Edge Power Driving Sustainability
   by: A. Carvallo and J. Cooper
   Published 2011
   by Artech House, Boston, London, 685 Canton Street,
   Norwood, MA 02062, USA, 237 pp
   ISBN: 13: 978-1-60807-127-2

This book contains the following chapters:

- The Inevitable Emergence of the Smart Grid

- The Rationale for an Advanced Smart Grid

- Smart Convergence

- Smart Gird 1.0 Emerges

- Envisioning and Designing Smart Gird 2.0

- Today's Smart Gird

- Fast-Forward to smart Grid 3.0.

Placing emphasis on practical how-to guidance, this cutting-edge resource provides a firsthand insider's perspective on the advent and evolution of smart grids in the 21st century (Smart Grid 1.0). *The Advanced Smart Grid*: Edge Power Driving Sustainability uses the design and construction of the first citywide smart grid in the USA as a case study, sharing the many successes and lessons learned. Readers gain working knowledge of successful tools and as they strive to build a next-generation smart grid (Smart Grid 2.0). Additionally, this unique book offers a glimpse at the future with interconnected advance smart grids and a redesigned energy ecosystem (Smart Grid 3.0).

6 Introduction to Modern EW Systems
   by: Andrea De Martino
   Published 2012
   by Artech House, Boston, London, 685 Canton Street,
   Norwood, MA 02062, USA, 417 pp
   ISBN: 13: 978-1-60807-207-1

A definition of the main subject of this book, electronic warfare, is "a set of measures and actions performed by the conflicting sides to detect and electronically attack enemy electronic systems for the control of forces and weapons, as well as to electronically defend one's own electronic systems and other targets". Electronic warfare is aimed to negate or at least reduce the effectiveness of a wide class of enemy systems, not only radar but also infrared sensors/seekers, radio communications and navigation equipment.

Dr. De Martino's book starts with operational aspects and scenarios, analyses their relevant emitters and their signals, continues with the topics of emitter detection and classification/identification as well as the very demanding aspect of precision emitter

location and ends with the different electronic measures used against the hostile emitter/platform.

Such an organisation makes the book of interest to both operational and technical people, probably with more emphasis on this latter class of readers. As a matter of fact, there are significant aspects of this book that provide real added value compared to others published on the same topic until about ten years ago. The first is the genuine system engineering approach, as discussed before. The second is the updated treatment of the most recent methods, techniques and technologies for electronic warfare system. The third and last benefit is the thoroughness of the text, with detailed and deep discussions of items not frequently treated in most electronic warfare books. These topics include the intercept and jamming of radio communications, of infrared systems, of laser systems, as well as the electronic actions against the main weapons of the so-called asymmetric warfare, i.e. against the improvised explosive devices and portable weapons.

The book contains the following chapters:

- Introduction to Electronic Warfare Scenarios

- Evolution of Signal Emitters and Sensors

- Electronic Warfare RF Band Sensor Systems

- RF Direction-Finding and Emitter Location Techniques

- Electronic Countermeasure System

- ECM Techniques and Sensor ECCMs

- Appendix A: Signal Detection in Sensor Receivers

- Appendix B: Introductory Concept of Estimation Theory

- Appendix C: Antennas and Phased Array Antennas

- Appendix D: Analogue Modulation Methods

- Appendix E: Evaluation of BER Increase for Noise and CW Tone Jamming in Communication Systems Employing BFSK Modulation.

7   Probability and Random Processes
by: G.R. Grimmett and D.R. Stirzaker
Published 2011, reprinted 2010, 2011, 2012
by Oxford University Press, Great Clarendon Street,
Oxford OX2 6DP, UK, 596 pp
ISBN: 978-0-19-857222-0 (pbk)

The third edition of this successful text gives an introduction to probability and many practical applications. The authors have four main aims:

- to provide a thorough but straightforward account of basic probability, giving the reader a natural feel for the subject unburdened by oppressive technicalities

- to discuss important random processes in depth with many examples

- to cover a range of important but less routine topics

- to impart to the beginner the flavour of advanced work.

The book begins with the basic ideas common to most undergraduate courses in mathematics, statistics and the sciences; it concludes with topics usually found at graduate level. Highlights of this third edition include new sections on sampling and Markov chain Monte Carlo, renewal-reward, queuing networks, stochastic calculus, Itô's formula and option pricing in the Black-Scholes model for financial markets. In addition there are many (more than 400) new exercises and problems that are entertaining and instructive. The solutions to these problems can be found in the companion volume One Thousand Exercises in Probability (OUP, 2001).

The book contains the following chapters:

- Events and their probabilities

- Random variables and their distributions

- Discrete random variables

- Continuous random variables

- Generating functions and their applications

- Markov chains

- Convergence of random variables

- Random processes

- Stationary processes

- Renewals

- Queues

- Martingales

- Diffusion processes

- Appendix Foundations and notation, Further reading, History and varieties of probability, John Arbuthnot's preface to Of the laws of chance (1692), Table of distributions, Chronology.

8   X-Rays, Neutrons and Muons Photons and Particles for Material Characterization
by: W.E. Fischer with the collaboration of R. Morf and M. Storni
Published 2012
by Wiley-VCH Verlag GmbH & Co. KgaA, Boschstrasse 12,
69469 Weinheim, Germany, 233 pp
ISBN: 978-3-527-30774-6

It is the aim of condensed matter research to investigate the properties of matter and to understand its behaviour through insight into its atomic structure and dynamics.

X-rays, neutrons, and muons became very prominent probes for these kinds of investigations down to atomic resolutions. One of the principal experimental means are scattering processes of these external probes at the sample to be investigated. The data thereby obtained provide information about structure and dynamics of the sample. This endeavour is facilitated considerably if the following requirements are fulfilled:

- proper understanding of the basic features of a scattering process

- knowledge of the elementary interactions of each probe with the constituents of matter.

Much of the first part of this book is dedicated to establish the theoretical principles in order to reach that goal. An attempt is made to cover the applications of the different probes to physics of condensed matter, which address common features. Presumably, this restricts the discussion in a natural way to scattering experiments which can be treated within linear response theory. Even within this restricted point of view, there still exist questions of complementarily which are quite instructive.

This book has its origin in a set of introductory lectures given at various national and international summer schools on methods of scattering for physics of condensed matter. The audience consisted usually of young scientists on the graduate and post-doc-level. Accordingly we assume that the reader of this book has general knowledge corresponding to the usual physics courses – in particular

- classical electrodynamics

- thermodynamics and statistical mechanics

- quantum mechanics

- as well as a basic course in solid-state physics.

The latter is particularly helpful since this book is not a textbook on condensed matter physics.