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## Book Reviews

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### **1 Introduction to Composite Materials Design, Second Edition**

**by: E.J. Barbero**

**Published 2011**

**by CRC Press, Taylor & Francis Group, 6000 Broken Sound**

**Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 520pp**

**ISBN: 978-1-4200-7915-9**

It has been over ten years since the first edition appeared. In the meantime, utilisation of composites has increased almost every market. Boeing's 787 main technological advance is based on widespread incorporation of composites, accounting for about 50% of the aircraft. Its use allows the plane to be lighter and consequently more fuel efficient. It also allows higher moisture content in the cabin, thus increasing passenger comfort. Cost and production time still hamper utilisation of composites in the automotive sector, but as in all other industries, there is a relentless transformation from using conventional to composite materials in more and more applications.

Increased utilisation of composites requires that more and more engineers be able to design and fabricate composite structures. As a result, practicing engineers and students are equally interested in acquiring the necessary knowledge. This second edition incorporates the advances in knowledge and design methods that have taken place over the last ten years, yet it maintains the distinguishing features of the first edition.

The book contains the following chapters:

- *Introduction*: Basic concepts, the design process, composites design methods, design for reliability, fracture mechanics.
- *Materials*: Fibre reinforcements, fibre types, fibre-matrix compatibility, fibre forms, matrix materials, thermoset matrices, thermoplastic matrices, creep, temperature and moisture, corrosion resistance, flammability.
- *Manufacturing processes*: Hand lay-up, prepreg lay-up, bag moulding, autoclave processing, compression moulding, resin transfer moulding, vacuum assisted resin transfer moulding, pultrusion, filament winding.
- *Micromechanics*: Basic concepts, stiffness, moisture and thermal expansion, strength.
- *Ply mechanics*: Coordinate systems, stress and strain, stress-strain equations, off-axis stiffness.
- *Macromechanics*: Plate stiffness and compliance, computation of stresses, common laminate types, laminate module, design using carpet plots, hydrothermal stresses.

- *Strength*: Lamina failure criteria, laminate first ply failure, laminate strength, strength design using carpet plots, stress concentrations.
- *Damage*: Continuum damage mechanics, longitudinal tensile damage, longitudinal compressive damage, transverse tension and in-plane shear.
- *Fabric-reinforced composites*: Wave pattern description, analysis, tow properties, element stiffness and constitutive relationship, laminate properties, failure analysis, woven fabrics with gap, twill and satin, randomly oriented reinforcement.
- *Beams*: Preliminary design, thin-walled beams.
- *Plates and stiffened panels*: Plate bending, plate buckling, stiffened panels.
- *Shells*: shells of revolution, cylindrical shells with general loading.
- *Strengthening of reinforced concrete*: Strengthening design, materials, flexural strengthening of RC beams, shear strengthening, beam-column.

Like the first edition, it remains a textbook for senior-level undergraduate students in the engineering disciplines and for self-studying, practicing engineers. Therefore, the discussion is based on math and mechanics of materials background that is common by the senior year, avoiding tensor analysis and other mathematical constructs typical of graduate school.

Seventy-eight fully developed examples are distributed throughout the textbook to illustrate the application of the analysis techniques and design methodology presented, making this textbook ideally suited for self-study.

## **2 Measurement and Data Analysis for Engineering and Science, Second Edition**

**by: P.F. Dunn**

**Published 2010**

**by CRC Press, Taylor & Francis Group, 6000 Broken Sound**

**Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 490pp**

**ISBN: 978-1-4398-2568-6**

This text covers the fundamental tools of experimentation that are currently used by both engineers and scientists. These include the basics of experimentation (types of experiments, units, and technical reporting), the hardware of experiments (electronics, measurement system components, system calibration, and system response), and the methods of data analysis (probability, statistics, uncertainty analysis, regression and correlation, signal characterisation, and signal analysis). Historical perspectives also are provided in the text.

This second edition of *Measurement and Data Analysis for Engineering and Science* follows the original edition published by McGraw-Hill in 2005. Since its first publication, the text has been used annually by over 30 universities and colleges in the USA, both at the undergraduate and graduate levels. The second edition has been condensed and reorganised following the suggestions of students and instructors who have used the first edition. The second edition differs from the first edition as follows.

The number of text pages and the cost of the text have been reduced.

- All text material has been updated and corrected.
- The order of the chapters has been changed to reflect the sequence of topics usually covered in an undergraduate class.
- Some sections within chapters have been reorganised to make the text easier to follow as an introductory undergraduate text.
- Over 150 new problems have been added, bringing the total to over 420 problems. A problem topic summary now is included immediately before the review and homework problems at the end of each chapter to guide the instructor and student to specific problems by topic.
- The text is now complemented by an extensive text website for students and instructors ([www.nd.edu/~pdunn/www.text/measurements.html](http://www.nd.edu/~pdunn/www.text/measurements.html)).

The book contains the following chapters:

- *Experiments*: Chapter overview, a role of experiments, the experiment, experimental approach, classification of experiments, problem topic summary, review problems, homework problems.
- *Electronics*: Chapter overview, concepts and definitions, circuit elements, RLC combinations, elementary DC circuit analysis, elementary AC circuit analysis, equivalent circuits, meters, impedance matching and loading error, electrical noise, problem topic summary, review problems, homework problems.
- *Measurement systems*: Chapter overview, measurement system elements, sensors and transducers, amplifiers, filters, analogue-to-digital converters, example measurement systems, problem topic summary, review problems, homework problems.
- *Calibration and response*: Chapter overview, static response characterisation, dynamic response characterisation, zero-order system dynamic response, first-order system dynamic response, second-order system dynamic response, higher-order system dynamic response, numerical solution methods, problem topic summary, review problems, homework problems.
- *Uncertainty analysis*: Chapter overview, uncertainty, comparing theory and measurement, uncertainty as an estimated variance, systematic and random errors, measurement process errors, quantifying uncertainties, measurement uncertainty analysis, general uncertainty analysis, detailed uncertainty analysis, uncertainty analysis summary, finite-difference uncertainties, uncertainty based upon interval statistics, problem topic summary, review problems, homework problems.
- *Regression and correlation*: Chapter overview, least-squares approach, least-squares regression analysis, linear analysis, regression parameters, confidence intervals, linear correlation analysis, uncertainty from measurement error, determining the appropriate fit, signal correlations in time, higher-order analysis, multi-variable linear analysis, problem topic summary, review problems, homework problems.

- *Probability*: Chapter overview, relation to measurements, sample vs. population, plotting statistical information, probability density function, various probability density functions, central moments, probability distribution function, probability concepts, problem topic summary, review problems, homework problems.
- *Statistics*: Chapter overview, normal distribution, normalised variables, student's *t* distribution, standard deviation of the means, pooling samples, hypothesis testing, the design of experiments, factorial design, problem topic summary, review problems, homework problems.
- *Signal characteristics*: Chapter overview, signal characterisation, signal variables, signal statistical parameters, Fourier series of a periodic signal, complex numbers and waves, exponential Fourier series, spectral representations, continuous Fourier transform properties, problem topic summary, review problems, homework problems.
- *Signal analysis*: Chapter overview, digital sampling, aliasing, discrete Fourier transform, fast Fourier transform, amplitude ambiguity, windowing, problem topic summary, review problems, homework problems.
- *Units and significant figures*: Chapter overview, English and metric systems, systems of units, SI standards, technical English and SI conversion factors.
- *Technical communication*: Chapter overview, guidelines for writing, technical memo, technical report, oral technical presentation, problem topic summary, review problems, homework problems.

Instructors who adopt the text for their course can receive a CD containing the review problem/homework problem solutions manual, the laboratory exercise solution manual, and a complete set of slide presentations for a lecture from Taylor & Francis/CRC Press.

### **3 Electric and Hybrid Vehicles, Design Fundamentals, Second Edition**

**by: I. Husain**

**Published 2011**

**by CRC Press, Taylor & Francis Group, 6000 Broken Sound**

**Parkway NW, Suite 300, Boca Raton, FL 33487-2742, USA, 501pp**

**ISBN: 978-1-4398-1175-7**

Environmental concerns and energy challenges have prompted the automotive industry to develop clean, efficient, and sustainable vehicles for urban transportation. Toward the end of the millennium, automotive industries in the USA and the rest of the world became proactive with the production of alternative vehicles. There is significant demand for engineers with experience in designing and engineering alternative vehicles and their components. There is an even greater need today for electric and hybrid vehicle teaching materials that include state-of-the-art technology. This book is intended to be used in a course to educate students on the multidisciplinary aspects of a vehicle system where electrical and mechanical engineers have to work together to complete the system. A technical course addressing the design fundamentals will provide students with the necessary theoretical background and enable them to become automotive engineers

capable of meeting today's needs. It has been more than seven years since the publication of the first edition of the book. The technology has advanced significantly since then and, therefore, a revised edition became essential.

This edition maintains the comprehensive systems-level perspective of electric and hybrid vehicles, but covers the hybrid architectures and components of the vehicle in much greater detail. Technical details, mathematical relationships, and design guidelines have been emphasised throughout the book to provide fundamental knowledge to students and engineers. The new additions to this edition include sizing and design guidelines for various hybrid architectures, modelling of energy storage components, control strategies for hybrid vehicles, component cooling systems, emission control systems, and in vehicle communication methods. The sections on power electronics, electric machines, and motor drives have been reorganised, and sections on DC/DC converters have been added. The sections on mechanical components have also been enhanced with more technical descriptions and example problems. The integration of mechanical and electrical components has been addressed to some extent to emphasise the interdisciplinary nature of automotive engineering.

The following chapters are included in the book:

- *Introduction to alternative vehicles*: Electric vehicles, hybrid electric vehicles, electric and hybrid vehicle components, vehicle mass and performance, electric motor and engine ratings, electric and hybrid vehicle history, well-to-wheel analysis, EV/ICEV comparison, electric vehicle market.
- *Vehicle mechanics*: Roadway fundamentals, laws of motion, vehicle kinetics, dynamics of vehicle motion, propulsion power, velocity and acceleration, tyre-road force mechanics, propulsion system design.
- *Alternative vehicle architectures*: Electric vehicles, hybrid electric vehicles, plug-in hybrid electric vehicle, powertrain component sizing, mass analysis and packaging, vehicle simulation.
- *Battery energy storage*: Batteries in electric and hybrid vehicles, battery parameters, electrochemical cell fundamentals, battery modelling, traction batteries, battery pack management.
- *Alternative energy storage*: Ultracapacitors, compressed air storage, flywheels.
- *Electric machines*: Simple electric machines, DC machines, three-phase AC machines, induction machines, permanent magnet machines, switched reluctance machines.
- *Power electronic converters*: Power electronic switches, DC/DC converters, cell balancing converters.
- *Electric motor drives*: Electric drive components, DC drives, operating point analysis, AC drives, SRM drives.
- *Control of AC machines*: Vector control of AC motors,  $dq$  modelling, induction machine vector control, PM machine vector control.

- *Internal combustion engines*: Internal combustion engines, BMEP and BSFC, vehicle fuel economy, emission control system, treatment of diesel exhaust emissions.
- *Powertrain components and brakes*: Powertrain components, clutches, differential, transmission, vehicle brakes.
- *Cooling systems*: Climate control system, powertrain component-cooling system.
- *Hybrid vehicle control strategy*: Vehicle supervisory controller, mode selection strategy, modal control strategies.
- *Vehicle communications*: OSI seven-layer model, in-vehicle communications, controller area network.

This book will serve educational aspects of electric and hybrid vehicles, which, in turn, will generate interest to support the development and usage of these vehicles. It will also serve as a reference for a working engineer dealing with the design and improvement of electric and hybrid vehicles. Discussion on most topics has been limited to fundamentals only, considering the wide spectrum of technical aspects related to electric and hybrid vehicle systems. Appropriate references are given to direct the reader toward entire spectrum of electric and hybrid electric vehicles, but to prepare students and engineers with the necessary background for starting the design process and evaluating the relevant technologies.

The equations and mathematical models presented in the book can be used to develop a system-level modelling and simulation tool for electric and hybrid vehicles on a suitable platform such as MATLAB and Simulink. The book contains several resolved problems and many exercises that are useful to convey the concept to students through numerical examples.

**4 Handbook on Material and Energy Balance Calculations  
in Materials Processing, Third Edition**  
**by: A.e. Morris, G. Geiger and H.A. Fine**  
**Published 2011**  
**by TMS, WILEY, John Wiley & Sons, Inc. publication Hoboken**  
**New Jersey, 111 River Street, Hoboken, NJ 07030-5774, USA**  
**Published simultaneously in Canada, 616pp**  
**ISBN: 978-1-118-06565-5**

The handbook reviews the basic principles of physical chemistry, linear algebra, and statistics, which are required to enable the practicing engineer to determine material and energy balances. It also includes enough worked examples and suggestions for additional reading that a novice to this field will be able to obtain the necessary skills for making material and energy balances. Some of the mathematical techniques, which can be used when a digital computer is available, are also presented.

The third edition of the text reflects these changes. The text now includes examples that involve environmental aspects, processing and refining of semiconductor materials, and energy-saving techniques for the extraction of metals from low-grade ores. However, the biggest change comes from the computational approach to problems. The spreadsheet

program Excel is used extensively throughout the text as the main computational »engine« for solving material and energy balance equations, and for statistical analysis of data. A large thermodynamic database replaces the thermodynamic tables in the back of the previous handbook.

Many changes have been made throughout the text. There are now ten chapters instead of six, which reflects a desire to organise the material in non-reactive vs. Reactive material and energy balance sections. The concept of degree-of-freedom analysis has been introduced to provide a basis for analysing the adequacy of information presented in a flowsheet. The concepts of extent-of-reaction and the equilibrium constant are presented as ways to designate how far a given chemical reaction will proceed. The introduction of the equilibrium constant requires the Handbook user to have completed a course in chemistry that covers the main principles of thermochemistry, or at least to have available a chemistry textbook typical of those used in the first year of a materials engineering program.

The book contains the following chapters:

- Dimensions, units, and conversion factors
- Thermophysical and related properties of materials
- Statistical concepts applied to measurement and sampling
- Fundamentals of material balances with applications to non-reacting systems
- Stoichiometry and the chemical equation
- Reactive material balances
- Energy and the first law of thermodynamics
- Enthalpy balances in non-reactive systems
- System balances on reactive processes
- Case studies
- Computational tools for making material and heat balance calculations.

The readers particularly those who are out to be able to perform energy balances in processes for which they are responsible, and as a result be able to improve process efficiencies.

## **5 Gamma Titanium Aluminide Alloys, Science and Technology**

**by: F. Appel, J. David, H. Paul and M. Oehring**

**Published 2011**

**by Wiley-VCH Verlag GmbH & Co. KGaA, Boschstrasse 12**

**69469 Weinheim, Germany, 745pp**

**ISBN: 978-3-527-31525-3 (print)**

**ISBN: 978-3-527-63622-8 (ePDF)**

**ISBN: 978-3-527-63621-1 (ePub)**

**ISBN: 978-3-527-63620-4 (eBook)**

The book discusses the relation between basic research and actual processing technologies. It covers complex microstructures down to the nanometer scale, structure/property relationships and potential applications in key industries.

It includes the following chapters:

- Introduction
- Constitution
- Thermophysical constants
- Phase transformations and microstructures
- Deformation behaviour of single-phase alloys
- Deformation behaviour of two-phase  $\alpha_2$  (Ti<sub>3</sub>Al) alloys
- Strengthening mechanisms
- Deformation behaviour of alloys with a modulated microstructure
- Creep
- Fracture behaviour
- Fatigue
- Oxidation behaviour and related issues
- Ingot production and component casting
- Powder metallurgy
- Wrought processing
- Joining
- Surface hardening
- Applications, component assessment, and outlook.

The metallurgy of TiAl alloys undoubtedly has several features in common with other intermetallic systems. Thus, in that we have chosen to emphasise the scientific principles, the book will provide a treatment of the subject for researchers and advanced students who need a more detailed coverage than is found in physical metallurgy textbooks. We expect that our compilation of the current state of titanium aluminide science and technology will not only serve as a guide through the huge body of literature to the TiAl community, but will also be of interest to materials scientists, engineers, and technical managers who are involved in areas where low-density, high-temperature resistant materials are required. The detailed description of interfaces and interface related phenomena will certainly be of interest to an extended scientific community.