

# Preface

The conventional motors driven by the electromagnetic force have been playing and will play the most important roles in motion control of automated machines like robots. However, for the advanced machines and instruments with higher performance, the conventional motors seem to be difficult to satisfy the coming sophisticated demands. And new outstanding actuators are expected to cause technological innovations in such broad fields of their applications as industry, basic science, medicine, welfare, and global environment. So, the development of innovative actuators is recognized as one of the most important key technology for next generation. In accordance with the requirement, the five year national research project “Next-Generation Actuators Leading Breakthroughs” was organized and granted by Ministry of Education, Culture, Sports, Science and Technology of Japan. This 5 year national research project started in September 2004 and finished in March 2009.

Since development of innovative actuators requires a comprehensive and interdisciplinary approach, the project was conducted by many researchers from various fields such as mechatronics, robotics, control engineering, MEMS, new material, processing, production technology, and bio technology.

The project was operated cooperatively by the following five research groups: (1) High precision and nano actuators, (2) Micro actuators, (3) Smart actuators, (4) Power actuators, and (5) Actuators for special environments. Each group consists of about 8 subjects. So, over 100 researchers participate the project. In order to seek the applications of the new actuators, research and development of some subjects have been propelled in cooperation with industry.

The objective of this book is to introduce the activity of the project with the latest results. It contains various kinds of new actuators like electrostatic actuators, micro actuators, surface acoustic wave motors, ultrasonic motors, bio-actuated micro pump, intelligent actuators, pneumatic soft actuators, polymer ion gel actuators, piezoelectric actuators, functional fluid actuators, thermal actuators, multi DOF actuators and magnetostrictive actuators. Readers of the volume are expected to obtain up-to-date knowledge of these new actuators.

As the leader of the project, I appreciate the authors for their contributions. I would like to express special thanks to Dr. Takefumi Kanda for his dedicated achievement as an associate editor.

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