

Nanotribology and Nanomechanics: An Introduction

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This volume serves as a timely, practical introduction to the principles of nanotribology and nanomechanics and applications to magnetic storage systems, MEMS/NEMS and BioMEMS/bioNEMS. Assuming some familiarity with macrotribology/mechanics, the book comprises chapters by internationally recognized experts, who integrate knowledge of the field from the mechanics and materials-science perspectives. They cover key measurement techniques, their applications, and theoretical modelling of interfaces, each beginning their contributions with macro- and progressing to microconcepts. After reviewing the fundamental experimental and theoretical aspects in the first part, Nanotribology and Nanomechanics then treats applications.

Three groups of readers are likely to find this text valuable: graduate students, research workers, and practicing engineers. It can serve as the basis for a comprehensive, one- or two-semester course in scanning probe microscopy; applied scanning probe techniques; or nanotribology/nanomechanics/nanotechnology, in departments such as mechanical engineering, materials science, and applied physics.

This second, revised edition is substantially enlarged by three new chapters: One new chapter introduces to the theory, physics and characterization of the Lotus-Effect. Other new chapters discuss the attaching properties of hairs as realized at gecko feet and present a comprehensive review of structural, mechanical, and tribological properties of various hair and skin as a function of ethnicity, damage, conditioning treatment, and various environments.

With a Foreword by Physics Nobel Laureate Gerd Binnig

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Editorial Review

Review

From the reviews of the second edition:

"This book offers a comprehensive treatment of the new and rapidly evolving field of nanotribology and nanomechanics. … this volume will find use in graduate level courses taught variously in departments of mechanical engineering, materials science and applied physics. … All the chapters are prepared to a high-standard, are well illustrated with high-quality diagrams and pictures and contain excellent reference lists. … For sure researchers and practicing engineers needing insights into nanotribology will want to draw heavily on the rich resources of this book." (K. Alan Shore, Contemporary Physics, Vol. 50 (2), March-April, 2009)

From the Back Cover

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With a Foreword by Physics Nobel Laureate Gerd Binnig

Dr. Bharat Bhushan is an Ohio Eminent Scholar and The Howard D. Winbigler Professor in the Department of Mechanical Engineering, Graduate Research Faculty Advisor in the Department of Materials Science and Engineering, and the Director of the Nanotribology Laboratory for Information Storage & MEMS/NEMS (NLIM) at the Ohio State University, Columbus, Ohio. He is an internationally recognized expert of tribology and mechanics on the macro- to nanoscales, and is one of the most prolific authors. He is considered by some a pioneer of the tribology and mechanics of magnetic storage devices and a leading

researcher in the fields of nanotribology and nanomechanics using scanning probe microscopy and applications to micro/nanotechnology.

He is the recipient of various international fellowships including the Alexander von Humboldt Research Prize for Senior Scientists, Max Planck Foundation Research Award for Outstanding Foreign Scientists, and the Fulbright Senior Scholar Award.

About the Author

Dr. Bharat Bhushan received an M.S. in mechanical engineering from the Massachusetts Institute of Technology in 1971, an M.S. in mechanics and a Ph.D. in mechanical engineering from the University of Colorado at Boulder in 1973 and 1976, respectively, an MBA from Rensselaer Polytechnic Institute at Troy, NY in 1980, Doctor Technicae from the University of Trondheim at Trondheim, Norway in 1990, a Doctor of Technical Sciences from the Warsaw University of Technology at Warsaw, Poland in 1996, and Doctor Honouris Causa from the National Academy of Sciences at Gomel, Belarus in 2000. He is a registered professional engineer (mechanical). He is presently an Ohio Eminent Scholar and The Howard D. Winbigler Professor in the Department of Mechanical Engineering, Graduate Research Faculty Advisor in the Department of Materials Science and Engineering, and the Director of the Nanotribology Laboratory for Information Storage & MEMS/NEMS (NLIM) at the Ohio State University, Columbus, Ohio. He is an internationally recognized expert of tribology and mechanics on the macro- to nanoscales, and is one of the most prolific authors. He is considered by some a pioneer of the tribology and mechanics of magnetic storage devices and a leading researcher in the fields of nanotribology and nanomechanics using scanning probe microscopy and applications to micro/nanotechnology. He has authored 5 technical books, more than 50 handbook chapters, more than 500 technical papers in referred journals, and more than 60 technical reports, edited more than 25 books, and holds 16 U.S. patents. He is co-editor of Springer NanoScience and Technology and co-editor of Microsystem Technologies Micro- & Nanosystems and Information Storage & Processing Systems (formerly called Journal of Information Storage and Processing Systems). He has given more than 250 invited presentations on five continents and more than 60 keynote/plenary addresses at major international conferences.

Dr. Bhushan is an accomplished organizer. He organized the first symposium on Tribology and Mechanics of Magnetic Storage Systems in 1984 and the first international symposium on Advances in Information Storage Systems in 1990, both of which are now held annually. He is the founder of an ASME Information Storage and Processing Systems Division founded in 1993 and served as the founding chair during 1993-1998. His biography has been listed in over two dozen Who's Who books including Who's Who in the World and has received more than two dozen awards for his contributions to science and technology from professional societies, industry, and U.S. government agencies. He is also the recipient of various international fellowships including the Alexander von Humboldt Research Prize for Senior Scientists, Max Planck Foundation Research Award for Outstanding Foreign Scientists, and the Fulbright Senior Scholar Award. He is a foreign member of the International Academy of Engineering (Russia), Byelorussian Academy of Engineering and Technology and the Academy of Triboengineering of Ukraine, a honorary member of the Society of Tribologists of Belarus, a fellow of ASME, IEEE, STLE, and the New York Academy of Sciences, and a member of ASEE, Sigma Xi and Tau Beta Pi.

Dr. Bhushan has previously worked for the R & D Division of Mechanical Technology Inc., Latham, NY; the Technology Services Division of SKF Industries Inc., King of Prussia, PA; the General Products Division Laboratory of IBM Corporation, Tucson, AZ; and the Almaden Research Center of IBM Corporation, San Jose, CA.

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Mattie Martin:

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