

---

## **Book Reviews**

---

Reviewed by Janez Grum

Email: janez.grum@fs.uni-lj.si

### **1 Wavelets, Tools for Science & Technology**

**by: S. Jaffard, Y. Meyer and R.D. Ryan**

**Published 2001**

**by SIAM Society for Industrial and applied Mathematics**

**3600 University City Science Center, Philadelphia**

**PA 19104-2688, USA, 133pp**

**ISBN: 0-89871-448-6**

Wavelet analysis, an exciting theory at the intersection of the frontiers of mathematics, science, and technology, is a unifying concept that interprets a large body of scientific research. In addition to its intrinsic mathematical interest, its applications have serious economic implications in the areas of signal and image compression. For these expanding fields, this book provides a clear set of concepts, methods, and algorithms adapted to a variety of applications ranging from the transmission of images on the internet to theoretical studies in physics.

The authors present with equal skill and clarity the mathematical background and major wavelet applications, including the study of turbulence, fractal objects, and the structure of the universe. Never before have the historic origins, the algorithms, and the applications of wavelets been discussed in such scope, providing a unifying presentation accessible to scientists and engineers across all disciplines and levels of training.

The book presents the following contents: signals and wavelets, wavelets from a historical perspective, quadrature mirror filters, pyramid algorithms for numerical image processing, time-frequency analysis for signal processing, time-frequency algorithms using Malvar–Wilson wavelets, time-frequency analysis and wavelet packets, computer vision and human vision, wavelets and turbulence, wavelets and multifractal functions, data compression and restoration of noisy images, wavelets and astronomy, filter fundamentals, wavelet transforms, a counterexample, Hölder spaces and Besov spaces.

Written specifically for scientist and engineers with diverse backgrounds, the material is presented in a manner that will appeal to both experts and non-experts alike. This book is a valuable tool for anyone from graduate student to expert faced with signal or image processing problems.

## 2 **Image Processing and Analysis, Variational, PDE, Wavelet, and Stochastic Methods**

**by: T.F. Chan and J. Shen**

**Published 2005**

**by SIAM Society for Industrial and Applied Mathematics**

**3600 University City Science Center, Philadelphia**

**PA 19104-2688, USA, 400pp**

**ISBN-10: 0-89871-589-X (pbk.)**

**ISBN-13: 978-0-898715-89-7(pbk.)**

At one other time in human history have the influence and impact of image processing on modern society, science, and technology been so explosive. Image processing has become a critical component in contemporary science and technology and has many important applications. This book develops the mathematical foundation of modern image processing and low-level computer vision, and presents a general framework for the analysis of image structures and patterns to their processing. The core mathematical and computational ingredients of several important image processing tasks are investigated. The book bridges contemporary mathematics with state-of-the-art methodologies in modern image processing while organising the vast contemporary literature into a coherent and logical structure.

Image processing has traditionally been built on the machinery of Fourier and spectral analysis; however, in the past few decades, numerous novel competing methods and tools have emerged. These diversified approaches, although seemingly distinct, are in fact intrinsically connected. The authors integrate this diversity of modern image processing approaches by revealing the few common threads connecting them. Some newer emergent integration efforts have also been highlighted and analysed.

*Image processing and analysis:* Variational, PDE, wavelet, and stochastic methods are systematic and well organised. The authors first investigate the geometric, functional, and atomic structures of images and then rigorously develop and analyse several image processors. The book is comprehensive and integrative, covering the four most powerful classes of mathematical tools in contemporary image analysis and processing while exploring their intrinsic connections and integration. The material is balanced in theory and computation, following a solid theoretical analysis of model building and performance with computational implementation and numerical examples.

In the present book, there are three key aspects of image processing and analysis.

- *Modelling:* What are the suitable mathematical models for  $u$  and  $T$ ? What are the fundamental principles governing the constructions of such models? What are the key features that have to be properly respected and incorporated?
- *Model analysis:* Are the two models for  $u$  and  $T$  compatible? Is  $T$  stable and robust to noises or general perturbations? Does  $F = T[u]$  exist, and if so, is it unique? What are the fine properties or structures of the solutions? In many applications, image processors are often formulated as inverse problem solvers, and as a result, issues like stability, existence, and uniqueness become very important.

- *Computation and simulation*: How can the models be efficiently computed or simulated? Which numerical regularisation techniques should be introduced to ensure stability and convergence? And how should the targeted entities is properly represented?

This book is written for graduate students and researchers in applied mathematics, computer science, electrical engineering, and other disciplines who are interested in the problem in imaging and computer vision. It can be used as a reference by scientists with specific tasks in image processing, as well as by researchers with a general interest in finding out about the latest advances.

### **3 Integral Approaches to Tribo-testing in Mechanical Engineering**

**by: H. Prashad**

**Published 2009**

**by BS Publications, CRC Press, Taylor & Francis Group**

**Boca Raton, London, New York, 6000 Broken Sound Parkway**

**NW, Suite 300, Boca Raton, FL 33487, USA, 275pp**

**ISBN 13: 9781439806081**

**ISBN: 10: 143980608X**

This book on “Integral Approaches of Tribo-testing in Mechanical Engineering” deals with the unique multifaceted problems and their solutions and in-depth analysis/investigations of nano/micro studies of different coatings, bioengineering, polymers, cosmetics, chemico-mechanical processing, indentation, scratch and mapping, lubricants and additives, system problems including reliability assessment and new testing and diagnosis approaches in various dimensions in ten sections with 37 chapters. In the net shell, book presents original typical investigations and studies as the summarised professional experience of various experts in the area of mechanical engineering and industrial tribology. The work presented in various chapters may prove to be useful for engineers and technologists of different industries, students, research engineers/scientists, academicians and others who grapple with the complex problems of testing of engineering components and tribology for multifaceted research for future developments.

- different investigations, their analysis and solutions detailed are unique in nature
- comprehensive tribo-mechanical testing of hard coatings, multi-sensing advance testing of thin and thick coatings, bond strength, scratch, indentation, wear and adhesion testing, mapping of thin overcoats for nano/micro tribo-metrology
- premature failure of bearings due to various unforeseen causes
- methods of characteristics, evaluation of electrical contact properties of carbon nanotube coated surfaces
- details of the theoretical and experimental analysis of magnetic flux density distribution as a diagnostic tool for critical failures of bearings

- friction and wear characteristics of rubber coating in fretting and experimental measurements of visco-elastic properties of polymers
- characterisation and simulation of cylinder liner surface finishes and study of low friction ring pack for gasoline engines
- life estimation of turbine oils, besides a non-conventional integral approach for testing of lubricating oils and effect of nano additives on lubricants
- tribological studies in bioengineering including tribo-metrology of skin, micro/nanoscale characterisation of orthopaedic applications and friction studies in bovine knee articular cartilage.

This book is useful for engineers and technologists of heavy industry, students, research engineers/scientists, academicians and others who grapple with the complex problems of testing engineering components and tribology for multifaceted research for further developments.

#### **4 Wavelets: A Mathematical tool for Signal Analysis**

**by: C.K. Chui**

**Published 1997**

**by SIAM Society for Industrial and Applied Mathematics**

**3600 University City Science Center, Philadelphia**

**PA 19104-2688, USA, 228pp**

**ISBN: 0-898971-384-6 (pbk.)**

In 1997, SIAM began a new series on mathematical modelling and computation. Books in the series develop a focused topic from its genesis to the current state of the art; these books

- present modern mathematical developments with direct applications in science and engineering
- describe mathematical issues arising in modern applications
- develop mathematical models of topical physical, chemical, or biological systems
- present new and efficient computational tools and techniques that have direct applications in science and engineering
- illustrate the continuing, integrated roles of mathematical, scientific, and computational investigation.

This writing is based on the author lectures at the SIAM one-day tutorial on ‘*Wavelets and Applications*’ at *SIAM Annual Meeting* in Philadelphia. In preparation for these lectures, he focused on one theme among the multidisciplinary aspects of the fundamental concepts, theory, mathematical methods, and algorithms of the rapidly developing subject of wavelets. The author chose signal processing as the main theme to help unify presentation for this audience with a diverse background. The reasons for this choice were, first to explore the notion of the integral wavelet transform, originally introduced for studying seismic waves, and, second, the author acquired a very strong

interest in signal processing through research, guiding electrical engineering and computer science students at Texas A & M University, and collaborating with several industrial companies.

It is an elementary treatise of the most basic concepts, techniques, and computational algorithms of the wavelet transform, as well as the implications of this transform to the understanding and solution of various problems in signal processing. The author a fairly complete and concise treatment of the elements of wavelets pertinent to signal processing applications, including various motivations of the wavelet transform from the point of view of signal analysis, procedures for constructing some of the most popular wavelets, comparisons of these wavelets for multilevel bandpass filtering, as well as algorithms and computational schemes for computer implementation.

The book contains the following chapters: what are wavelets, time-frequency localisation, multiresolution analysis, orthonormal wavelets, biorthogonal wavelets, algorithms, applications, data compression, numerical solutions of integral equations.

Wavelets continue to be powerful mathematical tools that can be used to solve problems for which the Fourier (spectral) method does not perform well or cannot handle. This book is for engineers, applied mathematicians, and other scientists who want to learn about using wavelets to analyse, process, and synthesise images and signals. Applications are described in detail and there are step-by-step instructions on how to construct and apply wavelets.

## **5 Polarized Light, Third Edition**

**by: D.H. Goldstein**

**Published 2011**

**by CRC Press, Taylor & Francis Group, Boca Raton, London**

**New York, 6000 Broken Sound Parkway, NW, Suite 300**

**Boca Raton, FL 33487, USA, 770pp**

**ISBN: 978-1-4398-3040-6**

Polarised light is a pervasive influence in our world-and scientists and engineers in a variety of fields require the tools to understand, measure, and apply it to their advantage. Offering an in-depth examination of the subject and a description of its applications, *Polarized Light, Third Edition* serves as a comprehensive self-study tool complete with an extensive mathematical analysis of the Mueller matrix and coverage of Maxwell's equations.

This book starts with a general description of light and continues with a complete exploration of polarised light, including how it is produced and its practical applications. The author incorporates basic topic, such as polarisation by refraction and reflection, polarisation elements, anisotropic materials, polarisation formalisms (Mueller–Stokes and Jones) and associated mathematics, and polarimetry, or the science of polarisation measurement.

New to the third edition:

- a new introductory chapter
- chapters on polarised light in nature, and form birefringence

- a review of the history of polarised light, and a chapter on the interference laws of Fresnel and Arago – both completely re-written
- a new appendix on conventions used in polarised light
- new graphics, and black-and-white photos and colour plates.

The following chapters are included:

- *Part I: Introduction to polarised light*: Introduction, polarisation in the natural environment, wave equation in classical optics, the polarisation ellipse, Stokes polarisation parameters, Mueller matrices for polarising components, Fresnel equations: derivation and Mueller matrix formulation, mathematics of the Mueller matrix, Mueller matrices for dielectric plates, the Jones matrix formalism, the Poincare sphere, Fresnel–Arago interference laws.
- *Part II: Polarimetry*: Introduction, methods of measuring Stokes polarisation parameters, measurement of the characteristics of polarising elements, Stokes polarimetry, Mueller matrix polarimetry, techniques in imaging polarimetry, channelled polarimetry for snapshot measurements.
- *Part III: Applications*: Introduction, crystal optics, optics of metals, polarisation optical elements, retarders, ellipsometry, form birefringence and meanderline retarders.
- *Part IV: Classical and quantum theory of radiation by accelerating charges*: Introduction to classical and quantum theory of radiation by accelerating charges, Maxwell's equations for electromagnetic fields, the classical radiation field, radiation emitted by accelerating charges, radiation of an accelerating charge in the electromagnetic field, the classical Zeeman effect, further applications of the classical radiation theory, the Stokes parameters and Mueller matrices for optical activity and Faraday rotation, Stokes parameters for quantum systems.

Divided into four parts, this book covers the fundamental concepts and theoretical framework of polarised light. Next, it thoroughly explores the science of polarimetry, followed by a discussion of polarised light applications. The author concludes by discussing how our polarised light framework is applied to physics concepts, such as accelerating charges and quantum systems. Building on the solid foundation of the first two editions, this book reorganises and updates existing material on fundamentals, theory, polarimetry, and applications. It adds new chapters, graphics, and colour photos, as well as a new appendix on conventions used in polarised light. As a result, the author has re-established this book's lofty status in the pantheon of literature on this important field.

This book is a comprehensive reference on polarised light for scientists and engineers working in a variety of fields. It also can be used as a textbook for advanced undergraduates or graduate students who have had calculus and linear algebra and perhaps a course in introductory physics.

## 6 Hybrid Laser-Arc Welding

by: F.O. Olsen

Published 2009

by CRC Press, Woodhead Publishing Limited and CRC Press LLC  
Taylor & Francis Group, Boca Raton, London, New York, 6000 Broken  
Sound Parkway, NW, Suite 300, Boca Raton, FL 33487, USA, 323pp

ISBN: 978-1-84569-370-1 (book)

ISBN: 978-1-84569-652-8 (e-book)

ISBN 978-1-4398-0214-4

Since the beginning of the 1980s, the industrial applications of high power lasers have been increasing and today lasers are a well established high technology industrial tool. Welding is one of the main applications of high power lasers. The potential of high brightness energy sources such as lasers and electron beams to perform high-quality narrow welds at high production rates is outstanding and many welding applications of these two processes have been developed through the years. Starting from spot welding and fine pulsed welding, which mainly use Nd-YAG lasers, seam welding using continuous-wave CO<sub>2</sub> lasers also became an industrial process in the 1980s.

Hybrid laser-arc welding (HLAW) is a combination of laser welding with arc welding that overcomes many of the shortcomings of both processes. This important book gives a comprehensive account of hybrid laser-arc welding technology and applications.

The first part of the book reviews the characteristics of the process, including the properties of joints produced by hybrid laser-arc welding and ways of assessing weld quality. Part II discusses applications of the process to such metals as magnesium alloys, aluminium and steel as well as the use of hybrid laser-arc welding in such sectors as ship building and the automotive industry.

In this book, a summary is presented of recent research on the hybrid laser-arc welding process and its applications. This provides a snapshot of this advanced technology at a particular point in time but developments will continue. New types of laser, the disc laser and the high-power fibre laser, will certainly improve this technology in the future. The results of research using these new laser sources are included in this book, but much more will certainly follow in the near future as a result of the many research teams throughout the world that are active in developing this important process.

The book contains the following chapters:

### *Part I: Characteristics of hybrid laser-arc welding*

- Advantages and disadvantages of arc and laser welding
- Fundamentals of hybrid laser-arc welding
- Heat sources of hybrid laser-arc welding processes
- Effect of shielding gas on hybrid laser-arc welding
- Properties of joints produced by hybrid laser-arc welding
- Quality control and assessing weld quality in hybrid laser-arc welding.

*Part II: Applications of hybrid laser-arc welding*

- Hybrid welding of magnesium alloys
- Shipbuilding applications of hybrid laser-arc welding
- Industrial robotic application of laser-hybrid and laser-hybrid-tandem welding
- Hybrid laser-arc welding of aluminium.
- Hybrid laser-arc welding of dissimilar metals.

*Part III: Hybrid laser-arc welding of steel:*

- Hybrid laser-arc welding of steel.