

Preface

Nowadays the Internet plays a very important role not only in our daily life and work, but also in real-time industrial manufacturing, scheduling and management. During the last decade, considerable research has been carried out to develop new technologies, called Internet-based control systems in our research, that make it possible to supervise and control industrial processes over the Internet. The use of the Internet for real-time interaction and for the remote control and monitoring of plant would bring many benefits to industry. Although such an approach seems promising, there remain many new challenges raised by the introduction of the Internet into control systems. The design methods of traditional control systems appear not to be completely suitable for this new type of control system. Consequently, new design issues need to be considered including requirement specification, architecture selection, user interface design, Internet latency, networked control system stability, safety and security. For example, Internet transmission delay can lead to irregular data transmission and data loss. In the worst case, this can make the whole system unstable. We also need to address the problem of security. If malicious hackers gain access to an Internet-enabled control system, the consequences could be catastrophic.

This book is concerned with the study of Internet-based control systems, which are systems by which sensors and actuators in different locations may be controlled and monitored from a central hub, using the Internet as the communications network. The book aims to systematically present the methods developed by the author for dealing with all the above design issues for Internet-based control systems. Furthermore, the application perspectives of Internet-based control are explored through a number of application systems. The book contains the latest research, much of which the author has performed or been intimately involved with, which presents new solutions to existing problems and explores the manifold future applications of Internet-based control systems. This book is unique in bringing together multiple strands of research, mainly from computer science and control engineering, into an over-arching study of the entire subject. Every time when I talk to industrial people about Internet-based control systems, the immediate question is

“Is it really worth doing in view of the safety risk of Internet-enabled control systems”. This book may build your confidence in fully exploiting the new technologies described here in your research and/or industrial work.

This book consists of 13 chapters, including an introduction and conclusion. Chapters 2–10 focus on providing solutions to the above design issues from a control engineering, or computer network perspective or from a fusion of the two. Chapters 11 and 12 explore the future applications of Internet-based control systems in remote performance monitoring, remote design, testing and maintenance.

The book can serve both as a textbook and a reference book. The potential audience for this book includes researchers in control engineering and computer networks, control and system engineers, real-time control system software developers and IT professionals. This book can also be used as a textbook for a final year option or elective on Internet-enabled system design, or as an advanced example of real-time software design at the postgraduate level. It can also be used as a textbook for teaching Internet-enabled systems in general.

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