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KEY=METROLOGY - CAITLYN PATRICK

A Practical Guide to Surface Metrology *Springer Nature* This book offers a genuinely practical introduction to the most commonly encountered optical and non-optical systems used for the metrology and characterization of surfaces, including guidance on best practice, calibration, advantages and disadvantages, and interpretation of results. It enables the user to select the best approach in a given context. Most methods in surface metrology are based upon the interaction of light or electromagnetic radiation (UV, NIR, IR), and different optical effects are utilized to get a certain optical response from the surface; some of them record only the intensity reflected or scattered by the surface, others use interference of EM waves to obtain a characteristic response from the surface. The book covers techniques ranging from microscopy (including confocal, SNOM and digital holographic microscopy) through interferometry (including white light, multi-wavelength, grazing incidence and shearing) to spectral reflectometry and ellipsometry. The non-optical methods comprise tactile methods (stylus tip, AFM) as well as capacitive and inductive methods (capacitive sensors, eddy current sensors). The book provides: Overview of the working principles Description of advantages and disadvantages Currently achievable numbers for resolutions, repeatability, and reproducibility Examples of real-world applications A final chapter discusses examples where the combination of different surface metrology techniques in a multi-sensor system can reasonably contribute to a better understanding of surface properties as well as a faster characterization of surfaces in industrial applications. The book is aimed at scientists and

engineers who use such methods for the measurement and characterization of surfaces across a wide range of fields and industries, including electronics, energy, automotive and medical engineering. **Handbook of Surface and Nanometrology** *CRC Press* The **Handbook of Surface and Nanometrology** explains and challenges current concepts in nanotechnology. It covers in great detail surface metrology and nanometrology and more importantly the areas where they overlap, thereby providing a quantitative means of controlling and predicting processes and performance. Trends and mechanisms are explained with **A Practical Guide to the Assessment of Surface Texture** *Surface Metrology for Micro- and Nanofabrication* *Elsevier* **Surface Metrology for Micro- and Nanofabrication** presents state-of-the-art measurement technologies for surface metrology in fabrication of micro- and nanodevices or components. This includes the newest general-purpose scanning probe microscopes, and both contact and non-contact surface profilers. In addition, the book outlines characterization and calibration techniques, as well as in-situ, on-machine, and in-process measurements for micro- and nanofabrication. Provides materials scientists and engineers with an informed overview of the state-of-the-art in surface metrology Helps readers select and design the optimized surface metrology systems and carry out proper surface metrology practices in the fabrication of micro/nano-devices and components **Assesses the best techniques for repairing micro-defects** **Industrial Metrology Surfaces and Roundness** *Springer Science & Business Media* The subject of this book is surface metrology, in particular two major aspects: surface texture and roundness. It has taken a long time for manufacturing engineers and designers to realise the usefulness of these features in quality of conformance and quality of design. Unfortunately this awareness has come at a time when engineers versed in the use and specification of surfaces are at a premium. Traditionally surface metrology usage has been dictated by engineers who have served long and demanding apprenticeships, usually in parallel with studies leading to technician-level qualifications. Such people understood the processes and the achievable accuracies of machine tools, thereby enabling them to match production capability with design requirements. This synergy, has been made possible by the understanding of adherence to careful metrological procedures and a detailed knowledge of surface measuring instruments and their operation, in addition to wider inspection room techniques. With the demise in the UK of polytechnics and technical colleges, this source of skilled technicians has all but dried up. The shortfall has been made up of semi skilled craftsmen, or inexperienced graduates who cannot be expected to satisfy traditional or new technology needs. Miniaturisation, for example, has had a profound effect. Engineering parts are now routinely being made with nanometre surface texture and flatness. At these molecular and atomic scales, the engineer has to be a physicist. **Advanced Metrology Freeform Surfaces** *Academic Press* **Advanced Metrology: Freeform Surfaces** provides the perfect guide for engineering designers and manufacturers interested in exploring the benefits of this technology. The

inclusion of industrial case studies and examples will help readers to implement these techniques which are being developed across different industries as they offer improvements to the functional performance of products and reduce weight and cost. Includes case studies in every chapter to help readers implement the techniques discussed Provides unique advice from industry on hot subjects, including surface description and data processing Features links to online content, including video, code and software Handbook of Non-Invasive Methods and the Skin, Second Edition *CRC Press* Firmly established as the leading international reference in this field, *Non-Invasive Methods and the Skin* broke new ground with its comprehensive coverage of methods used in both clinical and experimental dermatology. Completely revised and updated, containing more than twice as much information, the Second Edition continues the tradition. The authors' thorough research and clear organization make this book a baseline reference for those using noninvasive biophysical methods to study the skin. Arranged by physical modality and structured to provide educational and practical information, the second edition, like its predecessor, will prove to be of value to young researchers and senior scientists alike. The coverage of major evaluation and measurement methods share a consistent format, including scope, sources of error, application, and validity. This edition incorporates 69 revised chapters with more than 90 new chapters covering topics such as computer technique, imaging techniques, skin friction, barrier functions, and more. New chapters provide coverage of: computers, computer techniques, and image analysis imaging techniques, including clinical photography legal situations and guidelines behind instrumental use skin friction barrier functions important new techniques such as in vitro confocal microscopy, OCT, and Raman spectroscopy veterinary/animal research use of methods The truly interdisciplinary, international panel of contributors includes experts from the specialties of dermatology, bioengineering, pathology, manufacturing engineering, medical physics, pharmacology, microbiology, neurology, surgery, obstetrics and gynecology, cardiovascular research, and pharmacy from academic institutions and hospitals in countries such as Denmark, Germany, the United Kingdom, the United States, Japan, Israel, Taiwan, and Singapore. The revision is extensive and covers a broad spectrum of methods while providing the same caliber of authoritative information that made the previous edition so popular. Application oriented, practical, and instructive, this Second Edition will meet the needs of the researchers today, and in years to come. The Surface Texture Answer Book Diamond Turn Machining Theory and Practice *CRC Press* The goal of this book is to familiarize professionals, researchers, and students with the basics of the Diamond Turn Machining Technology and the various issues involved. The book provides a comprehensive knowledge about various aspects of the technology including the background, components of the machine, mechanism of material removal, application areas, relevant metrology, and advances taking place in this domain. Solved and unsolved examples are provided in each of the areas

which will help the readers to practice and get familiarized with that particular area of the Diamond Turn Machining process. **Software Measurement Standards in Surface Metrology Basics, Concepts, Methods** *LAP Lambert Academic Publishing* This book documents the realisation of software measurement standards in surface metrology, as part of the National Measurement System in the UK. Those standards, in the form of the reference dataset with reference results, have been developed by both simulation and experimental methods. The analysis of associated uncertainty has been undertaken through a series of case studies. Some decision rules have been proposed to guide the use of software measurement standards. Those developed software measurement standards provided a novel route to demonstrate the metrological traceability for most surface profile parameters which has not been tried before. It is expected that this route could be implemented for demonstrate all surface parameters in further development. Currently, those standards are distributed via internet by National Measurement Laboratory (NPL) in the United Kingdom. **Handbook of Optical Metrology Principles and Applications, Second Edition** *CRC Press* **Handbook of Optical Metrology: Principles and Applications** begins by discussing key principles and techniques before exploring practical applications of optical metrology. Designed to provide beginners with an introduction to optical metrology without sacrificing academic rigor, this comprehensive text: Covers fundamentals of light sources, lenses, prisms, and mirrors, as well as optoelectronic sensors, optical devices, and optomechanical elements Addresses interferometry, holography, and speckle methods and applications Explains Moiré metrology and the optical heterodyne measurement method Delves into the specifics of diffraction, scattering, polarization, and near-field optics Considers applications for measuring length and size, displacement, straightness and parallelism, flatness, and three-dimensional shapes This new Second Edition is fully revised to reflect the latest developments. It also includes four new chapters—nearly 100 pages—on optical coherence tomography for industrial applications, interference microscopy for surface structure analysis, noncontact dimensional and profile metrology by video measurement, and optical metrology in manufacturing technology. **Industrial Metrology Surfaces and Roundness** *Springer Science & Business Media* The subject of this book is surface metrology, in particular two major aspects: surface texture and roundness. It has taken a long time for manufacturing engineers and designers to realise the usefulness of these features in quality of conformance and quality of design. Unfortunately this awareness has come at a time when engineers versed in the use and specification of surfaces are at a premium. Traditionally surface metrology usage has been dictated by engineers who have served long and demanding apprenticeships, usually in parallel with studies leading to technician-level qualifications. Such people understood the processes and the achievable accuracies of machine tools, thereby enabling them to match production capability with design requirements. This synergy, has been made possible by the understanding of adherence to careful metrological

procedures and a detailed knowledge of surface measuring instruments and their operation, in addition to wider inspection room techniques. With the demise in the UK of polytechnics and technical colleges, this source of skilled technicians has all but dried up. The shortfall has been made up of semi skilled craftsmen, or inexperienced graduates who cannot be expected to satisfy traditional or new technology needs. Miniaturisation, for example, has had a profound effect. Engineering parts are now routinely being made with nanometre surface texture and flatness. At these molecular and atomic scales, the engineer has to be a physicist. **Fundamental Principles of Engineering Nanometrology** *William Andrew* **Fundamental Principles of Engineering Nanometrology** provides a comprehensive overview of engineering metrology and how it relates to micro and nanotechnology (MNT) research and manufacturing. By combining established knowledge with the latest advances from the field, it presents a comprehensive single volume that can be used for professional reference and academic study. Provides a basic introduction to measurement and instruments Thoroughly presents numerous measurement techniques, from static length and displacement to surface topography, mass and force Covers multiple optical surface measuring instruments and related topics (interferometry, triangulation, confocal, variable focus, and scattering instruments) Explains, in depth, the calibration of surface topography measuring instruments (traceability; calibration of profile and areal surface texture measuring instruments; uncertainties) Discusses the material in a way that is comprehensible to even those with only a limited mathematical knowledge **Characterisation of Areal Surface Texture** *Springer Science & Business Media* The function of a component part can be profoundly affected by its surface topography. There are many examples in nature of surfaces that have a well-controlled topography to affect their function. Examples include the hydrophobic effect of the lotus leaf, the reduction of fluid drag due to the riblet structure of shark skin, the directional adhesion of the gecko foot and the angular sensitivity of the multi-faceted fly eye. Surface structuring is also being used extensively in modern manufacturing. In this way many properties can be altered, for example optical, tribological, biological and fluidic. Previously, single line (profile) measurements were adequate to control manufacture of surfaces, but as the need to control the functionality of surfaces increases, there is a growing need for three-dimensional (areal) measurement and characterisation techniques. For this reason there has been considerable research, development and standardisation of areal techniques. This book will present the areal framework that is being adopted by the international community. Whereas previous books have concentrated on the measurement aspects, this book concentrates on the characterisation techniques, i.e. how to interpret the measurement data to give the appropriate (functional) information for a given task. The first part of the book presents the characterisation methods and the second part case studies that highlight the use of areal methods in a broad range of subject areas - from automobile manufacture to

archaeology. Contents Introduction to Surface Topography The Areal Field Parameters The Areal Feature Parameters Areal Filtering Methods Areal Form Removal Areal Fractal Methods Choosing the Appropriate Parameter Characterisation of Individual Areal Features Multi-Scale Signature of Surface Topography Correlation of Areal Surface Texture Parameters to Solar Cell Efficiency Characterisation of Cylinder Liner Honing Textures for Production Control Characterisation of the Mechanical Bond Strength for Copper on Glass Plating Applications Inspection of Laser Structured Cams and Conrods Road Surfaces Precision Lens Molding of Glass: A Process Perspective *Springer Nature* This book highlights the tools and processes used to produce high-quality glass molded optics using commercially available equipment. Combining scientific data with easy-to-understand explanations of specific molding issues and general industry information based on firsthand studies and experimentation, it provides useful formulas for readers involved in developing develop in-house molding capabilities, or those who supply molded glass optics. Many of the techniques described are based on insights gained from industry and research over the past 50 years, and can easily be applied by anyone familiar with glass molding or optics manufacturing. There is an abundance of information from around the globe, but knowledge comes from the application of information, and there is no knowledge without experience. This book provides readers with information, to allow them to gain knowledge and achieve success in their glass molding endeavors. The Certified Quality Inspector Handbook *Quality Press* A comprehensive reference manual to the Certified Quality Inspector Body of Knowledge and study guide for the CQI exam. Optical Measurement of Surface Topography *Springer Science & Business Media* The measurement and characterisation of surface topography is crucial to modern manufacturing industry. The control of areal surface structure allows a manufacturer to radically alter the functionality of a part. Examples include structuring to effect fluidics, optics, tribology, aerodynamics and biology. To control such manufacturing methods requires measurement strategies. There is now a large range of new optical techniques on the market, or being developed in academia, that can measure areal surface topography. Each method has its strong points and limitations. The book starts with introductory chapters on optical instruments, their common language, generic features and limitations, and their calibration. Each type of modern optical instrument is described (in a common format) by an expert in the field. The book is intended for both industrial and academic scientists and engineers, and will be useful for undergraduate and postgraduate studies. Proceedings of the 2nd International Conference on Surface Metrology October 25-27, 2010, Worcester Polytechnic Institute, Worcester, MA, USA *WPI Surface Metrology Lab* Advanced Metrology Freeform Surfaces *Academic Press* Advanced Metrology: Freeform Surfaces provides the perfect guide for engineering designers and manufacturers interested in exploring the benefits of this technology. The inclusion of industrial case studies and examples will help readers to implement these techniques which are being

developed across different industries as they offer improvements to the functional performance of products and reduce weight and cost. Includes case studies in every chapter to help readers implement the techniques discussed Provides unique advice from industry on hot subjects, including surface description and data processing Features links to online content, including video, code and software Recent Interferometry Applications in Topography and Astronomy *BoD - Books on Demand* This book provides a current overview of the theoretical and experimental aspects of some interferometry techniques applied to Topography and Astronomy. The first two chapters comprise interferometry techniques used for precise measurement of surface topography in engineering applications; while chapters three through eight are dedicated to interferometry applications related to Earth's topography. The last chapter is an application of interferometry in Astronomy, directed specifically to detection of planets outside our solar system. Each chapter offers an opportunity to expand the knowledge about interferometry techniques and encourage researchers in development of new interferometry applications. Wood Structure and Properties '02 *Arbora Publishers* Fused Deposition Modeling Based 3D Printing *Springer Nature* This book covers 3D printing activities by fused deposition modeling process. The two introductory chapters discuss the principle, types of machines and raw materials, process parameters, defects, design variations and simulation methods. Six chapters are devoted to experimental work related to process improvement, mechanical testing and characterization of the process, followed by three chapters on post-processing of 3D printed components and two chapters addressing sustainability concerns. Seven chapters discuss various applications including composites, external medical devices, drug delivery system, orthotic inserts, watertight components and 4D printing using FDM process. Finally, six chapters are dedicated to the study on modeling and optimization of FDM process using computational models, evolutionary algorithms, machine learning, metaheuristic approaches and optimization of layout and tool path. Handbook of Semiconductor Manufacturing Technology *CRC Press* Retaining the comprehensive and in-depth approach that cemented the bestselling first edition's place as a standard reference in the field, the Handbook of Semiconductor Manufacturing Technology, Second Edition features new and updated material that keeps it at the vanguard of today's most dynamic and rapidly growing field. Iconic experts Robert Doering and Yoshio Nishi have again assembled a team of the world's leading specialists in every area of semiconductor manufacturing to provide the most reliable, authoritative, and industry-leading information available. Stay Current with the Latest Technologies In addition to updates to nearly every existing chapter, this edition features five entirely new contributions on... Silicon-on-insulator (SOI) materials and devices Supercritical CO₂ in semiconductor cleaning Low- κ dielectrics Atomic-layer deposition Damascene copper electroplating Effects of terrestrial radiation on integrated circuits (ICs) Reflecting rapid progress in many areas, several chapters were heavily revised and updated,

and in some cases, rewritten to reflect rapid advances in such areas as interconnect technologies, gate dielectrics, photomask fabrication, IC packaging, and 300 mm wafer fabrication. While no book can be up-to-the-minute with the advances in the semiconductor field, the Handbook of Semiconductor Manufacturing Technology keeps the most important data, methods, tools, and techniques close at hand. Rough Surfaces *World Scientific* This book is intended for scientists and engineers who need to know about surface roughness, how to measure and describe it and what practical problems it might cause them. The original Rough Surfaces was widely accepted as the definitive work on the subject; this is a completely new edition, updated to take account of recent major advances in measurement and characterisation. Modern instruments are introduced, including laser interferometers and AFM's, and there are sections on fractals and motif analysis. Problems of 3D surface measurement and description are extensively treated. Manufacturing and production engineers, optical and QC engineers, tribologists and many other applied scientists will find this book an essential addition to their libraries. Contents: Stylus Instruments Optical Instruments Other Measurement Techniques Other Measurement Topics Data Acquisition and Filtering Amplitude Parameters Texture Parameters Surfaces in Three Dimensions Applications: Contact Mechanics Tribology Some Other Applications Readership: Manufacturing, production, quality-control, mechanical and optical engineers, tribologists and applied physicists. Keywords: Rough Surfaces; Stylus Instruments; Optical Instruments Surfaces and their Measurement *Elsevier* The importance of surface metrology has long been acknowledged in manufacturing and mechanical engineering, but has now gained growing recognition in an expanding number of new applications in fields such as semiconductors, electronics and optics. Metrology is the scientific study of measurement, and surface metrology is the study of the measurement of rough surfaces. In this book, Professor David Whitehouse, an internationally acknowledged subject expert, covers the wide range of theory and practice, including the use of new methods of instrumentation. · Written by one of the world's leading metrologists · Covers electronics and optics applications as well as mechanical · Written for mechanical and manufacturing engineers, tribologists and precision engineers in industry and academia Guide to Cleaner Technologies Cleaning and Degreasing Process Changes *DIANE Publishing* Identifies new approaches for pollution prevention in cleaning and degreasing processes to remove dirt, soil, and grease in various manufacturing industries . Addresses available technologies, emerging technologies, pollution prevention strategy and benefits, operating features, application, and limitations. List of information sources. Drawings, charts and figures. Guide to Cleaner Technologies Cleaning and Degreasing Process Changes Nanoporous Materials Advanced Techniques for Characterization, Modeling, and Processing *CRC Press* Having successfully replaced elements used in traditional, pollution-prone, energy-consuming separation processes, nanoporous materials play an important role in chemical

processing. Although their unique structural or surface physicochemical properties can, to an extent, be tailored to meet specific process-related requirements, the task of characterizing fundamental principles of engineering nanometrology *Elsevier* Working at the nano-scale demands an understanding of the high-precision measurement techniques that make nanotechnology and advanced manufacturing possible. Richard Leach introduces these techniques to a broad audience of engineers and scientists involved in nanotechnology and manufacturing applications and research. He also provides a routemap and toolkit for metrologists engaging with the rigor of measurement and data analysis at the nano-scale. Starting from the fundamentals of precision measurement, the author progresses into different measurement and characterization techniques. The focus on nanometrology in engineering contexts makes this book an essential guide for the emerging nanomanufacturing / nanofabrication sector, where measurement and standardization requirements are paramount both in product specification and quality assurance. This book provides engineers and scientists with the methods and understanding needed to design and produce high-performance, long-lived products while ensuring that compliance and public health requirements are met. Updated to cover new and emerging technologies, and recent developments in standards and regulatory frameworks, this second edition includes many new sections, e.g. new technologies in scanning probe and e-beam microscopy, recent developments in interferometry and advances in coordinate metrology. Demystifies nanometrology for a wide audience of engineers, scientists, and students involved in nanotech and advanced manufacturing applications and research Introduces metrologists to the specific techniques and equipment involved in measuring at the nano-scale or to nano-scale uncertainty Fully updated to cover the latest technological developments, standards, and regulations *Aslib Book Guide* *Aspherical Metrology for Non-Specular Surfaces with the Scanning Long-Wave Optical Test System* Aspherical optics are increasingly used these days. The application of aspherical surfaces on large, astronomical telescope mirrors brings challenge to the fabrication. Since the surface radius of curvature varies across the surface, the grinding/polishing tool needs to change its shape when working on different parts of the surface, making surface error more easily embedded into the surface. Therefore, a tighter test-fab loop is needed to guide the fabrication process. To maximize the accuracy during the grinding of the surface and to minimize the working time in the polishing stage, a better metrology device that can measure rough surface is needed to guide the grinding process. Scanning long-wave optical test system (SLOTS) is designed to meet this demand by providing accurate, fast, large dynamic range, and high spatial resolution measurements on rough optical surfaces (surface rms roughness *The Metrology Handbook* *Asq Press* "The Measurement Quality Division, ASQ." *Handbook of Silicon Based MEMS Materials and Technologies* *Elsevier* A comprehensive guide to MEMS materials, technologies and manufacturing, examining the state of the art with a particular emphasis on current and future

applications. Key topics covered include: Silicon as MEMS material Material properties and measurement techniques Analytical methods used in materials characterization Modeling in MEMS Measuring MEMS Micromachining technologies in MEMS Encapsulation of MEMS components Emerging process technologies, including ALD and porous silicon Written by 73 world class MEMS contributors from around the globe, this volume covers materials selection as well as the most important process steps in bulk micromachining, fulfilling the needs of device design engineers and process or development engineers working in manufacturing processes. It also provides a comprehensive reference for the industrial R&D and academic communities. Veikko Lindroos is Professor of Physical Metallurgy and Materials Science at Helsinki University of Technology, Finland. Markku Tilli is Senior Vice President of Research at Okmetic, Vantaa, Finland. Ari Lehto is Professor of Silicon Technology at Helsinki University of Technology, Finland. Teruaki Motooka is Professor at the Department of Materials Science and Engineering, Kyushu University, Japan. Provides vital packaging technologies and process knowledge for silicon direct bonding, anodic bonding, glass frit bonding, and related techniques Shows how to protect devices from the environment and decrease package size for dramatic reduction of packaging costs Discusses properties, preparation, and growth of silicon crystals and wafers Explains the many properties (mechanical, electrostatic, optical, etc), manufacturing, processing, measuring (incl. focused beam techniques), and multiscale modeling methods of MEMS structures Applied Mechanical Design *John Wiley & Sons* This book is the result of lessons, tutorials and other laboratories dealing with applied mechanical design in the universities and colleges. In the classical literature of the mechanical design, there are quite a few books that deal directly and theory and case studies, with their solutions. All schools, engineering colleges (technical) industrial and research laboratories and design offices serve design works. However, the books on the market remain tight in the sense that they are often works of mechanical constructions. This is certainly beneficial to the ordinary user, but the organizational part of the functional specification items is also indispensable. SPS2022 Proceedings of the 10th Swedish Production Symposium *IOS Press* The realization of a successful product requires collaboration between developers and producers, taking account of stakeholder value, reinforcing the contribution of industry to society and enhancing the wellbeing of workers while respecting planetary boundaries. Founded in 2006, the Swedish Production Academy (SPA) aims to drive and develop production research and education and to increase cooperation within the production area. This book presents the proceedings of the 10th Swedish Production Symposium (SPS2022), held in Skövde, Sweden, from 26-29 April 2022. The overall theme of the symposium was 'Industry 5.0 Transformation - Towards a Sustainable, Human-Centric, and Resilient Production'. Since its inception in 2007, the purpose of SPS has been to facilitate an event at which members and interested participants from industry and academia can meet to

exchange ideas. The 69 papers accepted for presentation here are grouped into ten sections: resource-efficient production; flexible production; humans in the production system; circular production systems and maintenance; integrated product and production development; industrial optimization and decision-making; cyber-physical production systems and digital twins; innovative production processes and additive manufacturing; smart and resilient supply chains; and linking research and education. Also included are three sections covering the Special Sessions at SPS2022: artificial intelligence and industrial analytics in industry 4.0; development of resilient and sustainable production systems; and boundary crossing and boundary objects in product and production development. The book will be of interest to all those involved in the development and production of future products. Bibliographic Guide to Technology Precision Metal Additive Manufacturing *CRC Press Additive manufacturing (AM)* is a fast-growing sector with the ability to evoke a revolution in manufacturing due to its almost unlimited design freedom and its capability to produce personalised parts locally and with efficient material use. AM companies, however, still face technological challenges such as limited precision due to shrinkage, built-in stresses and limited process stability and robustness. Moreover, often post-processing is needed due to high roughness and remaining porosity. Qualified, trained personnel are also in short supply. In recent years, there have been dramatic improvements in AM design methods, process control, post-processing, material properties and material range. However, if AM is going to gain a significant market share, it must be developed into a true precision manufacturing method. The production of precision parts relies on three principles: Production is robust (i.e. all sensitive parameters can be controlled). Production is predictable (for example, the shrinkage that occurs is acceptable because it can be predicted and compensated in the design). Parts are measurable (as without metrology, accuracy, repeatability and quality assurance cannot be known). AM of metals is inherently a high-energy process with many sensitive and inter-related process parameters, making it susceptible to thermal distortions, defects and process drift. The complete modelling of these processes is beyond current computational power, and novel methods are needed to practicably predict performance and inform design. In addition, metal AM produces highly textured surfaces and complex surface features that stretch the limits of contemporary metrology. With so many factors to consider, there is a significant shortage of background material on how to inject precision into AM processes. Shortage in such material is an important barrier for a wider uptake of advanced manufacturing technologies, and a comprehensive book is thus needed. This book aims to inform the reader how to improve the precision of metal AM processes by tackling the three principles of robustness, predictability and metrology, and by developing computer-aided engineering methods that empower rather than limit AM design. Richard Leach is a professor in metrology at the University of Nottingham and heads up the Manufacturing Metrology Team.

Prior to this position, he was at the National Physical Laboratory from 1990 to 2014. His primary love is instrument building, from concept to final installation, and his current interests are the dimensional measurement of precision and additive manufactured structures. His research themes include the measurement of surface topography, the development of methods for measuring 3D structures, the development of methods for controlling large surfaces to high resolution in industrial applications and the traceability of X-ray computed tomography. He is a leader of several professional societies and a visiting professor at Loughborough University and the Harbin Institute of Technology. Simone Carmignato is a professor in manufacturing engineering at the University of Padua. His main research activities are in the areas of precision manufacturing, dimensional metrology and industrial computed tomography. He is the author of books and hundreds of scientific papers, and he is an active member of leading technical and scientific societies. He has been chairman, organiser and keynote speaker for several international conferences, and received national and international awards, including the Taylor Medal from CIRP, the International Academy for Production Engineering. *Optical Metrology with Interferometry Cambridge Scholars Publishing* The accurate measurements of surface topography are becoming important to many applications in both engineering and science. Optical interferometry is considered a preferable technique for featuring accurate 3D surface profiling since it is non-contacting, non-destructive and highly accurate. In combination with computers and other electronic devices, optical interferometry has become faster, more reliable, more convenient and more robust. There is now a wealth of new optical interferometry techniques on the market, or being developed in academia, that can measure surface topography with high precision. Each method has both its strong points and its limitations. This book explains in detail the basics of optical interferometry, their common language, generic features and limitations, and their simulation and uncertainties. Moreover, it provides an introduction to new frontiers in optical interferometry, including terahertz technology and optical frequency combs. *DeGarmo's Materials and Processes in Manufacturing John Wiley & Sons* Now in its eleventh edition, *DeGarmo's Materials and Processes in Manufacturing* has been a market-leading text on manufacturing and manufacturing processes courses for more than fifty years. Authors J T. Black and Ron Kohser have continued this book's long and distinguished tradition of exceedingly clear presentation and highly practical approach to materials and processes, presenting mathematical models and analytical equations only when they enhance the basic understanding of the material. Completely revised and updated to reflect all current practices, standards, and materials, the eleventh edition has new coverage of additive manufacturing, lean engineering, and processes related to ceramics, polymers, and plastics. *Optical Inspection of Microsystems, Second Edition CRC Press* Where conventional testing and inspection techniques fail at the microscale, optical techniques provide a fast, robust, noninvasive, and

relatively inexpensive alternative for investigating the properties and quality of microsystems. Speed, reliability, and cost are critical factors in the continued scale-up of microsystems technology across many industries, and optical techniques are in a unique position to satisfy modern commercial and industrial demands. **Optical Inspection of Microsystems, Second Edition**, extends and updates the first comprehensive survey of the most important optical measurement techniques to be successfully used for the inspection of microsystems. Under the guidance of accomplished researcher **Wolfgang Osten**, expert contributors from industrial and academic institutions around the world share their expertise and experience with techniques such as image processing, image correlation, light scattering, scanning probe microscopy, confocal microscopy, fringe projection, grid and moire techniques, interference microscopy, laser-Doppler vibrometry, digital holography, speckle metrology, spectroscopy, and sensor fusion technologies. They also examine modern approaches to data acquisition and processing, such as the determination of surface features and the estimation of uncertainty of measurement results. The book emphasizes the evaluation of various system properties and considers encapsulated components to increase quality and reliability. Numerous practical examples and illustrations of optical testing reinforce the concepts. Supplying effective tools for increased quality and reliability, this book Provides a comprehensive, up-to-date overview of optical techniques for the measurement and inspection of microsystems Discusses image correlation, displacement and strain measurement, electro-optic holography, and speckle metrology techniques Offers numerous practical examples and illustrations Includes calibration of optical measurement systems for the inspection of MEMS Presents the characterization of dynamics of MEMS