

# Preface

Iterative learning control (ILC) techniques have been successfully applied to solve a variety of real-life control-engineering problems, for example mechanical systems such as robotic manipulators, electrical systems such as electrical drives, chemical process systems such as batch reactors, as well as aerodynamic systems, bioengineering systems, and others. When such systems are operated repeatedly, iterative learning control can be used as a novel enabling technology to improve the system response significantly from trial to trial.

ILC is reputed for its promising and unique features: the structural simplicity, the perfect output tracking, almost model-independent design, and delay compensation. These highly desirable features make ILC a promising control alternative suitable for numerous real-time control tasks where a simple controller is required to achieve precise tracking in the presence of process uncertainties and delays.

In the past two decades, a great number of research studies focusing on ILC theory and performance analysis have been summarized and reported in dedicated volumes [1, 14, 20, 83, 153]. On the other hand, there is a lack of such a dedicated volume that can provide a wide spectrum of ILC designs, case studies and illustrative examples for real-time ILC applications. In a sense, this book serves as a partial solution to meet the need in this specific area of control and applications. The ultimate objective of this book is to provide readers with the fundamental concepts, schematics, configurations and generic guidelines in ILC design and implementations, which are enhanced through a number of well-selected, representative, simple and easy-to-learn application examples.

In this book various key issues with regard to ILC design and implementations are addressed. In particular we discuss ILC design in the continuous-time domain and discrete-time domain, design in time and frequency domain, design with problem-specific performance objectives including both robustness and optimality, and design for parametric identification in open and closed-loop. The selected real-time implementations cover both linear and non-linear plants widely found in mechatronics, electrical drives, servo, and process control problems.

By virtue of the design and implementation nature, this book can be used as a reference for site engineers and research engineers who want to develop their own

learning control algorithms to solve practical control problems. On the other hand, each control problem explored in this book is formulated systematically with the necessary analysis on the control-system properties and performance. Therefore, this book can also be used as a reference or textbook for a course at graduate level. Finally, we list open issues associated with the ILC design and analysis, and expect more academic researchers to look into and solve those challenging problems.

We would like to take the opportunity to thank our postgraduate students or research associates, Q.P. Hu, D.Q. Huang, W.Z. Qian, S.K. Sahoo, P. Srinivasan, Y. Tan, J. Xu, and H.W. Zhang, who made contributions to this book.

Singapore,  
August 2008

*Jian-Xin Xu*  
*Sanjib Kumar Panda*  
*Tong Heng Lee*



<http://www.springer.com/978-1-84882-174-3>

Real-time Iterative Learning Control  
Design and Applications

Xu, J.-X.; Panda, S.K.; Lee, T.H.

2009, XVI, 194 p., Hardcover

ISBN: 978-1-84882-174-3