

# Multispectral Imaging Toolbox

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In keeping with the style of the Handbook of Modern Biophysics, this fourth volume, Application of Near-Infrared Spectroscopy in Biomedicine, balances the need for physical science/mathematics formalism with a demand for biomedical perspectives. Each chapter divides the presentation into two major parts: the first establishes the conceptual framework and describes the instrumentation or technique, while the second illustrates current applications in addressing complex biology questions. With the additional sections on further reading, problems, and references, the interested reader can explore some chapter ideas more widely.

Support vector machines (SVM) have both a solid mathematical background and practical applications. This book focuses on the recent advances and applications of the SVM, such as image processing, medical practice, computer vision, and pattern recognition, machine learning, applied statistics, and artificial intelligence. The aim of this book is to create a comprehensive source on support vector machine applications.

This book presents cases from different countries with a main focus on the perspectives of using precision farming in Europe. Divided into 12 chapters

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it addresses some of the most recent developments and aspects of precision farming. The intention of this book is to provide an overview of some of the most promising technologies with precision agriculture from an economic point of view. Each chapter has been put together so that it can be read individually should the reader wish to focus on one particular topic. Precision Farming as a farm technology benefits from large-scale advantages due to relatively high investment costs and is primarily adopted on farms with medium to large field areas. The global population is increasing rapidly, and feeding the ever-increasing population poses a serious challenge for agriculturalists around the world. Seed is a basic and critical input in agriculture to ensure global food security. Roughly 90 percent of the crops grown all over the world are propagated by seed. However, seed can also harbour and spread pathogens, e.g. fungi, bacteria, nematodes, viruses etc., which cause devastating diseases. Seed-borne pathogens represent a major threat to crop establishment and yield. Hence, timely detection and diagnosis is a prerequisite for their effective management. The book "Seed-Borne Diseases of Agricultural Crops: Detection, Diagnosis & Management" addresses key issues related to seed-borne/transmitted diseases in various agricultural crops. Divided into 30 chapters, it offers a comprehensive compilation of papers concerning:

the history of seed pathology, importance of seed-borne diseases, seed-borne diseases and quarantine, seed health testing and certification, detection and diagnosis of seed-borne diseases and their phytopathogens, host-parasite interactions during development of seed-borne diseases, diversity of seed-borne pathogens, seed-borne diseases in major agricultural crops, non-parasitic seed disorders, mechanisms of seed transmission and seed infection, storage fungi and mycotoxins, impact of seed-borne diseases on human and animal health, and management options for seed-borne diseases. We wish to thank all of the eminent researchers who contributed valuable chapters to our book, which will be immensely useful for students, researchers, academics, and all those involved in various agro-industries.

This second edition of the successful reference work has been updated and revised with approximately 30% new content to reflect the numerous instrumental developments and improvements, as well as the significant expansion of this rapidly developing field. For example, the combination of IR imaging with AFM has enhanced the achievable lateral resolution by an order of magnitude down to a few hundred nanometers, thus launching a multiplicity of new applications in material science. Furthermore, Raman and IR spectroscopic imaging have become key technologies for the life sciences

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and today contribute tremendously to a better and more detailed understanding of numerous biological and medical research topics. The topical structure of this new edition is now subdivided into four parts.

The first treats the fundamentals of the instrumentation for infrared and Raman imaging and mapping and an overview on the chemometric tools for image analysis. The second part describes a wide variety of applications ranging from biomedical via food, agriculture and plants to polymers and pharmaceuticals. This is followed by a description of imaging techniques operating beyond the diffraction limit, while the final part covers special methodical developments and their utility in specific fields. With its many valuable practical tips, this is a must-have overview for researchers in academic and industrial laboratories wishing to obtain reliable results with this method.

*Jatropha curcas*, or physic nut, is a small tree that, in tropical climates, produces fruits with seeds containing ~38% oil. The physic nut has the potential to be highly productive and is amenable to subculture in vitro and to genetic modification. It also displays remarkable diversity and is relatively easy to cross hybridize within the genus. Thanks to these promising features, *J. curcas* is emerging as a promising oil crop and is gaining commercial interest among the biofuel research communities. However, as a crop, physic nut has been an economic flop

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since 2012, because the species was not fully domesticated and the average productivity was less than 2 t/ha, which is below the threshold of profitability.<sup>7</sup> t/ha could be reached and it is contributing to new markets in some countries. As such, it is important for research to focus on the physiology and selective breeding of *Jatropha*. This book provides a positive global update on *Jatropha*, a crop that has suffered despite its promising agronomic and economic potential. The editors have used their collective expertise in agronomy, botany, selective breeding, biotechnology, genomics and bioinformatics to seek out high-quality contributions that address the bottleneck features in order to improve the economic trajectory of physic nut breeding.

This is a revised reprint of the 2018 second edition. *Chemometrics in Spectroscopy, Second Edition*, provides the reader with the methodology crucial to apply chemometrics to real world data. It allows scientists using spectroscopic instruments to find explanations and solutions to their problems when they are confronted with unexpected and unexplained results. Unlike other books on these topics, it explains the root causes of the phenomena that lead to these results. While books on NIR spectroscopy sometimes cover basic chemometrics, they do not mention many of the advanced topics this book discusses. In addition, traditional

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chemometrics books do not cover spectroscopy to the point of understanding the basis for the underlying phenomena. The second edition has been expanded with 50% more content covering advances in the field that have occurred in the last 10 years, including calibration transfer, units of measure in spectroscopy, principal components, clinical data reporting, classical least squares, regression models, spectral transfer, and more. Written in the column format of the authors' online magazine Presents topical and important chapters for those involved in analysis work, both research and routine Focuses on practical issues in the implementation of chemometrics for NIR Spectroscopy Includes a companion website with 350 additional color figures that illustrate CLS concepts

In an age of heightened nutritional awareness, assuring healthy human nutrition and improving the economic success of food producers are top priorities for agricultural economies. In the context of these global changes, new innovative technologies are necessary for appropriate agro-food management from harvest and storage, to marketing and consumer consumption. Optical Monitoring of Fresh and Processed Agricultural Crops takes a task-oriented approach, providing essential applications for a better understanding of non-invasive sensory tools used for raw, processed, and stored

agricultural crops. This authoritative volume presents interdisciplinary optical methods technologies feasible for in-situ analyses, such as: Vision systems VIS/NIR spectroscopy Hyperspectral camera systems Scattering Time and spatial-resolved approaches Fluorescence Sensorfusion Written by an Internationally Recognized Team of Experts Using a framework of new approaches, this text illustrates how cutting-edge sensor tools can perform rapid and non-destructive analysis of biochemical, physical, and physiological properties, such as maturity stage, nutritional value, and neoformed compounds appearing during processing. These are critical components to maximizing nutritional quality and safety of fruits and vegetables and decreasing economic losses due to produce decay. Quality control systems are quickly gaining a foothold in food manufacturing facilities, making Optical Monitoring of Fresh and Processed Agricultural Crops a valuable resource for agricultural technicians and developers working to maintain nutritional product value and approaching a fine-tuned control process in the crop supply chain.

Process Analytical Technology explores the concepts of PAT and its application in the chemical and pharmaceutical industry from the point of view of the analytical chemist. In this new edition all of the original chapters have been updated and revised, and new chapters covering the important topics of

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sampling, NMR, fluorescence, and acoustic chemometrics have been added. Coverage includes: Implementation of Process Analytical Technologies UV-Visible Spectroscopy for On-line Analysis Infrared Spectroscopy for Process Analytical Applications Process Raman Spectroscopy Process NMR Spectroscopy: Technology and On-line Applications Fluorescent Sensing and Process Analytical Applications Chemometrics in Process Analytical Technology (PAT) On-Line PAT Applications of Spectroscopy in the Pharmaceutical Industry Future Trends for PAT for Increased Process Understanding and Growing Applications in Biomanufacturing NIR Chemical Imaging This volume is an important starting point for anyone wanting to implement PAT and is intended not only to assist a newcomer to the field but also to provide up-to-date information for those who practice process analytical chemistry and PAT. It is relevant for chemists, chemical and process engineers, and analytical chemists working on process development, scale-up and production in the pharmaceutical, fine and specialty chemicals industries, as well as for academic chemistry, chemical engineering, chemometrics and pharmaceutical science research groups focussing on PAT. Review from the First Edition "The book provides an excellent first port of call for anyone seeking material and discussions to understand the



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area better. It deserves to be found in every library that serves those who are active in the field of Process Analytical Technology.”—Current Engineering Practice

The Fifth International Workshop on Seeds was held at the University of Reading, UK, from 10 to 15 September, 1995. Some 230 seed scientists, from a wide range of disciplines (botanists, biochemists, ecologists, agriculturalists, foresters, and commercial seedsmen), from 31 countries (Europe, the Americas, and Asia) participated in the workshop. A large number of oral and poster presentations was made during the workshop and we are pleased to publish so many of them in these Proceedings. The papers herein are listed by the sessions in which they were presented but, as is often the case, many papers cover a broader range of topics than the session titles imply. For seed physiologists, ecologists, and technologists, this book collates much of the current research on seeds.

The art and secrets of making fermented sausages finally revealed. The majority of books written on making sausages do not tackle the subject of fermented sausages at all. The topic is limited to a statement that this is an advanced field of sausage making which is not recommended for an amateur sausage maker. Well, the main reason for writing this book was that the authors did not share this opinion. On the contrary, they believed that any

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hobbyist could make wonderful salami at home, if he only knew how. For thousands of years we have been making dry fermented sausages without any understanding of the process involved. Only in the past 60 years, sufficient advances were made in the field of meat science which explained the fermentation and drying of meats. Until then, the manufacturing process was shrouded in secrecy, and was more a combination of art and magic than a solid science. Highly technical papers were published in Food Technology journals, unfortunately these works were written in such difficult terms, that they were beyond the comprehension of the average sausage maker. Thus was born the idea of bridging the technology gap that existed between Meat Science and the requirements of the typical hobbyist making products at home. With more information obtainable every day, and commercial starter cultures available to the public, there is little reason to abstain from making quality salamis at home, regardless of the climate and outside conditions. Little Miss Contrary always says and does the opposite of what she really means, to the confusion of those around her.

Evaluation Technologies for Food Quality summarizes food quality evaluation technologies, which include sensory evaluation techniques and chemical and physical analysis. In particular, the book introduces many novel micro and nano

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evaluation techniques, such as atomic force microscopy, scanning electron microscopy, and other nanomaterial-based methods. All topics cover basic principles, procedures, advantages, limitations, recent technology development, and application progress in different types of foods. This book is a valuable resource for scientists in the field of food science, engineering, and professionals in the food industry, as well as for undergraduate and postgraduate students studying food quality evaluation technology. Explains basic principles, procedures, advantages, limitations, and current applications of recent food quality technologies Provides guidance on the understanding and application of food quality evaluation technology in the field of food research and food industry Introduces many novel micro/nano evaluation techniques, such as atomic force and scanning electron microscopies and other nanomaterial-based methods

The Alliums are some of the most ancient cultivated crops and include onions, garlic, leeks and other related plants. This book provides an up-to-date review of Allium science for postgraduates and researchers. It contains commissioned chapters on topics that have shown major advances particularly in the last ten years such as molecular biology, floriculture and biofertilizers.

Designed to serve as the first point of reference on

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the subject, Comprehensive Chemometrics presents an integrated summary of the present state of chemical and biochemical data analysis and manipulation. The work covers all major areas ranging from statistics to data acquisition, analysis, and applications. This major reference work provides broad-ranging, validated summaries of the major topics in chemometrics—with chapter introductions and advanced reviews for each area. The level of material is appropriate for graduate students as well as active researchers seeking a ready reference on obtaining and analyzing scientific data. Features the contributions of leading experts from 21 countries, under the guidance of the Editors-in-Chief and a team of specialist Section Editors: L. Buydens; D. Coomans; P. Van Espen; A. De Juan; J.H. Kalivas; B.K. Lavine; R. Leardi; R. Phan-Tan-Luu; L.A. Sarabia; and J. Trygg Examines the merits and limitations of each technique through practical examples and extensive visuals: 368 tables and more than 1,300 illustrations (750 in full color) Integrates coverage of chemical and biological methods, allowing readers to consider and test a range of techniques Consists of 2,200 pages and more than 90 review articles, making it the most comprehensive work of its kind Offers print and online purchase options, the latter of which delivers flexibility, accessibility, and usability through the search tools and other productivity-enhancing

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### features of ScienceDirect

Provides a complete and up-to-date introduction to the technique, taking account of developments in instrumentation for remote and non-invasive measurements and significant advances in calibration and mathematics. The clear explanation of practical and theoretical aspects of the techniques and mathematical treatments available will be essential reading for those working in the food industry and for anyone approaching NIR for the first time.

Techniques and Applications of Hyperspectral Image Analysis gives an introduction to the field of image analysis using hyperspectral techniques, and includes definitions and instrument descriptions. Other imaging topics that are covered are segmentation, regression and classification. The book discusses how high quality images of large data files can be structured and archived. Imaging techniques also demand accurate calibration, and are covered in sections about multivariate calibration techniques. The book explains the most important instruments for hyperspectral imaging in more technical detail. A number of applications from medical and chemical imaging are presented and there is an emphasis on data analysis including modeling, data visualization, model testing and statistical interpretation. Cluster analysis finds groups in data automatically. Most methods have been heuristic and leave open such central questions as: how many clusters are there? Which method should I use? How should I handle outliers? Classification assigns new observations to groups given previously classified observations, and also has open questions about parameter tuning, robustness and uncertainty assessment.

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This book frames cluster analysis and classification in terms of statistical models, thus yielding principled estimation, testing and prediction methods, and sound answers to the central questions. It builds the basic ideas in an accessible but rigorous way, with extensive data examples and R code; describes modern approaches to high-dimensional data and networks; and explains such recent advances as Bayesian regularization, non-Gaussian model-based clustering, cluster merging, variable selection, semi-supervised and robust classification, clustering of functional data, text and images, and co-clustering. Written for advanced undergraduates in data science, as well as researchers and practitioners, it assumes basic knowledge of multivariate calculus, linear algebra, probability and statistics.

This book provides an overview of the state of the art in pharmaceutical applications of UV-VIS spectroscopy. This book presents the fundamentals for the beginner and, for the expert, discusses both qualitative and quantitative analysis problems. Several chapters focus on the determination of drugs in various matrices, the coupling of chromatographic and spectrophotometric methods, and the problems associated with the use of chemical reactions prior to spectrophotometric measurements. The final chapter provides a survey of the spectrophotometric determination of the main families of drugs, emphasizing the achievements of the last decade.

Offering a fundamental basis in kernel-based learning theory, this book covers both statistical and algebraic principles. It provides over 30 major theorems for kernel-based supervised and unsupervised learning models. The first of the theorems establishes a condition, arguably necessary and sufficient, for the kernelization of learning models. In addition, several other theorems are devoted to proving mathematical equivalence between seemingly unrelated models. With over 25 closed-

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form and iterative algorithms, the book provides a step-by-step guide to algorithmic procedures and analysing which factors to consider in tackling a given problem, enabling readers to improve specifically designed learning algorithms, build models for new applications and develop efficient techniques suitable for green machine learning technologies. Numerous real-world examples and over 200 problems, several of which are Matlab-based simulation exercises, make this an essential resource for graduate students and professionals in computer science, electrical and biomedical engineering. Solutions to problems are provided online for instructors.

The development of new sources and methods in the terahertz spectral range has generated intense interest in terahertz spectroscopy and its application in an array of fields. Presenting state-of-the-art terahertz spectroscopic techniques, *Terahertz Spectroscopy: Principles and Applications* focuses on time-domain methods based on femtosecond laser sources and important recent applications in physics, materials science, chemistry, and biomedicine. The first section of the book examines instrumentation and methods for terahertz spectroscopy. It provides a comprehensive treatment of time-domain terahertz spectroscopic measurements, including methods for the generation and detection of terahertz radiation, methods for determining optical constants from time-domain measurements, and the use of femtosecond time-resolved techniques. The last two sections explore a variety of applications of terahertz spectroscopy in physics, materials science, chemistry, and biomedicine. With chapters contributed by leading experts in academia, industry, and research, this volume thoroughly discusses methods and applications, setting it apart from other recent books in this emerging terahertz field.

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Chemometrics originated from multivariate statistics in chemistry, and this field is still the core of the subject. The increasing availability of user-friendly software in the laboratory has prompted the need to optimize it safely. This work comprises material presented in courses organized from 1987-1992, aimed mainly at professionals in industry. The book covers approaches for pattern recognition as applied, primarily, to multivariate chemical data. These include data reduction and display techniques, principal components analysis and methods for classification and clustering. Comprehensive case studies illustrate the book, including numerical examples, and extensive problems are interspersed throughout the text. The book contains extensive cross-referencing between various chapters, comparing different notations and approaches, enabling readers from different backgrounds to benefit from it and to move around chapters at will. Worked examples and exercises are given, making the volume valuable for courses. Tutorial versions of SPECTRAMAP and SIRIUS are optionally available as a Software Supplement, at a low price, to accompany the text. Resolving Spectral Mixtures: With Applications from Ultrafast Time-Resolved Spectroscopy to Superresolution Imaging offers a comprehensive look into the most important models and frameworks essential to resolving the spectral unmixing problem—from multivariate curve resolution and multi-way analysis to Bayesian positive source separation and nonlinear unmixing. Unravelling total spectral data into the contributions from individual unknown components with limited prior information is a complex problem that has attracted continuous interest for almost four decades. Spectral unmixing is a topic of interest in statistics, chemometrics, signal processing, and image analysis. For decades, researchers from these fields were often unaware of the work in other disciplines due to their different scientific and



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technical backgrounds and interest in different objects or samples. This led to the development of quite different approaches to solving the same problem. This multi-authored book will bridge the gap between disciplines with contributions from a number of well-known and strongly active chemometric and signal processing research groups. Among chemists, multivariate curve resolution methods are preferred to extract information about the nature, amount, and location in time (process) and space (imaging and microscopy) of chemical constituents in complex samples. In signal processing, assumptions are usually around statistical independence of the extracted components. However, the chapters include the complexity of the spectral data to be unmixed as well as dimensionality and size of the data sets. Advanced spectroscopy is the key thread linking the different chapters. Applications cover a large part of the electromagnetic spectrum. Time-resolution ranges from femtosecond to second in process spectroscopy and spatial resolution covers the submicronic to macroscopic scale in hyperspectral imaging. Demonstrates how and why data analysis, signal processing, and chemometrics are essential to the spectral unmixing problem Guides the reader through the fundamentals and details of the different methods Presents extensive plots, graphical representations, and illustrations to help readers understand the features of different techniques and to interpret results Bridges the gap between disciplines with contributions from a number of well-known and highly active chemometric and signal processing research groups

Tomato is one of the most widespread horticultural species in the world. Used in a wide and diverse range of forms, from being suitable for consumption fresh to use as a manufactured derivative, e.g. sauce, peeled, juices, ketchup, etc., it is hard to imagine tomato-free cuisine. With many

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national traditions and dishes based on this culinary vegetable, it is said to be one of the symbols of Mediterranean cuisine. This book looks at the many changes that are taking place in the tomato market and industry; tomato producers are combining tomato origin, tradition, territory, quality, service and supply chain to adapt to the needs of the new consumers. It deals with the topics that are pertinent to the current industry: rheology and mechanical properties; origin determination; innovation and new product development; market research; sensory and consumer preference; quality control and new methods; volatile compounds and aroma; non-conventional processing technologies; functional and healthy compounds; waste and by-product valorization; and sustainability and traditional products. Providing a comprehensive overview of the actual tomato industry; how it ensures product authenticity; new product development, particularly focused on consumer demands; the presence of bio-active substances able to prevent chronic diseases (carotenoids, phenolic and flavonoids); and how to convert industrial waste into added value by-products; this book will appeal to professionals and food product developers.

The Hymenoptera is one of the largest orders of terrestrial arthropods and comprises the sawflies, wasps, ants, bees and parasitic wasps. This book examines the current state of all major areas of research for this important group of insects, including systematics, biological control, behaviour and use in education.

Omics in Plant Breeding John Wiley & Sons

Preceded by Magnetic resonance imaging: physical principles and sequence design / E. Mark Haacke ...

[et al.]. c1999.

Computational and high-throughput methods, such as genomics, proteomics, and transcriptomics, known collectively as “-omics,” have been used to study plant biology for well over a decade now. As these technologies mature, plant and crop scientists have started using these methods to improve crop varieties. *Omics in Plant Breeding* provides a timely introduction to key omics-based methods and their application in plant breeding. *Omics in Plant Breeding* is a practical and accessible overview of specific omics-based methods ranging from metabolomics to phenomics. Covering a single methodology within each chapter, this book provides thorough coverage that ensures a strong understanding of each methodology both in its application to, and improvement of, plant breeding. Accessible to advanced students, researchers, and professionals, *Omics in Plant Breeding* will be an essential entry point into this innovative and exciting field.

- A valuable overview of high-throughput, genomics-based technologies and their applications to plant breeding
- Each chapter explores a single methodology, allowing for detailed and thorough coverage
- Coverage ranges from well-established methodologies, such as genomics and proteomics, to emerging technologies, including phenomics and physiomics

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Viçosa in Brazil. Roberto Fritsche-Neto is a Professor of Genetics and Plant Breeding at the University of São Paulo in Brazil.

The complex and multidisciplinary nature of environmental problems requires that they are dealt with in an integrated manner. Modeling and software have become key instruments used to promote sustainability and improve environmental decision processes, especially through systematic integration of various knowledge and data and their ability to foster learning and help make predictions. This book presents the current state-of-the-art in environmental modeling and software and identifies the future challenges in the field. State-of-the-art in environmental modeling and software theory and practice for integrated assessment and management serves as a starting point for researchers. Identifies the areas of research and practice required for advancing the requisite knowledge base and tools, and their wider usage. Best practices of environmental modeling enables the reader to select appropriate software and gives the reader tools to integrate natural system dynamics with human dimensions.

The issue of food authenticity is not new. For centuries unscrupulous farmers and traders have attempted to 'extend', or otherwise alter, their products to maximise revenues. In recent years the subject has reached new prominence and there

even have been situations where food authenticity has featured as a newspaper headline in various countries. Food legislation covering the definition, and in some cases composition, of various commodities has been in place in developed countries for many years and paradoxically it is the legislative trend away from emphasis on composition and more on accurate and truthfullabeliing that has been one driving force for the authenticity issue. Another, and many would speculate as the more potent, driving force is the move towards fewer and larger supermarket chains in many countries. Such trading companies with their images of quality products, buying power and commercial standing, exercise considerable commercial power which has been claimed as a significant source of financial pressure on food prices and food commodity product quality. For whatever reason, recent food authenticity issues have become news and consumers, the media and enforcement authorities are showing more interest than ever before in the subject.

Aqueous-based film coating has become routine in the pharmaceutical industry. This process eliminates the use of organic solvents and thus avoids economic, environmental, and toxicological issues related to residual solvents and solvent recovery. Aqueous-based coating, however, is complex and many variables may impact the final product and its

performance. This fourth edition of *Aqueous Polymeric Coatings for Pharmaceutical Dosage Forms* aims to provide insight into the factors and parameters that should be considered and controlled for the successful development and commercialization of a coated product. The fourth edition has been revised and expanded to reflect the most recent scientific advancements from the literature. The contributing authors explain in detail, using illustrated examples, appropriate steps to solve and ideally avoid formulation, processing, and stability problems and to achieve an optimized dosage form. Trade names and chemical names of commercially marketed coatings are used throughout the text to help familiarize the reader with the various materials available for pharmaceutical applications. This book will be a valuable resource for anyone in the pharmaceutical industry working in the area of aqueous-based film coating.

This monograph is devoted to urgent questions of the theory and applications of the Monte Carlo method for solving problems of atmospheric optics and hydrooptics. The importance of these problems has grown because of the increasing need to interpret optical observations, and to estimate radiative balance precisely for weather forecasting. Inhomogeneity and sphericity of the atmosphere, absorption in atmospheric layers, multiple scattering and polarization of light, all create difficulties in

solving these problems by traditional methods of computational mathematics. Particular difficulty arises when one must solve nonstationary problems of the theory of transfer of narrow beams that are connected with the estimation of spatial location and time characteristics of the radiation field. The most universal method for solving those problems is the Monte Carlo method, which is a numerical simulation of the radiative-transfer process. This process can be regarded as a Markov chain of photon collisions in a medium, which result in scattering or absorption. The Monte Carlo technique consists in computational simulation of that chain and in constructing statistical estimates of the desired functionals. The authors of this book have contributed to the development of mathematical methods of simulation and to the interpretation of optical observations. A series of general methods using Monte Carlo techniques has been developed. The present book includes theories and algorithms of simulation. Numerical results corroborate the possibilities and give an impressive prospect of the applications of Monte Carlo methods.

As industrial processes and their corresponding control models increase in complexity, the data provided by traditional point sensors is no longer adequate to ensure product quality and cost-effective operation. Process Imaging for Automatic Control demonstrates how in-process imaging technologies surpass the limitations of

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traditional monitoring systems by providing real-time multidimensional measurement and control data. Combined with suitable data extraction and control schemes, such systems can optimize the performance of a wide variety of industrial processes. Contributed by leading international experts, *Process Imaging for Automatic Control* offers authoritative, comprehensive coverage of this new area of process control technology, including: Basic goals of process modeling and their application to automatic control Direct imaging devices and applications, such as machine vision and spatial measurement of flow velocity, pressure, shear, pH, and temperature Various techniques, hardware implementations, and image reconstruction methods for process tomography Image enhancement and restoration State estimation methods State space control system models, control strategies, and implementation issues Five chapters devoted to case studies and advanced applications From theory to practical implementation, this book is the first to treat the entire range of imaging techniques and their application to process control. Supplying broad coverage with more than 270 illustrations and nearly 700 cited references, it presents an accessible introduction to this rapidly growing, interdisciplinary technology.

Of all the early medieval and Renaissance arts--from sculptures, ivories, frescoes, stained glass to easel and wall paintings--it is manuscript illumination, protected between its pages, that has been able to preserve the best evidence for experiencing the dazzling effects that the gold, silver and original glowing colours these objects



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would have had on earlier spectators. The focus therefore of this exciting and innovative exhibition is on COLOUR: it demonstrates and explains the acquisition and chemistry of pigments, the basic materials and constitution of the artist's colour palette, the technique and art of their application by the illuminator, and finally the understanding and aesthetic impact on the viewer. The fundamental algorithms in data mining and machine learning form the basis of data science, utilizing automated methods to analyze patterns and models for all kinds of data in applications ranging from scientific discovery to business analytics. This textbook for senior undergraduate and graduate courses provides a comprehensive, in-depth overview of data mining, machine learning and statistics, offering solid guidance for students, researchers, and practitioners. The book lays the foundations of data analysis, pattern mining, clustering, classification and regression, with a focus on the algorithms and the underlying algebraic, geometric, and probabilistic concepts. New to this second edition is an entire part devoted to regression methods, including neural networks and deep learning.

Based on the integration of computer vision and spectroscopy techniques, hyperspectral imaging is a novel technology for obtaining both spatial and spectral information on a product. Used for nearly 20 years in the aerospace and military industries, more recently hyperspectral imaging has emerged and matured into one of the most powerful and rapidly growing methods of non-destructive food quality analysis and control.

Hyperspectral Imaging for Food Quality Analysis and

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Control provides the core information about how this proven science can be practically applied for food quality assessment, including information on the equipment available and selection of the most appropriate of those instruments. Additionally, real-world food-industry-based examples are included, giving the reader important insights into the actual application of the science in evaluating food products. Presentation of principles and instruments provides core understanding of how this science performs, as well as guideline on selecting the most appropriate equipment for implementation Includes real-world, practical application to demonstrate the viability and challenges of working with this technology Provides necessary information for making correct determination on use of hyperspectral imaging Trains researchers and graduate students in state-of-the-art statistical and machine learning methods to build models with real-world data.

FAO is launching the new and revised Statistical Yearbook 2012. This publication is the foremost collection and reference point for statistical data on food and agriculture globally. Provides a snapshot of related economic, environmental and social trends and issues. A must-have publication for every researcher, statistician, academic and everyone interested in agricultural statistics. The 2012 edition of the FAO Statistical Yearbook represents a break away from FAO tradition. Through employing data from global statistical providers, including FAO, the publication presents a visual synthesis of the major trends and factors shaping the global food and agricultural landscape and their interplay

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with broader environmental, social and economic dimensions. In doing so, it strives to serve as a unique reference point on the state of world food and agriculture for policy-makers, donor agencies, researchers and analysts as well as the general public. The book is subdivided into four thematic parts, where an attempt is made to exhaustively present the spectrum of issues relevant to the subject matter. Part 1 The setting measures the state of the agricultural resource base, by assessing the supply of land, labour, capital, inputs and the adequacy of infrastructure, and also examines the pressure on the world food system stemming from demographic and macroeconomic change Part 2 Hunger dimensions gauges the state of food insecurity and malnutrition, measuring the multitude of dimensions that give rise to hunger and those that shape undernourishment Part 3 Feeding the world evaluates the past and present productive capacity of world agriculture together with the role of trade in meeting changing food, feed and other demands Part 4 Sustainability dimensions examines the sustainability of agriculture in the context of the pressure it exerts on the environment, including the interaction of agriculture with climate change, and how it can provide ecosystem services in relation to the bio-based economy. Relates the production and utilization of onions and other vegetable allium crops to the many aspects of plant science underpinning their production and storage technologies. This book covers species and crop types, plant structure, genetics and breeding, physiology of growth and development as well as pests and diseases.

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