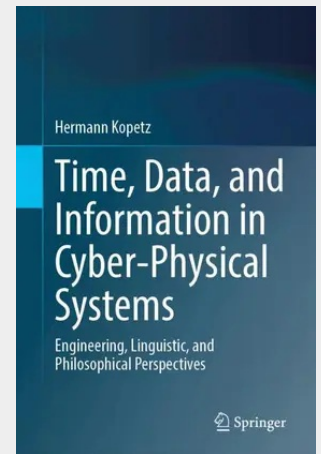


Time, Data, and Information in Cyber-Physical Systems

Engineering, Linguistic, and Philosophical Perspectives

Cyber-physical systems (CPS) have become the technological backbone of modern transportation, manufacturing, healthcare, energy, and other critical infrastructures. While existing textbooks provide extensive coverage of computation, communication, control, and software technologies, they often devote limited attention to the conceptual foundations that govern the interaction between these technologies and the physical world. This monograph addresses that gap by presenting a unified framework that integrates physical time, data, information, knowledge, and human cognition with the engineering principles of dependable cyber-physical systems. The book introduces the conceptual models needed to understand the semantics of sensing, communication, control, and system behavior before developing methods for modeling physical systems, designing real-time control systems, achieving fault tolerance, and assuring safety in hostile and uncertain operating environments. Drawing on insights from engineering, linguistics, cognitive science, and the philosophy of information, it demonstrates why trustworthy CPS depend not only on correct hardware and software but also on sound conceptual foundations. Designed for graduate students, researchers, and practicing engineers involved in the development of dependable and safety-critical systems, the monograph requires only a basic background in engineering, computer science, or a related field. No prior knowledge of philosophy or cognitive science is assumed. Readers will gain a deeper understanding of the principles underlying trustworthy cyber-physical systems and a coherent framework for their analysis, design, and assurance.

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