

Preface

The industrial processes of high complexity are composed of various units, which are used in different working environments. The total productive processes change frequently with time, and the changes of the model are uncertain. In addition, the relevant industrial products demand of high quality and huge amount, which is one of the most challenging missions in the field of control engineering to build a reliable, efficient, and continuous control system.

The rapidly developing modern bioscience has been exploring the self-regulation mechanism from the natural organism featured by human body which is a perfect control system. The related studies expressed via mathematization, which not only enriched the study of biological sciences, but also provided a theoretical basis for bio-inspired tools and systems. And the self-regulation mechanism also became the source of inspiration to design novel intelligent control algorithms. The complex industrial processes are of high complexity, behavioral uncertainty, strict control, and high-quality requirements, which are similar to the organism. Therefore, bio-inspired intelligent control methods have potential utility in complex industrial processes. In this book, various intelligent coordination control systems and methods through mathematics have been designed, and based on the organism's (especially the human body) regulatory mechanism, such as the comprehensive regulation mechanism of neuroendocrine-immune system, the algorithms are applied to typical complex industrial production processes, the carbon fiber spinning process as an example.

The book is divided into nine chapters. Chapter 1 introduces the related background about the neuroendocrine-immune system and complex industrial production processes. Chapters 2–9 design various biological-inspired cooperative controls and optimization approaches in detail, and provide the related examples as well.

This work in the book was supported in part by the Key Project of the National Natural Science Foundation of China (no. 61134009), the National Natural Science Foundation of China (nos. 61473078, 61473077, 61503075), Cooperative research funds of the National Natural Science Funds Overseas and Hong Kong and Macao scholars (no. 61428302), National Key Research and Development Plan from

Ministry of Science and Technology (2016YFB0302701), Program for Changjiang Scholars from the Ministry of Education (2015–2019), International Collaborative Project of the Shanghai Committee of Science and Technology (no. 16510711100), and Shanghai Pujiang Program (no. 15PJ1400100). The research contents in this book, which elaborate and discuss systematically in many aspects of biological-inspired cooperative control theories and their applications, are multi-disciplinary cross connection with both theory and practice closely integrated.

Thanks to the research and work conditions provided by Donghua University and the persistent supports from our colleagues, which helped us accomplish the related research. Thanks to the intelligent system and network intelligence laboratory, since all the group members worked hard and cooperated with each other, we achieved great progress. I would like to acknowledge the generous contribution made by our Ph.D. students, *Bao Liu, Xiao Liang, Lei Zhang, Tong Wang, Tao Zhang, Nan Xu, Jiajia Chen, Fan Guo, Chuncai Xiao et al.*, and graduate students *Yi Wang, Sheng-Fang Dai, Lei Wang, Lezhi Wang et al.*, for their valuable research achievements.

Shanghai, China
June 2017

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Bio-Inspired Collaborative Intelligent Control and
Optimization

Ding, Y.; Chen, L.; Hao, K.

2018, VII, 474 p. 220 illus., 123 illus. in color.,

Hardcover

ISBN: 978-981-10-6688-7