

# Preface

Industrial automation has become an important feature today, especially in this age of rapid production and high precision. Automation allows industries to achieve the level of speed and quality unattainable by labour power; with affordable cost. While industrial automation is mostly profitable for mass manufacturing and homogeneous products, the bulk of industries produce goods in low quantity. In this situation, the challenge shifts into developing automation systems in industry that still justifies the installation cost. The knowledge and skill on this area has therefore become increasingly necessary.

This book recollects necessary materials related to servo control for industrial automation. It starts from a macroscopic view of servo control, especially for industrial automation, treating drives and control systems as inseparable entities. It then continues with detail discussions of major types of drives for precision control realization; namely servo hydraulic and pneumatic drives, electric drives, and piezoelectric drives. Each chapter contains detail discussions of the respective major components: actuators, sensors, and controllers—without going into the control theory. The techniques and theory of motion control itself is discussed in a separate chapter, considering that the control theory for all of the abovementioned drives is identical. For the same reason, digital communication protocol is also discussed in a separate chapter. This chapter is included as a recognition of the importance and growing trend of digitalization in motion and precision control. The more general trend in motion control is discussed in the closing chapter. Throughout the discussion, the integrity and nuance of mechatronics—a synergistic integration of the abovementioned components—are maintained, reflecting the reality of their synergy in today's industrial automation.

Despite its mechatronics nuance, the structure of this book allows traditional approach of step-by-step teaching to still be conducted should it be desired. Each chapter contains a material of its own that can be studied separately without compromising the understanding of the readers. This book is written for wide readership, from students, technicians, engineers, and researchers. The discussion is thorough, with concise basics yet sufficient details. Equations are provided as means to explain the certain concepts from the fundamentals such that it does not discourage inexperienced readers but is useful for those with prior knowledge. Readers who

wish to know the applications of various sensors, actuators, and control systems in industrial automation will find this book of value. Readers will also find that the flow of the book reflects the current approach and view taken by the industry, yet is still sensible and is easy-to-read, which they can relate to the prior knowledge they have learned traditionally.

The inclusion of hydraulic and piezoelectric drives, as well as control and communication, is intended to ensure that the book covers all necessary aspects in control system. The discussion in the book starts from the history and the basic principle of each device, as well as the assembled systems. The synergistic integration of actuators, sensors, control systems, and communication protocols are maintained throughout the course of the book to reflect the current trend in industrial applications. This book is intended for professionals, engineers, and postgraduate students whose areas of interest are drives, sensors, and control system design. For teaching purpose, it is most suitable to courses such as: Control System, Mechatronic System Design, Industrial Drives, and Instrumentation and Sensors. For professionals, it is most suitable for those working in system design and control, which require broad perspective of drives and control system of plants.

This book is equipped with many illustrations, especially to present the working principles and structures of the abovementioned industrial systems. The combined usage of words and figures are prevalent in the entire book to convey clear concepts to the readers.

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