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Special Issue Reprint

Modeling and Optimization of Complex Engineering Systems under Uncertainties

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This Reprint contains all of the articles that were accepted and published in the Special Issue of *Mathematics* titled “Modeling and Optimization of Complex Engineering Systems under Uncertainties”. It offers a comprehensive overview of the current state of the art in reliability engineering and applied mathematics. The research highlights a fundamental transition in engineering design and control, moving away from static safety factors toward dynamic, probabilistic, and data-driven frameworks. We have observed that hybrid optimization algorithms, such as the coupled Simulated Annealing and Particle Swarm Optimization, offer superior efficiency in navigating high-dimensional design spaces. We have seen that Scientific Machine Learning can be made robust to uncertainty through Bayesian inference, ensuring that soft sensors and control models remain trustworthy in critical applications. Furthermore, the successful application of these methods to diverse fields, including tunnel engineering, wind energy, structural health monitoring, and construction safety, confirms the universal relevance of uncertainty quantification. We hope that the methodologies and findings presented in this volume will serve as a foundation for future inquiries and inspire researchers to further explore the intricate dynamics of complex engineering systems.

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