

Preface

Real-world control applications are difficult to tackle with conventional control systems because, in most of the cases, they present uncertainty, noise, and non-linearities. In that sense, intelligent control systems have been considered for designing robust and predictive controls, offering better performance than conventional control systems. However, new nature-inspired computing has proved to improve the performance over intelligent control systems, mainly using meta-heuristic optimization methods, social communication techniques, chemical structure-based learning algorithms, and so on.

Thus, the aim of this book is to present recent advances in nature-inspired computing applied for control systems. Readers with conventional control systems background will be motivated to undergo with these cutting-edge technologies, and advanced readers will be able to know and deeply understand a broad perspective of different methods and techniques.

At first, the book presents a review in the context of engineering control systems developed with nature-inspired computing. Then, the book is divided into three parts. The first part considers general approaches in control systems. Readers will find two contributions in terms of artificial neural networks, and improvements of techniques using hybrid methods. The second part considers on control tuning methods and adaptive control systems. This part summarizes some techniques and schemes that can be useful for real-world applications. For example, contributions show improvements to PID controllers using nature-inspired optimization, or develop fuzzy controllers in multi-input and multi-output systems. Other works present enhancements in neural controllers, or show advancements in neuro-fuzzy controllers. Lastly, the third part is dedicated to robotics systems using natural inspiration. Contributions in this part include controlling quadrotors using neuro-fuzzy techniques, developing algorithms for gait generation on legged robots, and designing new controllers for mobile robots using an optical flow approach. As shown, the book intends to give a practical overview in nature-inspired computing for engineering control applications.

In fact, this book cannot be possible without the support of many people. Thus, I want to thank Universidad Panamericana for its support in all concerns to this publication. I also want to acknowledge Dejanira Araiza-Illan and Roberto Ayala for their valuable comments and all the anonymous reviewers that helped me during the reviewing process. I also appreciate all the good words and advices from Omar Saldívar that motivated me through the development of this book. I acknowledge the assistance of Lourdes Martínez and Pedro Ponce. Finally, I want to thank all contributors for their amazing works and their research effort in the application of nature-inspired computing for control systems.

Mexico
August 2015

Hiram Eredín Ponce Espinosa

Nature-Inspired Computing for Control Systems

Ponce, H. (Ed.)

2016, XII, 289 p. 179 illus., 62 illus. in color., Hardcover

ISBN: 978-3-319-26228-4