The central idea in this book is to provide a comprehensive treatment of both theory and algorithms needed for parameter identification of systems with quantized observations. In recent years the relevant methodologies have become badly needed due to the widespread use of networked systems such as computer and communication networks, sensor networks, mobile agents, coordinated data fusion, remote sensing, etc. Sampling and quantization are inherent in their design, implementation and operation, and therefore, classical approaches are not applicable here. This cutting-edge monograph is primarily based on the papers published previously by the four authors in first-rate journals (beyond any doubt, they are renowned experts in the field), but this does not mean that the content boils down solely to a collection of sophisticated technical results. It constitutes a coherent whole and its reading is a real pleasure, which results from the authors’ erudition and hard work spent on making the text readily comprehensible for a wide audience (many comments, remarks and examples are added to highlight the importance of individual results and make them intuitively clear). Thus, practitioners will understand the main ideas behind the approach even if they are not familiar with subtleties of stochastic convergence or martingales, and theory-oriented readers will appreciate rigorous proofs of all new results.

The monograph is organized in five parts. The first of them gives an overview of basic system structures, i.e., FIR, IIR, rational and nonlinear (Wiener and Hammerstein) systems, outlines representative system configurations (open-loop, closed-loop, systems with communication channels), and characterizes various sources of uncertainty. They are discussed in detail in the rest of the book. The second part covers the statistical approach to system identification with quantized observations. The key idea in parameter estimation here is to exploit the empirical cumulative distribution function for the output. Various convergence properties are examined and upper and lower error bounds are derived. The design of sensor thresholds to guarantee the maximum information content in the output signal is also studied. The input design problem is additionally discussed for periodic signals. The book is limited to such signals due to their capability of providing input richness while simplifying the identification problem. As such inputs are designed to provide sufficient excitation primarily for asymptotic convergence (this is characteristic for most methods of experimental design), at the beginning the initial uncertainty is reduced rather slowly. This is why Part 3 sets forth a deterministic worst-case framework to achieve fast uncertainty reduction when the uncertainty set is still large. An efficient method is proposed to combine the two approaches. In turn, the focus of Part 4 is on identification of nonlinear and switching systems. The former refer to Wiener and Hammerstein systems, whereas the latter are reduced to systems in which the parameters are themselves Markov chains. Part 5 contains material on complexity is-
sues. A basic framework and some tools to analyse space and time complexities are introduced in order to characterize the trade-off in terms of identification accuracy and optimized resource usage.

In summary, the book conveys a clear and very complete overview of recent exciting developments in the area of identification with quantized observations. It is meant as a “state-of-the-art” book, rather than as a textbook. However, although it is somewhat mathematically challenging, practitioners will find useful tips throughout. All this makes the book an extremely valuable resource for researchers and engineers interested in modern system identification.

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