Advances in Industrial Control

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Editors

Identification of Continuous-time Models from Sampled Data

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Series Editors' Foreword

The series *Advances in Industrial Control* aims to report and encourage technology transfer in control engineering. The rapid development of control technology has an impact on all areas of the control discipline. New theory, new controllers, actuators, sensors, new industrial processes, computer methods, new applications, new philosophies…, new challenges. Much of this development work resides in industrial reports, feasibility study papers and the reports of advanced collaborative projects. The series offers an opportunity for researchers to present an extended exposition of such new work in all aspects of industrial control for wider and rapid dissemination.

The importance of system models in the current paradigm of advanced control design cannot be overestimated. Three recent volumes in the *Advances in Industrial Control* series: *Model-based Process Supervision* by Arun Samantaray and Belkacem Ould Bouamama, *Wind Turbine Control Systems* by Fernando Bianchi and colleagues and *Soft Sensors for Monitoring and Control of Industrial Processes* by Luigi Fortuna and colleagues testify to the pervasive use of system models in different aspects of control engineering and in different application areas.

This growth in the use of models to accomplish different objectives in the design of industrial control systems has been accompanied by a similar growth in the science of system identification. Today, there is a thriving research community pursuing new developments in system identification that support the use of system models in control design, and for process comprehension. The IFAC Symposium on System Identification (SYSID) is a popular forum for the work of this research community.

System identification is often classed as a white-box problem or a black-box problem, but when the designer is allowed to introduce *a priori* system knowledge into the process then more pragmatic grey-box methods emerge. For the interested reader, the *Advances in Industrial Control* monograph *Practical Grey-box Process Identification* by Torsten Bohlin describes the fundamentals of, some new software for and some applications of the grey-box identification approach.

A mainstay of the control system modelling paradigm are continuous-time models because they arise naturally when describing the physical phenomena of

systems and processes. These models of physical systems usually involve differential equations that stem from the application of physical and chemical laws. However, the widespread use of digital computing technology and the concomitant sampled data led to an emphasis on the use of discrete system models, discrete control designs and sampled-data-based system identification algorithms from the 1980s onward. In an attempt to address this imbalance in technical methods, Hugues Garnier and Liuping Wang initiated international conference sessions and research activities to re-establish interest in the techniques for the identification of continuous-time models. One outcome of their endeavours is this entry in the *Advances in Industrial Control* series. Hugues Garnier and Liuping Wang are not only the Editors of this fourteen-contributed-chapter book but have also, along with many other leading international researchers in the system identification field, contributed to several chapters as authors.

Identification of Continuous-time Models from Sampled Data covers a wealth of material from this field. Usefully, the opening survey chapter defines the basic identification problem, reviews the issues arising from the continuous-time aspect of the problem and then provides a road map to the very substantial set of contributed chapters that follows. The range of topics covered includes: experimental design, model structure determination, closed-loop identification, and software aspects along with a generous number of practical examples. This list is by no means exhaustive of the breadth of the contents and subject matter of the book.

The encyclopedic and highly focussed nature of the book means that it is likely to become a standard reference text for this particular aspect of the system identification subject. It is, after all, the first major book contribution to this field for nearly fifteen years and as such is a very welcome addition to the *Advances in Industrial Control* series.

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