

Studies in Systems, Decision and Control 15

Christian Servin · Vladik Kreinovich

Propagation of Interval and Probabilistic Uncertainty in Cyberinfrastructure-Related Data Processing and Data Fusion

Based on various examples ranging from geosciences to environmental sciences this book explains how to generate an adequate description of uncertainty, how to justify semi-heuristic algorithms for processing uncertainty, and how to make these algorithms more computationally efficient. It explains in what sense the existing approach to uncertainty as a combination of random and systematic components is only an approximation and presents a more adequate three-component model with an additional periodic error component and how the existing uncertainty propagation techniques can be extended to this model. It provides a justification for a practically efficient heuristic technique; namely, for a technique based on fuzzy decision-making; and explains how the computational complexity of processing uncertainty can be reduced. It also shows that all these methods are based on the idealized assumption that we have a good description of the uncertainty of the original data. It shows that in real life the description of uncertainty is often only approximate, the presented algorithms for uncertainty propagation are not well-justified and not very computationally efficient, and describes how this uncertainty information can be extracted from the data in the practice case.

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