

Friction And Wear Of Materials Rabinowicz Free

This title is designed to provide a clear and comprehensive overview of tribology. The book introduces the notion of a surface in tribology where a solid surface is described from topographical, structural, mechanical, and energetic perspectives. It also describes the principal techniques used to characterize and analyze surfaces. The title then discusses what may be called the fundamentals of tribology by introducing and describing the concepts of adhesion, friction, wear, and lubrication. The book focuses on the materials used in tribology, introducing the major classes of materials used, either in their bulk states or as coatings, including both protective layers and other coatings used for decorative purposes. Of especial importance to the tribology community are sections that provide the latest information on Nanotribology, Wear, Lubrication, and Wear-Corrosion: Tribocorrosion and Erosion-Corrosion.

Tribosystem Analysis: A Practical Approach to the Diagnosis of Wear Problems provides a systematic framework for conducting root cause analyses and categorizing various types of wear. Designed specifically for engineers without formal training in tribology, this book: Describes a number of direct and indirect methods for detecting and quantifying wear problems Surveys different microscopy techniques, including those for light optics, electron optics, and acoustic imaging Discusses the selection of wear and friction test methods, both standard and custom, identifying possible pitfalls for misuse Presents practical examples involving complex materials and environments, such as those with variable loads and operating conditions Uses universally accepted terminology to create consistency along with the potential to

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recognize similar problems and apply comparable solutions Complete with checklists to ensure the right questions are asked during diagnosis, Tribosystem Analysis: A Practical Approach to the Diagnosis of Wear Problems offers pragmatic guidance for defining wear problems in the context of the materials and their surroundings.

Friction, wear, and erosion are major issues in mechanical engineering and materials science, resulting in major costs to businesses operating in the automotive, biomedical, petroleum/oil/gas, and structural engineering industries. The good news is, by understanding what friction, wear, or erosion mode predominates in a mechanism or device, you can take action to prevent its costly failure. Seeing Is Believing Containing nearly 300 photos of component failures, macro- and micrographs of surface damage, and schematics on material removal mechanisms collected over 50 years of tribology consulting and research, Friction, Wear, and Erosion Atlas is a must-have quick reference for tribology professionals and laymen alike. Complete with detailed explanations of every friction, wear, and erosion process, the atlas' catalog of images is supported by a wealth of practical guidance on: Diagnosing the specific causes of part failure Identifying popular modes of wear, including rolling and impact, with a special emphasis on adhesion and abrasion Understanding manifestations of friction, such as force traces from a laboratory test rig for a variety of test couples Recognizing liquid droplet, solid particle, slurry, equal impingement, and cavitation modes of erosion Developing solutions to process-limiting problems Featuring a glossary of tribology terms and definitions, as well as hundreds of visual representations, Friction, Wear, and Erosion Atlas is both user friendly and useful. It not only raises awareness of the importance of tribology, but provides guidance for how designers can proactively mitigate tribology concerns.

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Friction and Wear of Materials Second Edition Written by one of the world's foremost authorities on friction, this classic book offers a lucid presentation of the theory of mechanical surface interactions as it applies to friction, wear, adhesion, and boundary lubrication. To aid engineers in design decisions, Friction and Wear of Materials evaluates the properties of materials which, under specified conditions, cause one material to function better as a bearing material than another. Featured also are thorough treatments of lubricants and the sizes and shapes of wear particles. This updated Second Edition includes new material on erosive wear, impact wear, and friction. Professor Rabinowicz's book will be especially welcomed by mechanical and design engineers, surface scientists, tribologists and others who design, produce and operate products, machines and equipment which involve friction and its effects.

Friction, lubrication, adhesion, and wear are prevalent physical phenomena in everyday life and in many key technologies. This book explains how these tribological phenomena originate from atomistic and microscale physical phenomena and shows how this understanding can be used to solve macroscale tribology problems. The book is intended to serve both as a textbook for advanced undergraduate and graduate courses in tribology and as an introduction to the field for those scientists and engineers working with technologies where a good grasp of tribology is essential. Integrating very interesting results from the most important R & D project ever made in Germany, this book offers a basic understanding of tribological systems and the latest developments in reduction of wear and energy consumption by tribological measures. This ready reference and handbook provides an analysis of the most important tribosystems using modern test equipment in laboratories and test fields, the latest results in material selection and wear protection by

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special coatings and surface engineering, as well as with lubrication and lubricants. This result is a quick introduction for mechanical engineers and laboratory technicians who have to monitor and evaluate lubricants, as well as for plant maintenance personnel, engineers and chemists in the automotive and transportation industries and in all fields of mechanical manufacturing industries, researchers in the field of mechanical engineering, chemistry and material sciences. In the field of tribology, the wear behaviour of polymers and composite materials is considered a highly non-linear phenomenon. *Wear of Polymers and Composites* introduces fundamentals of polymers and composites tribology. The book suggests a new approach to explore the effect of applied load and surface defects on the fatigue wear behaviour of polymers, using a new tribometer and thorough experiments. It discusses effects of surface cracks, under different static and cyclic loading parameters on wear, and presents an intelligent algorithm, in the form of a neural network, to map the relationship between wear rate and relevant factors. Using the aforementioned method leads to more accurate and cost effective prediction of surface fatigue wear rates, under different service conditions. The first three chapters of the book introduce polymers and composite materials tribology, followed by three chapters that cover testing in wear, applied load and contact pressure and surface defects. The remaining chapter moves on to predicting wear of polymers, and concludes by discussing questions and problems. Prepares senior undergraduates as well as postgraduate students Focuses on the factors influencing wear of polymers and composites Contains detailed design of Tribometer, wear test procedures and detailed dataset of more than 50 experimental wear tests Introduces an artificial neural network approach as one of the recently developed wear prediction models.

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Providing a useful summary of current knowledge on the friction and wear properties of composite materials, this book fills the gap between publications on fundamental principles of tribology and those on the friction and wear behavior of metals and polymers. Detailed coverage is given of: the fundamental aspects of tribology in general and polymer composites in particular; the effects of the microstructure of composites on friction and wear behavior under different external loading conditions; and the problem of the control of friction and wear behavior in practical situations. Although emphasis is on polymer composites associated with bearing-type applications, part of the book is also devoted to the friction and wear of metal-based composites and rubber compounds. The data are represented in the form of 277 figures, diagrams and photographs, and 68 tables. The author index covers more than 670 references, and the subject index more than 1,000 keywords. The book will be of particular interest to: those involved in research on some aspects of polymer composites tribology (material scientists, physical chemists, mechanical engineers); those wishing to learn more methods for solving practical friction or wear problems (designers, engineers and technologists in industries, dealing with selection, reprocessing and application of polymer engineering materials); and teachers and students at universities.

As with the previous edition, the third edition of *Engineering Tribology* provides a thorough understanding of friction and wear using technologies such as lubrication and special materials. Tribology is a complex topic with its own terminology and specialized

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concepts, yet is vitally important throughout all engineering disciplines, including mechanical design, aerodynamics, fluid dynamics and biomedical engineering. This edition includes updated material on the hydrodynamic aspects of tribology as well as new advances in the field of biotribology, with a focus throughout on the engineering applications of tribology. This book offers an extensive range of illustrations which communicate the basic concepts of tribology in engineering better than text alone. All chapters include an extensive list of references and citations to facilitate further in-depth research and thorough navigation through particular subjects covered in each chapter. * Includes newly devised end-of-chapter problems * Provides a comprehensive overview of the mechanisms of wear, lubrication and friction in an accessible manner designed to aid non-specialists. * Gives a reader-friendly approach to the subject using a graphic illustrative method to break down the typically complex problems associated with tribology.

In the past few decades, friction material engineering has become more sophisticated with many tests and techniques to investigate the properties of the materials and their counterparts before, during and after friction occurred. There has not been too much information available on the different raw materials used for friction materials. This book is more focused towards the raw materials that formulate the different friction materials. It explains about their main friction effects and material structure. Handbook of Friction Materials and Their Applications begins by explaining about different friction

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materials and how they can be used for brakes. It then goes on to explain the tribology of friction materials. Further out it discusses how different friction materials are formulated and produced. Noise and vibration are explained in a further chapter. The later part talks about how different raw materials can be used for friction materials, such as metals, carbon, organic and inorganic materials. Explains how different friction materials can be used for brakes Discusses the noise and vibration effects in friction materials Covers the raw materials that are used in friction materials

Tribology covers the fundamentals of tribology and the tribological response of all types of materials, including metals, ceramics, and polymers. The book provides a solid scientific foundation without relying on extensive mathematics, an approach that will allow readers to formulate appropriate solutions when faced with practical problems. Topics considered include fundamentals of surface topography and contact, friction, lubrication, and wear. The book also presents up-to-date discussions on the treatment of wear in the design process, tribological applications of surface engineering, and materials for sliding and rolling bearings. Tribology will be valuable to engineers in the field of tribology, mechanical engineers, physicists, chemists, materials scientists, and students. Features Provides an excellent general introduction to the friction, wear, and lubrication of materials Presents a balanced comparison of the tribological behavior of metals, ceramics, and polymers Includes discussions on tribological applications of surface engineering and materials for sliding and rolling bearings Emphasizes the

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scientific foundation of tribology Discusses the treatment of wear in the design process Uses SI units throughout and refers to U.S., U.K., and other European standards and material designations

Friction and Wear in Polymer-Based Materials discusses friction and wear problems in polymer-based materials. The book is organized into three parts. The chapters in Part I cover the basic laws of friction and wear in polymer-based materials. Topics covered include frictional interaction during metal-polymer contact and the influence of operating conditions on wear in polymers. The chapters in Part II discuss the structure and frictional properties of polymer-based materials; the mechanism of frictional transfer when a polymer comes into contact with polymers, metals, and other materials; and controlling the frictional properties of polymer materials. Part III is devoted to applications of polymer-based materials in friction assemblies. It covers composite self-lubricating materials and polymer materials for complexly loaded main friction assemblies. This work may prove useful to specialists interested in the problems of using polymer materials. It also aims to stimulate deeper research into the field of friction and wear in polymer-based materials.

The proceedings collect invited and contributed papers from more than 150 scientists and engineers worldwide which provide an up-to-date overview of the current research on friction and wear, including new systematic approaches as well as innovative technical solutions. Tribology in Materials and Manufacturing - Wear, Friction and Lubrication brings an interdisciplinary perspective to

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accomplish a more detailed understanding of tribological assessments, friction, lubrication, and wear in advanced manufacturing. Chapters cover such topics as ionic liquids, non-textured and textured surfaces, green tribology, lubricants, tribolayers, and simulation of wear. **Friction and Wear of Materials Second Edition** Written by one of the world's foremost authorities on friction, this classic book offers a lucid presentation of the theory of mechanical surface interactions as it applies to friction, wear, adhesion, and boundary lubrication. To aid engineers in design decisions, **Friction and Wear of Materials** evaluates the properties of materials which, under specified conditions, cause one material to function better as a bearing material than another. Featured also are thorough treatments of lubricants and the sizes and shapes of wear particles. This updated Second Edition includes new material on erosive wear, impact wear, and friction. Professor Rabinowicz's book will be especially welcomed by mechanical and design engineers, surface scientists, tribologists and others who design, produce and operate products, machines and equipment which involve friction and its effects.

Wear of Metals deals with the mechanisms underlying the wear of metals such as brass, cast iron, and aluminum-silicon alloys. Topics covered include surface topography, contact of solids, and friction, along with the effect of sliding and rolling

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resistance. Fretting, wear under rolling contact, and the friction and wear of polymers are also discussed. Comprised of 27 chapters, this volume begins with an overview of adhesion, types of wear, and friction and wear experiments. The following chapters explore surface topography and the contact (single and multiple) of solids; molecular theory of friction and wear; running-in wear and abrasive wear; and surface contaminants. An oxidational hypothesis of wear is then presented, and the phenomenology of metal transfer involving steel on brass and steel on steel is described. The remaining chapters consider sliding in surfaces and subsurfaces; the effect of temperature and speed on friction and wear; the role of solubility and crystal structure in friction and wear; and wear of brass. The two principal effects associated with rolling, namely, the slip or creep and energy loss, are also examined. Examples of tribological components are given. This book should be of value to undergraduates and research workers in the fields of metallurgy and engineering.

The modern vision of the micromechanism of friction and wear is explored, from the examination of ideal and real crystal structure and adhesion properties to the dynamics of solid frictional interaction. The fundamental quantum-mechanical and relativity principles of particle interaction are considered as basis of friction micro-process examination. The changes in solid structure originated from the

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influence of different kinds of force fields are considered. The principal possibility of relativity effect manifestation by friction is explained. The critical state of friction – triboplasma – was studied. Structural peculiarities of triboplasma, the kinetics of its transformation during frictional interaction as well as the influence of plasma and postplasma processes on tribojunction friction characteristics and complex formation by friction were examined. The book addresses to tribology researchers.

Tribology of Polymeric Nanocomposites provides a comprehensive description of polymeric nanocomposites, both as bulk materials and as thin surface coatings, and provides rare, focused coverage of their tribological behavior and potential use in tribological applications. Providing engineers and designers with the preparation techniques, friction and wear mechanisms, property information and evaluation methodology needed to select the right polymeric nanocomposites for the job, this unique book also includes valuable real-world examples of polymeric nanocomposites in action in tribological applications. Provides a complete reference to polymer nanocomposite material use in tribology from preparation through to selection and use. Explains the theory through examples of real-world applications, keeping this high-level topic practical and accessible. Includes contributions from more than 20 international tribology experts to offer

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broad yet detailed coverage of this fast-moving field. Friction and Wear of Materials John Wiley & Sons Tribology: Friction and Wear of Engineering Materials, Second Edition covers the fundamentals of tribology and the tribological response of all classes of materials, including metals, ceramics, and polymers. This fully updated and expanded book maintains its core emphasis on friction and wear of materials, but now also has a strengthened coverage of the more traditional tribological topics of contact mechanics and lubrication. It provides a solid scientific foundation that will allow readers to formulate appropriate solutions when faced with practical problems, as well as to design, perform and interpret meaningful tribological tests in the laboratory. Topics include the fundamentals of surface topography and contact mechanics, friction, lubrication, and wear (including tribo-corrosion), as well as surface engineering, selection of materials and design aspects. The book includes case studies on bearings, automotive tribology, manufacturing processes, medical engineering and magnetic data storage that illustrate some of the modern engineering applications in which tribological principles play vital roles. Each chapter is complemented by a set of questions suitable for self-study as well as classroom use. This book provides valuable material for advanced undergraduates and postgraduates studying mechanical engineering,

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materials science and other technical disciplines, and will also be a useful first reference point for any engineer or scientist who encounters tribological issues. Provides an excellent general introduction to friction, wear, and lubrication of materials Acts as the ideal entry point to the research literature in tribology Provides the tribological principles to underpin the design process Through systematic coverage of the subject and appropriate questions, develops the reader's understanding and knowledge of tribology in a logical progression.

Provides comprehensive information on the tribological aspects of advanced ceramic materials for all uses that require controlled friction and wear resistance. The text is a guide to altering the microstructure of ceramics to create optimum performance in sliding and rolling contact applications.

Tribology is emerging from the realm of steam engines and crank-case lubricants and becoming key to vital new technologies such as nanotechnology and MEMS. Wear is an integral part of tribology, and an effective understanding and appreciation of wear is essential in order to achieve the reliable and efficient operation of almost any machine or device. Knowledge in the field has increased considerably over recent years, and continues to expand: this book is intended to stimulate its readers to contribute towards the progress of this fascinating subject that relates to most of the known disciplines in physical science. *Wear – Materials, Mechanisms and Practice* provides the reader with a unique insight into our current understanding of wear, based on the

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contributions of numerous internationally acclaimed specialists in the field. Offers a comprehensive review of current knowledge in the field of wear. Discusses latest topics in wear mechanism classification. Includes coverage of a wide variety of materials such as metals, polymers, polymer composites, diamonds, and diamond-like films and ceramics. Discusses the chemo-mechanical linkages that control tribology, providing a more complete treatment of the subject than just the conventional mechanical treatments. Illustrated throughout with carefully compiled diagrams that provide a unique insight into the controlling mechanisms of tribology. The state of the art research on wear and the mechanisms of wear featured will be of interest to post-graduate students and lecturers in engineering, materials science and chemistry. The practical applications discussed will appeal to practitioners across virtually all sectors of engineering and industry including electronic, mechanical and electrical, quality and reliability and design.

This new book will be useful not only to practising engineers and scientists, but also to advanced students interested in wear. It reviews our current understanding of the influence of microstructural elements and physical properties of materials (metals, polymers, ceramics and composites) on wear. The introductory chapters describe the relation between microstructure and mechanical properties of materials, surfaces in contact and the classification of wear processes. The following chapters are concerned with wear modes of great practical interest such as grooving wear, sliding wear, rolling-sliding wear and erosive wear. Our present understanding of abrasion, adhesion, surface fatigue and tribochemical reactions as the relevant wear mechanisms is discussed, and new wear models are presented. In addition to extensive experimental results, sketches have been widely used for clarifying the physical events.

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Friction and Wear of Polymers

Roy Cox provides readers with a thorough presentation of the topic, beginning with the earliest work on brakes by Froom in the early 1900s and friction studies by daVinci in the 1400s. From there, details about the processes of wear and the components of tribological systems are presented. Methods of manufacturing friction materials are described, and the elements of friction material are detailed--binders, fibers, abrasives, and lubricants. A large portion of the book delves deeply into materials for binders, resins, fibres, abrasives, lubricants, and fillers, providing background on the various materials, their pros and cons, and numerous ways they can be applied to friction systems. Much of this discussion focuses on the compositional makeup and effects of ingredients as they relate to the wear and friction performance of the final product. Readers will gain a solid background about tribology, as well as a solid understanding of matrices, fibres and additives that make up engineered tribological composites. They will learn how manufacturing affects these composites, along with how friction and wear affect those materials. They will gain a better understanding of which materials provide the optimum balance of cost, friction and wear for various applications, enabling them to better create and apply engineered tribological composites for whatever application is at hand.

Tribology for engineers discusses recent research and applications of principles of friction, wear and lubrication, and provides the fundamentals and advances in tribology for modern industry. The book examines tribology with special emphasis on surface topography, wear of materials and lubrication, and includes dedicated coverage on the fundamentals of micro and nanotribology. The book serves as a valuable reference for academics, tribology and materials researchers, mechanical, physics and materials engineers

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and professionals in related industries with tribology. Edited and written by highly knowledgeable and well-respected researchers in the field Examines recent research and applications of friction, wear and lubrication Highlights advances and future trends in the industry

Friction and Wear: Calculation Methods provides an introduction to the main theories of a new branch of mechanics known as "contact interaction of solids in relative motion." This branch is closely bound up with other sciences, especially physics and chemistry. The book analyzes the nature of friction and wear, and some theoretical relationships that link the characteristics of the processes and the properties of the contacting bodies essential for practical application of the theories in calculating friction forces and wear values. The effect of the environment on friction and wear is also considered. Finally, the requirements, which must be fulfilled by the physicommechanical properties of the materials of which contacting bodies are made and which determine their behavior in moving contacts, are formulated. The book will be of interest to a wide circle of readers, e.g. engineers, designers, machine users, and research workers, working on the production of wear-resistant materials and working on the nature of friction and wear.

The second edition of a bestseller, this book introduces tribology in a way that builds students' knowledge and understanding. It includes expanded information on topics such as surface characterization as well as recent advances in the field. The book provides additional descriptions of common testing methods, including diagrams and surface texturing for enhanced lubrication, and more information on rolling element bearings. It also explores surface profile characterization and elastic plastic contact mechanics including wavy surface contact, rough surface contact models, friction and wear plowing models, and

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thermodynamic analysis of friction.

This book deals with the new and now-expanding field of friction, wear, and other surface-related mechanical phenomena for polymers. Polymers have been used in various forms such as bulk, films, and composites in applications where their friction, wear resistance, and other surface-related properties have been effectively utilized. There are also many examples in which polymers have performed extremely well, such as in tyres, shoes, brakes, gears, bearings, small moving parts in electronics and MEMS, cosmetics/hair products, and artificial human joints. Around the world, much research is currently being undertaken to develop new polymers, in different forms, for further enhancing tribological performance and for finding novel applications. Keeping in view the importance of tribology of polymers for research and technology as well as the vast literature that is now available in research papers and review articles, this timely book brings together a wealth of research data for an understanding of the basic principles of the subject. Contents: Bulk Polymers: Adhesion and Friction of Polymers Tribophysical Interpretation of Polymer Sliding Mechanisms Scaling Effects in Tribotesting of Polymers Biopolymer Tribology Reinforced Polymers: Wear of Polytetrafluoroethylene and PTFE Composites Mechanical and Tribological Behaviour of Polymers Filled with Inorganic Particulate Fillers The Sliding Wear of Polypropylene and Its Blends Brake Friction Materials Polymer Films: Mechanical Properties of Thin Polymer Films Within Contacts AFM Testing of Polymeric Resist Films for Nanoimprint Lithography and other papers Readership: Engineering professionals working on polymers for designing bearing materials; managers and researchers in materials laboratories; graduate students in the area of materials/tribology.

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Keywords: Polymer; Tribology; Wear; Friction; Scratching

Key Features: Covers, for the first time, all areas of polymer tribology (bulk, films, composites, and applications) in one comprehensive book. Describes new applications for polymers, such as in microscale and nanoscale machines where surface properties or tribology play a crucial role in the durability and performance of the machine. Compiles various works in this area into one volume, and includes opinions or contributions from some of the world's leading authorities in this field. Reviews: "This book brings together a vast wealth of research data and a fundamental understanding of the basic principles in this important research area. Those working in the field of polymer tribology will find it helpful in learning about the most recent developments. Those new to the area will find its many chapters on the fundamentals of polymer tribology very instructive." IEEE Electrical Insulation Magazine. Chapters describe friction and wear in general, emphasizing not theory, but examples of materials behavior, variables which affect transitions, and considerations in tribotesting materials. Annotation copyright Book News, Inc. Portland, Or. This book helps students and practicing scientists alike understand that a comprehensive knowledge about the friction and wear properties of advanced materials is essential to further design and development of new materials. With important introductory chapters on the fundamentals, processing, and applications of tribology, the book then examines in detail the nature and properties of materials, the friction and wear of structural ceramics, bioceramics, biocomposites, and nanoceramics, as well as lightweight composites and the friction and wear of ceramics in a cryogenic environment.

Friction, lubrication, adhesion, and wear are prevalent physical phenomena in everyday life and in many key technologies. This book incorporates a bottom-up approach

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to friction, lubrication, and wear into a versatile textbook on tribology. This is done by focusing on how these tribological phenomena occur on the small scale -- the atomic to the micrometer scale -- a field often called nanotribology. The book covers the microscopic origins of the common tribological concepts of roughness, elasticity, plasticity, friction coefficients, and wear coefficients. Some macroscale concepts (like elasticity) scale down well to the micro- and atomic-scale, while other macroscale concepts (like hydrodynamic lubrication) do not. In addition, this book also has chapters on topics not typically found in tribology texts: surface energy, surface forces, lubrication in confined spaces, and the atomistic origins of friction and wear. These chapters cover tribological concepts that become increasingly important at the small scale: capillary condensation, disjoining pressure, contact electrification, molecular slippage at interfaces, atomic scale stick-slip, and atomic bond breaking. Throughout the book, numerous examples are provided that show how a nanoscale understanding of tribological phenomena is essential to the proper engineering of important modern technologies such as MEMS, disk drives, and nanoimprinting. For the second edition, all the chapters have been revised and updated to incorporate the most recent advancements in nanoscale tribology. Another important enhancement to the second edition is the addition of problem sets at the end of each chapter.

This book introduces the basic concepts of contact mechanics, friction, lubrication, and wear mechanisms, providing simplified analytical relationships that are useful for quantitative assessments. Subsequently, an overview on the main wear processes is provided, and guidelines on the most suitable design solutions for each specific application are outlined. The final part of the text is devoted to a description of the main materials and surface treatments specifically

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developed for tribological applications and to the presentation of tribological systems of particular engineering relevance. The text is up to date with the latest developments in the field of tribology and provides a theoretical framework to explain friction and wear problems, together with practical tools for their resolution. The text is intended for students on Engineering courses (both bachelor and master degrees) who must develop a sound understanding of friction, wear, lubrication, and surface engineering, and for technicians or professionals who need to solve tribological problems in their work.

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