

# Preface

My motivation for editing the book came from a perceived need for educational materials in the interdisciplinary subject area of micro/nanorobotics in biomedical applications. This perception emerged from two fronts. On one hand, I have been looking for new robotic techniques to introduce in my advanced robotics class at Stevens. On the other hand, the recently established Biomedical Engineering (BME) program at Stevens needs to expand its current curriculum so that cutting-edge engineering technologies supporting biomedical applications are included. During the 2005–2006 academic year, a group of four Biomedical Engineering undergraduate students initiated a so-called BioCybernetics project to develop a nano-scale autonomous device that would have the potential to diagnose and perhaps, treat illness in the field of gastrointestinal endoscopy. The project eventually involved 15 students from mechanical, electrical, chemical, computer, and biomedical engineering at all levels from freshman to seniors. In the end, the students realized that only limited objectives could be met within the resources available and within the time frame of one academic year. Several faculty members from multiple disciplines were approached by the students for guidance on various aspects of the project, and it was recognized that the group of students would have achieved much more in the BioCybernetics project if some training materials on this topic are made available to them.

After several discussions with faculty from different departments, we realized that this is not only a Stevens' problem, but also there is a national need for more educational materials on the emerging topic. Over the last decade, there has been a significant growth in the number of undergraduate BME programs and the number of students enrolled in these BME programs. Based on a recent forecast by the US Bureau of Labor Statistics, biomedical engineering jobs will climb almost twice as fast as the overall average for a 26.1 % gain by 2012 while overall job growth is projected to be 14.8 %. Micro/nanorobotics for biomedical applications is an emerging area that has received advancement during the last decade. However, contrary to the large amount of teaching and learning materials on large-scale medical robots, there is a general lack of learning materials on micro/nanorobotics

in undergraduate education, and the national growth of the BME programs calls for new educational materials supporting biomedical engineering.

Motivated by the above-mentioned reasons, we have put together an educational proposal for the National Science Foundation's Course Curriculum and Laboratory Improvement Program (CCLI), which is now named as Transforming Undergraduate Education in Science (TUES). We were fortunate to get it funded. With the support, we developed case studies and laboratory modules to introduce robotics concepts to BME students. Expanding the effort, we have invited other researchers in the field to contribute to the rich interdisciplinary aspects of the subject as sampled in the chapters of the book.

Principle audience of the book includes upper-level undergraduates and graduate students in biomedical engineering and other disciplines where micro/nanorobotics techniques could be readily applied. Interested readers may also include researchers of relevant fields and biomedical engineers who are interested in robotics technologies. It is impossible to include every piece of ideas and research work on the subject. It is my wish that a representative selection of them as presented in the book will inspire a student to pursue a career in the challenging field, help to generate an awareness of the diversified technology, and provide some guidance to interested readers.

This book would not be possible without the research support from the funding agencies including National Science Foundation's DUE, CMMI, EFRI programs. I would also like to acknowledge my co-PIs on the NSF CCLI project, Profs. Arthur Ritter and Hong Man, who helped me to pilot-test some of the developed materials. Sincere thanks go to the chapter contributors of the book, who have spent their precious research time on the preparation of the chapters. I would also like to thank the Springer Editor, Brett Kurzman, for his patience and guidance on my first book project. Last but not the least, I would like to thank my family for their continuous support.

NJ, February 2012

Yi Guo

Selected Topics in Micro/Nano-robotics for Biomedical  
Applications

Guo, Y. (Ed.)

2013, XIV, 194 p., Hardcover

ISBN: 978-1-4419-8410-4