

Preface

Our goal in writing this book has been to provide a comprehensive, mathematically rigorous, but still accessible treatment of the interaction between information and control in multi-agent decision making in the context of networked control systems. These are systems where different decision units (or equivalently decision makers or agents, which could be sensors, controllers, encoders, or decoders) are connected over a real-time communication network, where the communication medium is heterogeneous, information is decentralized and distributed, and its acquisition is not instantaneous. The questions we address are all performance driven, and entail the issues of what data to pick and how to shape and transmit them for control purposes under various resource constraints as well as how to design optimal control policies with partial information. We deal specifically with the issues of quantization and encoding, design of optimum channels, effects of decentralization on control performance, stability, learning, signaling, and relationships between team performance (of a group of agents) and various information structures.

The book draws and utilizes a diverse set of tools (of both conceptual and analytical nature) from various disciplines, including stochastic control, stochastic teams, information theory, probability theory and stochastic processes, and source-coding and channel-coding theory, and amalgamates them into a unified, coherent, applicable theory. It could be used as a textbook or as an accompanying text in a graduate course on networked control or multi-agent decision making under informational constraints.

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