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BOOK REVIEWS

MARIUS-NICUŞOR GRIGORE, LĂCRĂMIOARA IVĂNESCU, CONSTANTIN TOMA, *Halophytes: An Integrative Anatomical Study*, Springer, Cham, Heidelberg, New York, Dordrecht, London, 2014, 548 p., ISBN: 978-3-319-05728-6.

The book entitled ***Halophytes: An Integrative Anatomical Study*****,** written by Marius-Nicuşor Grigore, Lăcrămioara Ivănescu, and Constantin Toma, represents a work expected to fill a large gap in the literature devoted to structural aspects in halophytes. There are many studies trying to dissect plant responses to salinity, at different levels, especially at biochemical and molecular level. Nevertheless, until now, the lack of a monograph focused on structural adaptations in halophytes was surprising; in spite of the information provided by plant biology, specialists were experiencing problems in finding concentrated morphological and anatomical data about salt tolerant plants.

This volume has 548 pages and includes an impressive number of 703 original illustrations, 543 color and 160 ink drawings, referring to structural features of the investigated species.

Title agrees with authors' intention and way of dealing with such a heterogeneous ecological group of plants that includes halophytes. Actually, the authors are the promoters of integrative anatomy in Romania, a tendency adopted several years ago and followed as a natural necessity of moving further on a simple descriptive characterization of anatomical features. In fact, this monograph includes and concentrates results derived from a long experience with respect to investigations conducted in the field of halophytes anatomy.

The book is divided into three parts: *General considerations on halophytes, An integrative anatomical study of halophytes (Anatomical structure in different family species)* and *Conclusions (An overall view on halophytes adaptations and their ecological significance)*. The first part, concise and very precise, provides a fundamental background familiarizing with general considerations about halophytes: definitions and classifications, halophytes and their habitats, general morphological and anatomical adaptations in halophytes, halophytes and salt stress.

The main body of the volume is dedicated to the anatomical study of halophytes (Part II). The authors have anatomically investigated 62 halophyte species belonging to 18 botanical families; these species evidence different ecological spectra and various degree of salt tolerance, ranging from typical euhalophytes (especially from *Chenopodiaceae, Plumbaginaceae, Frankeniaceae* families) to less specialized halophytes, facultative and accidental species. Analyzed taxa have been collected from various salinized ecosystems (dry inland and coastal saline areas, saltmarshes) from different countries: Romania, Spain, and Poland. Anatomical description of every species is associated with color micrographs and often with ink drawings. Authors found out that, despite the different climatic and ecological conditions in which halophytes vegetate, there are several structural adaptive strategies that allow to these striking plants to successfully cope with environmental factors. These adaptive mechanisms refer to harmoniously integrated structural features, such as: succulence, salt secretion (salt glands, salt hairs), aerenchyma, Kranz anatomy (related to C_4 photosynthesis), successive cambia, tracheoidioblasts, bulliform cells, and developed endodermis. These structural mechanisms are discussed in relation to environmental conditions, emphasizing that salinity represents the major factor involved in building up adaptive strategies during evolution; however, they cannot be reduced only to the impact of salinity, as other ecological factors should also be considered.

Authors discuss the ecological, physiological, and evolutionary aspects of the various adaptive structures in an integrative way.

Part three of the book synthesizes the major anatomical adaptations found out in investigated halophytes; all are discussed in relation to an ecological or functional value, thus stressing the higher plasticity of adaptations correlated with environmental factors. For instance, succulence is found in halophytes vegetating both in wet and dry saline areas, and authors comment this finding by explaining the xerophytic nature of halophytes, as induced by physiological drought. The same is true for bulliform cells evidenced in many halophytes nominated by authors as amphibious halophytes. Aerenchyma helps halophytes to survive in water logging conditions as well, while Kranz anatomy acts as a structural support for C_4 photosynthesis.

Starting with the structural level, this book offers new and interesting insights into the ecology of halophytes and opens new perspectives for the identification of salt-tolerant crop plants or halophytes that might be selected for ecological purposes, such as bio-remediation of salt-affected areas.

Overall, this expected and welcome monograph is dedicated to those interested in the biology of halophytes, having different expertise and interests; authors of this book proved that a structural approach, projected in an integrative manner, can stimulate further investigations through interdisciplinary studies, including biochemical, ecophysiological and molecular data. Moreover, their work emphasizes that halophytes remain an exciting group of plants and there are still many possibilities and horizons to be reached in order to extend the knowledge on these species.

Maria-Magdalena Zamfirache

TATSIEN LI, TIEHU QIN, *Physics and Partial Differential Equations*, vol. II, SIAM, Philadelphia; Higher Education Press, Beijing, 2014, X + 271 p., ISBN 978-1- 611973-31-0 (Translated by Yachun Li).

Partial differential equations are fundamental in many important physical and mechanical disciplines. Although the names of these equations are well known, and they have been the focus of a considerable amount of research, gaining a comprehensive and deep understanding of the related physical and mechanical background is not an easy task for writing such a theoretical book.

The purpose of this volume is to offer some help not only to teachers, graduate students, and senior undergraduates student engaged in studying, researching, and teaching applied partial differential equations, but also to scholars and researchers in other disciplines and applications areas.

Readers will found the tools to become proficient in the use of important fundamental equations in modern physics, to gain familiarity with the whys, wherefores, and derivation of these equations, as well as to understand more easily some commonly used mathematical models more easily.

The volume starts with the presentation of most basic concepts of physics, it continues on the whole process of establishing the fundamental equations for physical and mechanical disciplines such as electrodynamics, fluid dynamics, mgnetohydrodynamics, reacting fluid dynamics, elastic mechanics, thermoelastic mechanics, viscoelastic mechanics, kinetic theory of gases, special relativity, and quantum mechanics.

This book represents a great tool for all researchers using PDEs, even if the are in the early days of learning or they are senior researchers. It is recommended for better understanding all the connections between mathematics and physic phenomena.

Ionuț Munteanu

JOHN P. BOYD, *Solving Transcendental Equations. The Chebyshev polynomial proxy and other numerical rootfinders, perturbation series, and oracles*, SIAM, Philadelphia, 2014, XVII + 460 p., ISBN 978-1-611973-51-8.

The goal of this book is to teach the art of finding the root of a single algebraic equation or of a pari of of such equations. Simple and practical recipes for solving various classes of nonlinear equations – presented not as isolated cases, being rather interwoven to form a whole – are provided.

Rootfinding is fundamental to junior high algebra, but its apparent simplicity is deceiving. The book has a chapter enteirely devoted to regular perturbation series for roots. It is unusual to combine numerical algorithms with perturbation series and computer algebra in a single volume, but it is highly appropriate here.

There are chapters dedicated to cubic, quartic, and quadratic equations, Chebyshev-proxy/ companion matrix rootfinder, addaptive Chebyshev interpolation, adaptive Fourier interpolation and root finding, Newton iteration and Its Kin, bifuracation theory and oracles.

This book represents an important tool for students that want to know more about the theory of rootfinding and on its major impact in the mathematical theory, and also in practice.

Ionuț Munteanu

AMIR BECK, *Introduction to Nonlinear Optimization: Theory, Algorithms, and Applications with MATLAB*, MOS-SIAM Series on Optimization, SIAM-MOS, Philadelphia, 2014, XII + 282 p., ISBN 978-1-611973-64-8.

This book is based on the idea that optimization training should include three basic concepts: an authoritative theoretical and algorithmic foundation, familiarity with various applications, and the ability to apply the theory and algorithms on actual real-life problems.

The book discusses several topics that, compared to other classical textbooks, are treated differently. Here are some examples of the less common issues:

a) The treatment of stationarity is comprehensive and discusses this important notion in the presence of sparsity constraints;

b) The concept of hidden convexity is discussed and illustrated in the context of the trust region subproblem;

c) The MATLAB toolbox CVX is explored and used;

d) The gradient mapping and its properties are studied and used in the analysis of the gradient projection method;

e) Second order necessary optimality conditions are treated using a descent direction approach;

f) Applications such as circle fitting, Chebyshev center, the Fermat-Weber problem, denoising, clustering, total least squares, and orthogonal regression are studied both theoretically and algorithmically. MATLAB programs are used to show how the theory can be implemented.

This is an essential book for beginner students in the field of optimization and MATLAB use.

Ionuț Munteanu

E.G. BIRGIN, J.M. MARTINEZ, *Practical Augmented Lagrangian Methods for Constrained Optimization*, Fundamentals of Algorithms Series, SIAM, 2014, XIII + 220 p., ISBN 978-1-611973-35-8.

This book is about Augmented Lagrangian method, a popular technique for solving constrained optimization problems. It is mainly dedicated to engineers, chemists, physicists, economists, and general users of constrained optimization for solving real-life problems. Nevertheless, it describes in rigorous mathematical terms the convergence theory that applies to the algorithms analyzed.

Users often need to understand with precision the properties of the solutions that a practical algorithm finds and the way in which these properties are reflected in practice. Many theorems concerning the behavior of practical algorithms will be found in this book. The geometrical and

computational meaning of each theoretical result is highlighted to make relevant theory accessible to practioners.

Often, the assumptions under which it is proven the algorithms work , are not in the most general form but they are being chosen to the reader to understand the computational behavior in real-life problems.

Modest mathematical background is required to understand the proofs and less is required for understanding and interpreting statements and definitions. Elementary calculus in n-dimensions with the basic topological properties concerning convergence of sequence and compact sets are sufficient.

Readers are introduced in this book to the employment of a specific constrained optimization package of Augmented Lagrangian type, called Algencan. The software is introduced after the statement and interpretation of all relevant theoretical aspects.

Ionuț Munteanu

WIM MICHIELS, SILVIU-IULIAN NICULESCU, *Stability, Control and Computation for Time-Delay Systems. An Eigenvalue-Based Approach*, Second edition, Advances in Design and Control, SIAM, Philadelphia, 2014, XXIII + 435 p., ISBN 978-1-611973-62-4.

This book treats the interconnections between two (or more) physical systems, accompanied by transfer phenomena (material, energy, information) such as transport an propagation. From a mathematical point of view, transport and propagation phenomena can be represented by delay elements. In this way, the corresponding overall systems are governed by a special type of differential equations, namely delay-differential equations.

This volume is organized into three parts:

a) Stability analysis of linear time-delay systems
b) Stabilization and robust fixed-order control
c) Applications.

Parts I and II analyze the stability, robust stability and synthesis of controllers using a unitary methodology- the eigenvalue based approach. Without any loss of generality, the authors mainly concentrate on the following aspects that have not received a full treatment in the literature, namely: sensitive analysis with respect to delays and to other systems' parameters; analytical, as well as numerical analysis tools (algorithms for computing characteristic roots); design of fixed-order or fixed-structure stabilizing and robust controllers. These approaches, new even in the context of finite-dimensional systems, are grounded on numerical linear algebra.

A lot of examples completes the presentations and illustrates the main results provided in the monograph. Most of the major ideas are explained by using extremely simple, easy-to- follow examples. Moreover, the last part is devoted to several applications important from apractical point of view.

Ionuț Munteanu

ROUBEN ROSTAMIAN, *Programming Projects in C for Students of Engineering, Science, and Mathematics*, Computational Science & Engineering, SIAM, Philadelphia, 2014, XV + 392 p., ISBN 978-1-611973-49-5.

This book is written for graduate and advanced undergraduate students of sciences, engineering, and mathematics as a tutorial on how to think about, organize, and implement programs in scientific computing. It may be used as a textbook for classroom instruction, or by individuals for self-directed learning.

Some of the main projects presented here are:

a) the Nelder-Mead simplex algorithm for minimizing functions in n dimensions (with or without constraints) with applications to computing finite deformations of trusses under large loads via minimizing the energy;

b) the HAAR wavelet transform in one and two dimensions, with applications to image analysis and image compression;

c) a very simple yet intriguing model of evolution through natural selection, and the effect of the environment on the emergence of genetically distinct species

d) a minimal implementation of the finite element method for solving second order elliptic partial differential equations on arbitrary two dimensional domains through unstructured triangular meshes and linear elements.

e) The comparison of several finite difference algorithms for solving the time-dependent linear heat equation and extending one of the algorithms to solving the porous medium equation.

Ionuț Munteanu

HEDY ATTOUCH, GIUSEPPE BUTTAZZO, GERARD MICHAILLE, *Variational Analysis in Sobolev and BV Spaces: Applications to PDEs and Optimization*, Second edition, MOS-SIAM Series on Optimization, SIAM-MOS, Philadelphia, 2014, XII + 793 p., ISBN 978-1-611973-47-1.

The first objective of the present book is to provide to students tools and methods of variational analysis and optimization in infinite dimensional spaces together with applications to classical PDEs problems. This is approached in the first part of the book, Chapters 1 through 9, being developed in classical Sobolev spaces.

The second objective is intended to make the book accessible to a large audience, from students to researchers, with various backgrounds in mathematics, as well as to physicists, engineers, and others.

The first part presents the basic variational principles. The ideas are based on those of D. Hilbert, which was first to delineate, in his famous lecture at College de France in 1900, then progressively solved throughout the 20^{th} century. The notion of weak solution is placed in the context of test functions, distribution theory, weak convergence and topologies. Some complements on the geometric measure theory, the Hausdorff measure is presented.

The second part is dedicated to advanced variational analysis. The modernization of a large number of problems in physics, image processing, requires the introduction of new functional spaces permitting discontinuities of the solution. Accordingly, the classical Sobolev theory, developed in the first part is complemented by a self contained and detailed presentation of these spaces.

The final chapter, which represents the major contribution of this second edition of this book is devoted to the problem of gradient flows from a variational point of view. It is analyzed the problem of optimization of mass transportation theory.

This work represents a very good contribution dedicated to an extended range of students and researchers in the field of optimization and variational analysis.

Ionuț Munteanu

ELDAD HABER, *Computational Methods in Geophysical Electromagnetic*, Mathematics in Industry Series, SIAM, Philadelphia, 2015, IX + 144 p., ISBN 978-1-611973-79-2.

One of the most important research topics in both mathematical PDEs and physical theory and practice is represented by Magnetohydrodynamic equations, which are a couple between Navier-Stokes and Maxwell equations.

The present book attempts at bridging the gap between more theoretical papers and books on inverse and forward problems and the complete applied material, which provides only scarce details on how to do things in practice, in relation with Magnetohydrodynamic equations.

Computer codes are added to enable the reader to solve realistic problems. Working through the codes attached to this book, the user should be able to solve moderate-size electromagnetic forward and inverse problems on a streched rectangulat mesh.

The book can be used by students who wish to study electromagnetic forward and inverse problems, as well as by students interested in applied inverse problems with partial differential equations as constraints. The MATLAB sofware that accompanies this book can be used to solve realistic electromagnetic inverse problems and can be easily modified to solve other problems, such as the medical ones.

Ionuț Munteanu

PAOLO TOTH, DANIELE VIGO (Editors), *Vehicle Routing. Problems, Methods and Applications*, Second edition, MOS-SIAM Series on Optimization, SIAM-MOS, Philadelphia, 2014, XVIII + 463 p., ISBN 978-1-611973-58-7.

The vehicle routing problem calls for the determination of the optimal set of routes to be performed by a fleet of vehicles to serve a given set of customers, representing one of the most important, and studied combinatorial optimization problems.

The volume covers the state of the art of both exact and heuristic methods developed in the last decades for VRP and some of its main variants. Moreover, a considerable part of the book is devoted to the discussion of practical issues.

Although focused on a specific family of problems, this book offers a complete overview of the effective use of the most important techniques proposed for solving hard combinatorial problems. It is assumed that readers have a basic knowledge of the main methods for the solution of combinatorial optimization problems (complexity theory, branch-and-bound, branch-and-cur, relaxations, heuristics, metaheuristics, local research, etc.)

The book is divided into three parts, preceded by an introductory chapter in which it is presented an overview of the VRP family, defines the most important variants of the problem, and introduces the main mathematical models. The second part covers three main variants of the VRP: VRP with time windows, VRP with backhauls, and VRP with pickup and delivery. Finally, in the third part, the issues arising in real-world VRP applications, such as the presence of dynamic and stochastic components, are discussed by analyzing relevant case studies and presenting software packages.

Ionuț Munteanu

ERIK M. BOLLT, NARATIP SANTITISSADEEKORN, *Applied and Computational Measurable Dynamics*, SIAM, 2013, XIII + 368 p., ISBN 978-1-611972-63-4.

This book is devoted to various aspects in measurable dynamics and its practical applications. Concepts in dynamical systems are connected to mathematical tools from graph theory or ergodic theory, as well as with practical applications.

The first two chapters are devoted to some concepts and terminology related to dynamical systems, such as orbits, stable and unstable manifolds, linearization, hyperbolicity, transfer operators. The authors emphasize the Eulerian perspective (trajectories following measurable ensembles of

initial conditions), with respect to the Lagrangian one (focusing on the evolution of trajectories corresponding to a single initial condition).

In the next chapter they develop the study of some concepts and tools in measurable dynamical systems, such as the Frobenius – Perron operator and its infinitesimal generator. These operators, understood as infinitely large stochastical matrices acting on infinite-dimensional spaces, are studied in Chapter 4 using the Ulam-Galerkin method, that is, by approximating such matrices using finite rank representations. This approximate action of the corresponding dynamical system can be seen as a weighted directed graph and the method involves graph theoretic techniques. Chapter 5 deals with such techniques. More specifically, questions of transport between (almost) invariant sets for dynamical systems are analysed in terms of transport on a graph.

Chapter 6 is devoted to symbol dynamics, as part of topological dynamics. The analogy between the methods discussed for measurable dynamics (and more specifically for the study of the Frobenius-Perron operators) and those for symbol dynamics are emphasized. Chapter 7 continues this analogy by discussing the transport mechanism as part of the global analysis of topological dynamics.

Chapter 8 deals with the method of finite time Lyapunov exponents. In the case of time-dependent dynamical systems the stable/unstable manifolds may not exist and the behaviour and properties of the hyperbolic points may not allow conclusions on the trajectory patterns, as in the case of autonomous systems. In these situations, one looks for dynamically evolving structures, called Lagrangian coherent structures, which exhibit the strongest local attraction or repulsion in the flow. A tool for locating the Lagrangian coherent structures is the finite time Lyapunov exponent (FTLE). An algorithm for approximating FTLE is presented, as well as several examples.

Chapter 9 is devoted to the connections between dynamical systems and a symbolic representation through symbolic dynamics. Symbolization is also used for emphasizing the connection between dynamical systems and ergodic theory. After reviewing some classical topics in information theory, the authors describe an information theoretic perspective of the symbolic dynamics. The connection between the orbits of a dynamical system and a dynamical system as an entropy process is discussed and the connection between the measurable dynamics and topological dynamics is described in terms of the variational principle for the entropy. These connections are stressed using the techniques analysed in the previous chapters (The Ulam-Galerkin matrix approximations, FTLE, etc.) and computational tools.

The book contains an appendix with some codes and computations related to the previously used methods. This book is appropriate for upper-level undergraduates in mathematics, graduate students and researchers in applied dynamical systems, ergodic theory, fluid dynamics, or geosciences.

Gabriela Liţcanu

ANSHU NARANG-SIDDARTH, JOHN VALASEK, *Nonlinear Time Scale Systems in Standard and Nonstandard Forms. Analysis and Control*, SIAM, 2014, 236 p., ISBN 978-1-611973-33-4.

Several phenomena incorporate processes evolving at different time scales. Singular perturbation methods play a significant role in analysis and design of control techniques for the systems modelling such situations. The goal of this book is to present control techniques based on singular perturbation theory that apply to a large class of systems, including some that are not traditionally controlled through these methods.

The book opens with a chapter containing a general discussion of multiple scale phenomena, a presentation of several examples motivating the development of the techniques explained in the book and a brief exposition of the forced singular perturbation method.

Chapter 2 is devoted to some essential concepts of singular perturbation theory, including a geometric perspective and the composite Lyapunov function.

Two main control problems are addressed throughout this book, using nonlinear techniques. In the first control problem, control techniques are developed for ensuring that the closed-loop system asymptotically follows a desired slow state reference. Standard and nonstandard forms of a singularly perturbed systems associated to this problem are considered in Chapters 3 and 4 respectively. In Chapter 3 the authors present the composite control scheme for controlling standard forms of singularly perturbed systems. They use simple examples and then develop a new approach called the modified composite control. Chapter 4 is devoted to the construction of an indirect manifold construction approach for dealing with the difficulties that appear while controlling the nonstandard singularly perturbed systems. The results are valid for both standard and nonstandard forms of systems. In Chapter 5 the authors extend the indirect manifold construction approach to systems with multiple time scales. Then they show, in Chapter 6, applications of these techniques to some non-minimum phase control problems.

The second problem considered in the book concerns control algorithms to ensure the closed loop systems follow both prescribed slow and fast state trajectories simultaneously. The presentation is limited to two time scales systems in nonstandard form. A new algorithm is developed in Chapter 7. The technique is validated through simulation of a generic enzyme kinetic model and a high-fidelity nonlinear model of an aircraft model.

The book contains new ideas and issues discussed through simple examples and tutorials. The authors also discuss benefits and limitations of the techniques developed. On the other hand, they do not analyse issues such as how time scales can be characterized and when they are defined.

This book is addressed to researchers and practitioners in control engineering and to applied mathematicians interested in control theory. It can also be used as a reference for advanced control theory courses.

Gabriela Liţcanu

RALPH C. SMITH, *Uncertainty Quantification. Theory, Implementation, and Applications*, SIAM Computational Science and Engineering, SIAM, 2014, XVIII + 382 p., ISBN 978-1-611973-21-1.

The book provides readers with the basic concepts, theory and algorithms necessary to quantify input and response uncertainities for simulation models arising in a broad range of disciplines. It covers concepts from probability and statistics, parameter selection techniques, frequentist and Bayesian model calibration, propagation of uncertainities, quantification of model discrepancy, surrogate model construction, and local and global sensitivity analysis.

The book is organized into 15 chapters and an appendix which contains basic concepts from functional analysis. Chapter 1, Introduction and details the nature of uncertainties and predictive estimation.

Chapter 2 presents five applications, the weather models, climate models, subsurface hydrology and geology models, nuclear reactor designs and models for biological phenomena, where model predictions with qunatified uncertainties are critical for understanding and predicting scientific phenomena and making informed decisions and designs based upon these predictions.

Chapter 3 contains prototypical models and Chapter 4 presents fundamentals of probability, random processes and statistics. Chapter 5 details techniques for transforming random algebraic and differential equations into problems posed in terms of inputs having densities that are constructed either experimentally or determined using the techniques discussed in Chapters 7 and 8. These last chapters, present statistical techniques to construct parameter densities using measured data. Chapter 6 adresses techniques to isolate the set of identifiable or influential parameters models. Chapter 9 presents uncertainty propagation in models and Chapter 10 details stochastic spectral methods.

Chapter 11 discusses the tensor product and sparse gird quadrature and interpolation techniques required to implement the stochastic spectral methods of Chapter 10. The model dicrepancy is detailed in Chapter 12 and the surrogate models are presented in Chapter 13. The local and global sensitivity analyses are provided in the last two chapters of the book.

The text is intended for advanced undergraduates, graduate students and researchers in mathematics, statistics, operations research, computer science, biology and engineering.

Cristina Stamate

KLAUS HÖLLIG, JÖRG HÖRNER, *Approximation and Modeling with B-Splines*, SIAM, Philadelphia, 2013, XIII + 214 p., ISBN 978-1-611972-94-8.

This book gives an introduction to the basic B-spline theory, describing approximation methods and algorithms, as well as modeling and design techniqiues. Topics include the Bezier form, computing with B-splines, approximation and interpolation, spline representations of curves, surfaces, and solids, hierarchical bases and finite element simulation.

The book contains 9 chapters and an Appendix which provides key definitions and results. Chapter 1 contains basic results which are important for B-spline techniques: the standard monomial form, the Taylor approximation and polynomial interpolation, the Bernstein basis, the Weierstrass approximation theorem.

Chapter 2 introduces the parametrization of curves with Bernstein polynomials and the properties of this representation referred to as Bézier form. Also, the authors present an expresion for the curvature and conditions for the smooth connection of Bézier curves.

The rational Bézier form and the basic properties of this more general curve format are presented in Chapter 3. The B-splines, the spline spaces and periodic splines are considered in Chapter 4.

To suit any type of application in Chapter 5, numerous approximation methods have been developed. Chapter 6 presents spline curves as the polynomial and rational spline curves and the authors explain how interpolation schemes for spline functions can be applied to curves. Chapter 7 presents the multivariate splines using the tensor product formalism. Methods for modeling and approximation of sufaces and solids are given in Chapter 8, while Chapter 9 presents finite elements techniques.

Notes and comments for each chapter, and 122 references recommend this book which focuses on key results and methods most widely used in practice.

The book is usefull for practitioners who are using B-splines in numerical simulations, computer-aided design and visualization, as well as for students in mathematics, computer science or for beginning graduates in engineering.

Cristina Stamate

PETER KUCHMENT, *The Radon Transform and Medical Imaging*, SIAM Series: CBMS-NSF regional conference series in applied mathematics, SIAM, 2014, XVI + 240 p., ISBN 978-1-611973-28-0.

The goal of this book is:

– to describe the main problems and techniques of some well-established medical imaging modalities;

– to explain important concepts concerning inversion, stability, incomplete data effects, the role of interior information, and other issues critical to all medical imaging methods.

The book is organizated into 3 parts: Part I, *Introduction*, contains 4 chapters concerning a brief and incomplete history of CT and the connection with the pure and applied mathematics used for the mathematics of CT.

Part II, *Traditional Computed Tomography Techniques and Integral Geometry*, starts with Chapter 5, where the basic imaging procedure and its mathematical model are introduced, leading to the X-ray transform. The main formula of this part, the projection slice formula offers information on inversion, stability and range of the 2D X-ray transform.

Chapter 6 addresses the so-called emission tomography methods (SPECT and PET).

Chapter 7 presents the techniques of microlocal analysis, very important in tomography. A more advanced part of this analysis, the techniques of pseudodifferential operators and Fourier integral operators, are not developed here but a recommended literature can be found in Appendix E. Chapter 8 discuss 3D Radon and X-ray tranforms; it present the John's parametrization of lines in 3-dimensions and the related ultrahyperbolic John's equation.

Chapter 9 provides a superficial overview of various numerical techniques and Chapter 10 provides brief looks at some other important modalities such as magnetic resonance imaging, electrical impedance imaging, optical tomography.

Part III addresses the slew of new, mostly not in clinics yet, but promising hybrid or coupled phisics techniques. Chapter 11 is devoted to the best-developed hybrid techniques of thermo-/photo – acoustic tomography. Chapter 12 provides brief accounts of how ultrasonis modulation can make safe the high contrast. Chapter 13 explains how internal information should be responsible for an improved stability.

The audience of the book includes a wide range of people- from graduate students to mature researchers who are interested in the mathematics behind medical imaging. For nonexperts, the author provides appendices that cover background information on notations, Fourier analysis, geometric rays and linear operators.

The vast bibliography (more than 800 references), directs readers to a wide array of additional information sources on medical imaging for further study.

Cristina Stamate

CATALIN STOEAN, RUXANDRA STOEAN, *Support Vector Machines and Evolutionary Algorithms for Classification. Single or Together?* Intelligent Systems Reference Library, Vol. 69, Springer, 2014, XIII+122 p., ISBN: 978-3-319-06940-1 (Print) , 978-3-319-06941-8 (Online).

This is a volume authored by two Romanian researchers and young professors, Catalin and Ruxandra Stoean, from the University of Craiova, Craiova, Romania. The volume includes 8 chapters, supplemented by Front Matter (12 pages). After a brief Introduction (4 pages), the first part of the book, titled "Part I: Support Vector Machines" introduces the topic of "Support Vector Learning and Optimization", including a discussion of structural risk minimization, a detailed treatment of support vector machines with linear learning, with Nonlinear Learning, and for Multi-class Learning (Chapter 2).

The "Part II: Evolutionary Algorithms" covers much of the volume and consists in three chapters. In Chapter 3, named "Overview of Evolutionary Algorithms", the authors deal with introductory aspects on the topic, illuminating "The Wheels of Artificial Evolution" and "What's What in Evolutionary Algorithms", then treat the representations used, the population model, the fitness evaluation and the internal procedures of these algorithms, including the selection operator, selection for reproduction, selection for replacement, the recombination operator, and the mutation

operator. Also presented are evolutionary algorithms for classification. The fourth chapter introduces genetic chromodynamics (crowding genetic chromodynamics, genetic chromodynamics for classification, and experimental results). Chapter 5 is devoted to cooperative coevolution; the authors expose evolutionary and cooperative approaches for coadaptive classification and demonstrates the approaches through results in the final part of the chapter.

The core of the volume is its third part, "Support Vector Machines and Evolutionary Algorithms". It starts with Chapter 6, "Evolutionary Algorithms Optimizing Support Vector Learning", continues with the 7th chapter on "Evolutionary Algorithms Explaining Support Vector Learning" and ends with a section (chapter 8) of final remarks. A rich bibliography and an index complement the volume.

The book is well written and throughout it one can easily guess two experienced researchers in the field. I recommend the volume to any Ph.D. student and young researcher who is active in SVM techniques and in classifications.

H.N. Teodorescu