

Identification and Control of Finite-Information Systems

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Abstract

The theory of identification and control of finite-information systems represents a deepening and extension of traditional control theory, and serves as a crucial theoretical foundation for breakthroughs in key technologies such as 6G communications and multi-scale high-precision sensing. Driven by major national strategic demands including future 6G communications and multi-scale infrared sensing, system design faces a fundamental contradiction: practical constraints such as hardware energy consumption and channel bandwidth result in available data that are low-precision, distributed, and subject to multiple uncertainties, while application scenarios simultaneously require high accuracy, high reliability, and low energy consumption. Traditional control and information theories struggle to effectively reconcile the inherent conflict between “information finiteness” and “performance optimality.” Consequently, the development of finite-information identification and control theory is of critical scientific and engineering significance. This report presents the author’s latest advances in the theory of identification and control of finite-information systems from three perspectives: (i) quantized identification under multiple uncertainties, (ii) quantized identification and consensus control in distributed networked environments, and (iii) applications in communication and sensing systems.



Yanlong Zhao is currently a full Professor of Academy of Mathematics and Systems Science (AMSS), Chinese Academy of Sciences (CAS), and a Vice Director of State Key Laboratory of Mathematical Sciences. He received the B.S. degree in mathematics from Shandong University, Jinan, China, in 2002, and the Ph.D. degree in systems theory from the AMSS, CAS, Beijing, China, in 2007. His research interests include the identification and control of quantized systems, information theory and modelling of financial systems. Yanlong Zhao was awarded the Second Prize of the State Natural Science Award of China in 2015. He has been a Deputy Editor-in-Chief of Journal of Systems Science and Complexity, an Associate Editor for Automatica, SIAM Journal on Control and Optimization, and IEEE Transactions on Systems, Man and Cybernetics: Systems. He served as a Vice-President of Asian Control Association and a Vice-President of IEEE CSS Beijing Chapter, and is now a Vice-President and Fellow of the Chinese Association of Automation (CAA) and the Chair of Technical Committee on Control Theory, CAA.