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Managing safety of heterogeneous systems: decisions under uncertainties and risks

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Abstrak

Managing safety of diverse systems requires decision-making under uncertainties and risks. Such systems are typically characterized by spatio-temporal heterogeneities, inter-dependencies, externalities, endogenous risks, discontinuities, irreversibility, practically irreducible uncertainties, and rare events with catastrophic consequences. Traditional scientific approaches rely on data from real observations and experiments; yet no sufficient observations exist for new problems, and experiments are usually impossible. Therefore, science-based support for addressing such new class of problems needs to replace the traditional "deterministic predictions" analysis by new methods and tools for designing decisions that are robust against the involved uncertainties and risks. The new methods treat uncertainties explicitly by using "synthetic" information derived by integration of "hard" elements, including available data, results of possible experiments, and formal representations of scientific facts, with "soft" elements based on diverse representations of scenarios and opinions of public, stakeholders, and experts. The volume presents such effective new methods, and illustrates their applications in different problem areas, including engineering, economy, finance, agriculture, environment, and policy making.;Managing safety of diverse systems requires decision-making under uncertainties and risks. Such systems are typically characterized by spatio-temporal heterogeneities, inter-dependencies, externalities, endogenous risks, discontinuities, irreversibility, practically irreducible uncertainties, and rare events with catastrophic consequences. Traditional scientific approaches rely on data from real observations and experiments; yet no sufficient observations exist for new problems, and experiments are usually impossible. Therefore, science-based support for addressing such new class of problems needs to replace the traditional "deterministic predictions" analysis by new methods and tools for designing decisions that are robust against the involved uncertainties and risks. The new methods treat uncertainties explicitly by using "synthetic" information derived by integration of "hard" elements, including available data, results of possible experiments, and formal representations of scientific facts, with "soft" elements based on diverse representations of scenarios and opinions of public, stakeholders, and experts. The volume presents such effective new methods, and illustrates their applications in different problem areas, including engineering, economy, finance, agriculture, environment, and policy making.