Book Reviews

Reviewed by Janez Grum

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1 Medical Device Software Verification, Validation, and Compliance

by: David A. Vogel
Published 2011
by Artech House, Boston, London, 685 Canton Street,
Norwood, MA 02062, USA, 424pp
ISBN-13: 978-1-59693-422-1

This is the first book written specifically to help medical device and software engineers, QA and compliance professionals, and corporate business managers better understand and implement critical verification and validation processes for medical device software. Offering a much broader, higher-level picture than books in the field, this book helps readers think critically about software validation to build confidence in their software's safety and effectiveness.

From software embedded within medical device to software that performs as a medical device itself, this comprehensive book explains how properly handled validation throughout the development life cycle can help bring higher-quality medical devices to completion sooner, in compliance with regulations.

The book contains the following chapters:

Part 1: Background

- the evaluation of medical device software validation and the need for this book
- regulatory background
- the FDA software validation regulations and way you should validate software anyway
- organisational considerations for software validations
- the software (developments) life cycle
- verification and validation: what they are, what they are not
- the life cycle approach to software validation
- supporting activities that span the life cycle: risk management
- other supporting activities: planning, reviews, configuration management, and defect management.

Part 2: Validation of medical device software

- the concept phase activities
- the software requirements phase activities
- the design and implementation phase activities
- the testing phase activities
- the maintenance phase validation activities.

Part 3: Validation of non-device software

- validating automatic process software: background
- planning validation for non-device software
- intended use and the requirements for fulfilling intended use
- risk management and configuration management of non-device software activities that span the life cycle
- non-device testing activities to support validation
- non-device software maintenance and retirement activities.

2 Joining: Understanding The Basics

by: F.C. Campbell
Published 2011
by ASM International, Materials Park, Ohio 44073-0002, USA, 336pp
ISBN-13: 978-1-61503-825-1, ISBN-10: 0-61503-825-6

This book is a rather brief introduction to industrial joining processes. The intent was to take an extensive amount of technical information on the individual joining processes and boil it down to provide a readable resource on joining. The majority of the information in this book was extracted from the ASM Handbook series. The book covers all of the major welding processes: brazing and soldering, mechanical fastening, mechanical fastening, and adhesive bonding.

Welding is a process that joins materials, usually metals or thermoplastics, by causing coalescence. This is often done by melting the workpieces and adding a filler material to form a pool of molten material (the weld pool) that cools to become a strong joint, with pressure sometimes used in conjunction with heat, or by itself, to produce the weld. No other technique is as widely used as welding to join metals and alloys efficiently and to add value to their products. Most of the familiar objects in modern society, from buildings and bridges, to vehicles, computers, and medical devices, could not be produced without the use of welding.

The book contains the following chapters:

- introduction to joining
- arc welding of metals

- resistance welding
- other fusion welding processes
- metallurgy variables in fusion welding
- solid-state welding and bonding
- brazing and soldering
- mechanical fastening
- adhesive bonding
- materials issues in joining.

This book is intended for those wishing to learn more about the technology of joining of materials. It would be useful to almost anyone who is interested in or deals with joining, including designers, structural engineers, material and process engineers, manufacturing engineers, managers, and students and faculty. It is brief enough to serve as a first text on joining that can later be supplemented by more advanced texts.

3 Fatigue and Fracture: Understanding the Basics

by: F.C. Campbell
Published 2012
by ASM International, Materials Park, Ohio 44073-0002, USA, 385pp
ISBN-13: 978-1-61503-976-0, ISBN-10: 1-61503-976-7

This book deals with the fatigue and fracture of engineering materials. Although modern fatigue analysis and fracture mechanics are mathematical disciplines, and mathematical rigour is normally found in texts on fatigue and fracture mechanics, I have endeavoured to construct a more basic book that balances the major points of fatigue and fracture analysis without burdening the reader with too much complex mathematical development.

The book contents the following chapters:

- introduction to fatigue and fracture
- mechanical behaviour
- ductile and brittle fracture
- fracture mechanics
- fatigue of metals
- fatigue and fracture of engineering alloys
- metallic joints – mechanically fastened and welded
- fracture control and damage tolerance analysis
- fatigue and fracture of ceramics and polymers

- fatigue and fracture of continuous – fibre polymer-matrix
- high-temperature failures
- wear failures
- environmentally-induced failures
- the failure analysis process
- defects leading to failure.

This book is ideal for the engineer with the basic knowledge of materials who is just starting to be involved with either failure analysis or fatigue and fracture analysis. It also provides a sound technical groundwork for further study of more advanced texts. This book is useful for the experienced failure analyst who needs a more thorough background in fatigue and fracture mechanics, or for the fatigue and fracture engineer who needs to know more about failure modes.

4 A Student's Guide to Data and Error Analysis

by: H.J.C. Berendsen
Published 2011
by Cambridge University Press, The Edinburgh Building, Cambridge CB2 8 RU, UK, 225pp
ISBN: 978-0-521-1194095 (Hardback), ISBN: 978-0-521-13492-7 (pbk.)

This book is written as a guide for the presentation of experimental data including a consistent treatment of experimental errors and inaccuracies. It is meant for experimentalists in physics, astronomy, chemistry, life sciences, and engineering. However, it can be equally useful for theoreticians who produce simulation data: they are often confronted with statistical data analysis for which the same methods apply as for the analysis of experimental data. The emphasis in this book is on the determination of best estimates for the values and inaccuracies of parameters in a theory, given experimental data. This is the problem area encountered by most physical scientists and engineers. The problem area of experimental design and hypothesis testing – excellently covered by many textbooks – is only touched upon but not treated in this book.

The text can be used in education on error analysis, either in conjunction with experimental classes or in separate courses on data analysis and presentation. It is written in such a way – by including examples and exercises – that most students will be able to acquire the necessary knowledge from self-study as well. The book is also meant to be kept for later reference in practical applications. For this purpose a set of 'data sheets' and a number of useful computer programs are included.

All students taking laboratory courses within the physical sciences and engineering will benefit from this book, whilst researchers will find it an invaluable reference. This concise, practical guide brings the reader up to speed on the proper handling and presentation of scientific data and its inaccuracies.

Throughout the book computer programs are included to facilitate the computations needed for applications. There are several professional software packages available for statistical data analysis.

The book contains the following chapters:

- *Part 1: Data and error analysis*: The presentation of physical quantities with their inaccuracies, errors – classification and propagation, probability distributions, processing of experimental data, graphical handling of data with errors, fitting functions to data, back to Bayes – knowledge as a probability distribution.
- *Part 2: Appendices*: Combining uncertainties, systematic deviations due to random errors, characteristic function, from binomial to normal distributions, central limit theorem, estimation of the variance, standard deviation of the mean, weight factors when variances are not equal, least-squares fitting.
- *Part 3*: Python codes.
- *Part 4*: Scientific data.

5 Reliability in Scientific Research Improving the Depending of Measurements, Calculations, Equipment and Software by: I.R. Walker Published 2011 by Cambridge University Press, The Edinburgh Building, Cambridge CB2 8 RU, UK, 587pp ISBN: 978-0-521-85770-3 Hardback

Most scientists who spend a significant of time in the laboratory are only too well aware of the amount of time, wasted resources, and diminished morale that result from unexpected problems that inevitably arise in research. These reliability problems include things such as sudden leaks in vacuum systems, vibrations in sensitive optics, and bugs in computer software. The purpose of this book is to help those working in the physical sciences and engineering to:

- identify potential sources of unexpected problems in their work
- reduce the likelihood of such problems
- detect and eliminate them if they occur.

Most of the problems discussed herein concern technical matters, as in the above examples. However, a significant part of the book is devoted to human errors and biases, and other similar issues.

In modern research it is common practice to employ a variety of different experimental methods, often in combination. Some – such as electronics, computing, vacuum, and optical – can be considered ‘core techniques’, which are widely used in many areas in the physical sciences and engineering. These are a major focus of this book. There are numerous specialised techniques used in particular research fields that can be sources of problems, but which cannot be included in a work of this size.

If one aims to cover a large range of subjects in a single volume, the depth at which they can be treated is necessarily limited. For this reason, each chapter is accompanied by extensive references that will allow the reader to explore the issue in more detail. Those that seemed to the author to be particularly useful have been placed in the 'Further reading' sections at the end of most chapters.

Each chapter is also provided with a summary of its key points. This allows busy readers to obtain a quick overview of important potential problems and their solutions in particular area.

It is not the propose of this book to provide basic instruction on various experimental techniques and their use. For such, the reader is referred to the references at the end of each chapter. It is assumed that the reader is familiar with the principal ideas behind the methods discussed here, and their associated terminologies. Also, this book is not intended to cover safety matters, although safety is mentioned now and again, and many of the suggestions contained within can improve it.

This book contains the following chapters:

- basic principles of reliability, human error, and other general issues
- mathematical calculations
- basic issues concerning hardware system
- obtaining items from commercial sources
- general points regarding the design and construction of apparatus
- vacuum system leaks and related problems
- mechanical devices and systems
- cryogenic system
- visible and near-visible optics
- electronic system
- interconnecting, writing, and cabling for electronics
- computer hardware and software, and stored information
- experimental method.

6 The Product Wheel Handbook, Creating Balanbe Flow in High-Mix Process Operations by: P.L. King, J.S. King Published 2013 by CRC Press, Taylor & Francis Group, 6000 Broken Sound Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, a productivity press book, 199pp ISBN: 978-1-4665-5418-4

The product wheel concept, conceived, pioneered, and refined within several process companies relatively independently, incorporates these features:

- Products are produced in a regularly repeating, fixed, sequence.
- The sequence is optimised to minimise changeover cost, time, difficulty, or all of these factors. Products are always made in the same sequence.
- The time for one complete cycle (cycle time, wheel time) is relatively fixed.
- The overall wheel time is divided among products based on relative demand for each product. Thus higher-volume products have longer 'spokes' on the wheel; lower-demand products have shorter spokes.
- Very lower-demand products might not be made on every cycle, but may be scheduled for every second or every fourth cycle, for example. But when they are made, they are made at the same point in the product sequence.
- The wheel is designed based on average product demand, but what is actually made on any cycle is based on current orders or on inventory consumed, based on lean pull system principles.

Among the companies who have used the wheel concept to provide a competitive advantage are BG Products, Inc., Appleton, the DuPont Company, the Down Chemical Company, and Exxon Mobil. These and other companies pioneering the product wheel methodology have used it to advantage in the production of automotive and house paints, extruded polymers, paper and plastic sheets goods, industrial chemicals, engine oil additives, waxes and pasts, laminated circuit board materials, and a host of other products. In addition to the obvious benefits of reduced changeover cost, reduced inventories, increased capacity, and improved customer delivery performance, most users have found the greatest benefits to be the regularity and predictability it brings to the operation, they have found that the organised, disciplined structure that product wheels provide reduces the chaos often found in production scheduling, allows planners and schedulers to spend less of their personal time resolving schedule problems, and provides a stable platform so that abnormal events can be dealt with in a less stressful, more logical manner. Response to problems becomes less reactive and more purposeful.

7 Semiconductor X-Ray Detectors

by: B.G. Lowe, R.A. Sareen
Published 2014
by CRC Press, Taylor & Francis Group,
6000 Broken Sound Parkway NW, Suite 300, Boca Raton,
FL 33487-2742, USA, a productivity press book, 585pp
ISBN: 978-1-4665-5400-9

Identifying and measuring the elemental X-rays released when materials are examined with electrons, protons, alpha particles, etc. Or X-rays and gamma rays are still considered to be the primary analytical technique for routine and non-destructive materials analysis. The lithium drifted silicon X-ray detector with its good resolution and peak to background, pioneered this type of analysis on electron microscopes, X-ray fluorescence instruments, and radioactive source- and accelerator-based excitation systems. Although rapid progress in silicon drift detectors (SDDs), charge coupled

devices (CCDs), and compound semiconductor detectors, including renewed interest in alternative materials such as CdZnTe and diamond has made the Si(Li) X-ray detector nearly obsolete, the device serves as a useful benchmark and still is used in special instances where its large, sensitive depth is essential.

Semiconductor X-Ray Detectors focuses on the history and development of Si(Li) X-ray detectors, an important supplement to the knowledge now required to achieve full understanding of the working of SDDs, CCDs, and compound semiconductor detectors. The book provides an up-to-date review of the principles, practical applications, and state of the art of semiconductor X-ray detectors. It describes many of the facets of X-ray detection and measurements using semiconductors from manufacture to implementation. The initial chapters present a self-contained summary of relevant background physics, materials science, and engineering aspects. Later chapters compare and contrast the assembly and physical properties of systems and materials currently employed, enabling readers to fully understand the materials and scope for applications.

The book contains the following chapters:

- introduction
- detector response function
- detector artefacts
- contacts
- Si(Li) X-ray detectors
- HPSi and HPGe X-ray detectors
- X-ray detectors based on silicon lithography and planar technology
- CCD-based X-ray detectors
- silicon drift X-ray detectors
- wide bandgap semiconductors
- history of semiconductor X-ray detectors and their applications.

8 Essential Readings in Magnesium Technology
by: S.N. Mathaudh, A.A. Luo, N.R. Neelameggham, E.A. Nyberg, W.H. Sillekens
Published 2014
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey, 111 River Street, Hoboken, NJ 07030-5774, USA, 634pp
ISBN: 978-1-118-85894-3

Due to their extraordinary low densities magnesium and its alloys have continued to be the focus of intensive research and development over the past century though widespread application has been restricted by property, cost, and performance limitations with respect to other metallic materials such as Al-alloys, Ti-alloys, and ferrous alloys. However in light of Mg's availability and global efforts to reduce weight in the transport

sector, there has been a tremendous resurgence in research, development, and application of these remarkable alloys.

Along with this renaissance came renewed interest from government, academia, and industry, and in the year 2000, the first Magnesium Technology Symposium was held at The Minerals, Metals & Material Society (TMS) Annual Meeting and Exhibition in Nashville, Tennessee. A proceedings volume with 56 manuscripts was published in parallel with the new symposium, and the tremendous interest that was generated enabled the symposium to be held annually with the *Magnesium Technology* proceedings becoming the *de facto* publishing for magnesium industry.

Introductions to each part further frame the importance and significance of the selected manuscript. The papers selected for inclusion were divided along nine topical thematic areas, with the papers arranged by subject area rather than chronologically to support the cohesiveness of subtopics within each theme.

The nine themes are as follows:

- magnesium technology history and overview
- electrolytic and thermal primary production
- melting, refining, recycling, and life-cycle analysis
- casting and solidification
- alloy and microstructural design
- wrought processing
- modelling and simulation
- joining
- corrosion, surface treatment, and coating.

9 Advanced Composites for Aerospace, Marine and Land Application Proceedings of a Symposium Sponsored by The Minerals, Metals & Materials Society (TMS) Held during TMS 2014 143rd Annual Meeting& Exhibition

by: T. Sano, T.S. Srivatsan, M.W. Peretti
Published 2014
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey,
111 River Street, Hoboken, NJ 07030-5774, USA, 268pp
ISBN: 978-1-118-88891-9

This symposium is the first in a planned and forthcoming series on the topic of advanced composites and was reasonably well-represented with abstracts from engineers, technologists, and scientists spanning the domains of academia, research laboratories, and industrial located both within the USA and few countries overseas. Over 30 abstracts were approved for presentation at the symposium and were divided into four sessions:

- *session 1*: processing and design of composites
- *session 2*: characteristics of composite microstructures and phases
- *session 3*: mechanical and material property evaluation
- *session 4*: interface and bonding of composite system.

In this symposium, research describing the latest advances in composite materials specifically for aerospace, maritime, or land applications were emphasised and presented. They have made every attempt to bring together individuals who could put forth recent advances in their research while concurrently enhancing our prevailing understanding of aspects related to the science, engineering, and far-reaching technological application of composite materials.

This bound volume will provide engineers, scientists, and technologists with both new perspectives and directions in their research endeavours with the purpose of evaluating and understanding the behaviour of composite materials so as to enable their selection and use for varied applications in the sectoring spanning aerospace, marine, and land-based components and products.

10 Proceedings of the 2nd World Congress on Integrated Computational Materials Engineering (ICME)

by: M. Li, C. Campbell, K. Thornton, E. Holm, P. Gumbsch
Published 2014
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey,
111 River Street, Hoboken, NJ 07030-5774, USA, 303pp
ISBN: 978-1-11876-689-7

This is a collection of manuscript presentation at the 2nd World Congress on Integrated Computational Materials Engineering. A specialty conference organised by The Minerals, Metals & Material Society (TMS) and the five conference organisers, and held in Salt Lake City, Utah, USA, on July 7–11, 2013.

Integrated Computational Materials Engineering (ICME) has received international attention as it has been proven to shorten product and process development time, while lowering costs, thereby improving outcome. Building on the great success of the 1st Congress on Integrated Computational Materials Engineering in 2011 and the motivation of Materials Genome Initiative (MGI) announced in June 2011, the 2nd World Congress on ICME convened researches, educators, and engineers to assess the state-of-the-art ICME and determine paths to further the global advancement of ICME. Over 200 authors and attendees from all over the world contributed to this conference in the form of presentations, lively discussions, and papers presented in this volume. The international advisory committee members representing 14 different countries actively participated in and promoted the conference.

The specific topics highlighted during this conference included ICME success stories and applications with separate session on lightweighting, composites, ferrous, and non-ferrous applications; process optimisation; materials data for ICME; building blocks

for ICME with separate session on experimental tools, first principles and atomistic tools, computational thermodynamic in kinetics, process and performance modelling; and ICME challenges and education. The conference consisted of both all-conference single session and parallel session in integrated 10 keynote presentations from international experts, two panel discussion, 83 contributed presentations, and 70 poster presentations.

The 45 papers presented in these proceeding are divided into five sections:

- ICME success stories and applications
- process optimisation
- material data for ICME
- building blocks of ICME
- ICME challenge and education.

These manuscripts represent a cross-section of presentation and discussions from this conference.

11 Liquid Metal Processing & Casting
Proceedings of the 2013 International Symposium
by: M.J.M. Krane, A. Jardy, R.L. Williamson, J.J. Beaman
Published 2014
by WILEY, John Wiley & Sons, Inc. Hoboken, New Jersey,
111 River Street, Hoboken, NJ 07030-5774, USA, 362pp
ISBN: 978-1-118-00202-5

This proceedings volume represents the work presented at the tenth International Symposium on Liquid Metal Processing & Casting held in Austin, Texas, USA from 22–25 September, 2013. This symposium is held every other year to bring together an international group of researchers to discuss important technical fields and present their latest research results. The conference is the principal international forum for research and development in the fields of melting, refining, and casting of special metals and alloys. Contribution covers a range of topics including vacuum arc and electroslag remelting, advances in process modelling, novel casting techniques, and characterisation and modelling of inclusions, segregation, and structure in cast metals.

Papers from both the oral and poster sessions are included in this volume. The collection is divided into the following five areas: electroslag remelting (24 papers), defects (10 papers), vacuum arc remelting (4 papers), aluminium processing (3 papers), and miscellaneous section with 11 papers on topic ranging from microsegregation to melt control. This volume contains a good mix of papers covering both experimental studies and mathematical modelling/simulation studies, with contributions from industry, academia, government laboratories, and teams from combination of these institution.

12 Ultrasonic Micro/Nano Manipulations
Principles and Examples
by: Junhui Hu
Published 2014
by World Scientific, New Jersey, London, Singapore,
Beijing, Shanghai, Hong Kong, Taipei, Chennai,
World Scientific Publishing Co. Pte. Ltd., 5 Toh Tuck Link,
Singapore 596224, 255pp
ISBN: 978-981-4525-31-2

This book is designed for scientists, engineers, students, and research project managers who are engaged in the research and development in ultrasonic manipulation technology or are interested in this technology. It gives the basic physical principles of ultrasonic micro/nano manipulations, and detailed methods of implementing these principles. Lots of examples are given in this book to help the readers better understand the applications of these principles and characteristics of ultrasonic manipulators utilising these principles.

Demands for high-performance micro/nano manipulations, which come from the manufacture of microelectronic and photonic devices, biomedical apparatus, nanoscience and nanotechnology, renewable energy, environment protection, high-end appliances, etc. have been rapidly increasing in recent years. However, there are very few books on ultrasonic manipulation technology, which is one of the important means in micro/nano manipulations. I hope that this book will make a contribution to the development and application of micro/nano manipulations technology.

Although this book involves the MEMS-based acoustic manipulation to some extent, the physical principles, demonstrated in this book, can also be applied in the MEMS-based acoustic manipulations.

Many outstanding scientists have contributed greatly to the physical principles of ultrasonic micro/nano manipulations, design, and fabrication of the devices based on these physical principles and modelling characterisation and optimisation of these devices. Due to the limited topic number in this book, only some of their work, which is relevant to the topics, is cited. However, the work of the others is equally important to ultrasonic micro/nano manipulations.