Preface

Nature has developed materials, objects, and processes that function from the macroscale to the nanoscale. The emerging field of biomimetics allows one to mimic biology or nature to develop nanomaterials, nanodevices, and processes which provide desirable properties. Hierarchical structures with dimensions of features ranging from the macroscale to the nanoscale are extremely common in nature to provide properties of interest. The biologically inspired materials and structured surfaces are eco-friendly or green with minimum human impact on the environment and are being explored for various commercial applications. This recognition has led to "Green Science and Technology," the term used for the first time in this book.

There are a large number of objects including bacteria, plants, land and aquatic animals, and seashells with properties of commercial interest. This book presents an overview of the general field of biomimetics and biomimetics-inspired surfaces. It deals with various examples of biomimetics, which include surfaces with roughness-induced superomniphobicity, self-cleaning, antifouling, and controlled adhesion. It primarily focuses on the *Lotus* effect which exhibits superhydrophobicity, self-cleaning, antifouling, low adhesion, and drag reduction. This book also includes the floating water fern which floats over water, rose petal effect which can provide either low adhesion or high adhesion, oleophobic/oleophilic surfaces inspired from aquatic animals, sharkskin which exhibits low drag and antifouling, and gecko feet which exhibits reversible adhesion.

This book provides theoretical background, characterization of natural objects and relevant mechanisms, and inspired structured surface of commercial interest. We hope this book would serve as a catalyst for further innovations as well as serve as a useful reference in the emerging field of biomimetics. This book should also serve as an excellent text for a one-semester graduate course in biomimetics or as a companion text for a general course in nanotechnology. Given the interdisciplinary nature of the discipline, the appeal of this book is expected to be broad.

The work reported in this book is largely based on the pioneering contributions made by former and present students, postdoctoral fellows, and visiting scholars. Special mention is deserved by Dr. Yong Chae Jung, a former Ph.D. student working in fabrication and characterization; Prof. Michael Nosonovsky, a former visiting

scholar and an ongoing collaborator in theoretical modeling; and Prof. Kerstin Koch of Nees-Institute for Biodiversity of Plants at University of Bonn, Germany, who spent a sabbatical year in the author's lab. All of them contributed immensely to the research on the *Lotus* Effect. Dr. Tae-Wan Kim, a visiting scholar, contributed immensely on theoretical modeling of Gecko Adhesion. Brian Dean, a graduate student, contributed to the understanding of the mechanisms of the sharkskin effect. Other postdoctoral fellows and students who have contributed include Dr. Andrei G. Peressadko (Gecko Adhesion), Zack Burton (*Lotus* Effect), Eun Kyu Her (Rose Petal Effect), Robert Sayer (Gecko Adhesion), James Hunt (*Salvinia* Effect), Daniel Ebert (*Lotus* Effect), and Dr. Hyungoo Lee (Gecko Adhesion). Finally, the author would like to thank Caterina Runyon-Spears for administrative support.

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Columbus, Ohio *Bharat Bhushan*

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