

IISE Transactions: Focused Issue on Data Science, Quality and Reliability (DSQR)

DSQR Focused Issue Statement

All papers published by the DSQR focused issue are expected to present a novel methodology that is motivated by real-world engineering applications. We especially welcome interdisciplinary research that can stimulate the interface research between DSQR and other focused issues of IISE Transactions or promote integrative research among different departments within DSQR. The application domain can be broad, including but not limited to manufacturing, healthcare, energy systems, homeland and cyber security, transportation, and environmental sustainability.

Department Statements

Data Analytics and Machine Learning (DA&ML)

The DA&ML department solicits papers in generic and novel data analytics methodologies or data-driven solutions for improving the design and operation of industrial engineering systems. Papers should include substantial work on data modeling, data analysis and inferences, and/or data-driven decision-making. The dataset should show certain sophisticated characteristics, which are either collected from real-world physical systems through design, operation, or measurements; or generated from realistic physics-based computer simulations. We especially welcome papers that promote the interface research between statistical and emerging machine learning and artificial intelligence methodologies including, but not limited to, variational Bayesian methods, transfer learning, multitask learning, reinforcement learning, federated learning, and deep learning. All papers published by this department are expected to provide a comparison study with alternative methods for justifying the development of the proposed method. There is no restriction in terms of application domains.

Process Monitoring and Control (PMC)

The PMC department welcomes submissions that advance new statistical methodologies in the modeling, monitoring, diagnosis, and control for improving the quality of processes, products, operations, and services. The specific methodological contributions may include: the advancement in quality modeling for complex processes (e.g., variation modeling, causal network modeling, retrospective analysis of quality data, clustering or classification based on quality indicators); statistical process control (SPC) methods based on rich data and complex data structures or types (e.g., heterogeneous sensing data including profile signals, image or video data, high-dimensional data streams for anomaly detection); optimal sensing and root cause diagnosis strategies, etc. We especially welcome papers that create new in-process quality control methods for new/complex data structures, and the integration with techniques in other fields, such as data mining, AI, signal processing, system control theory, optimization, or simulations, for solving process monitoring and control challenges. Applications of novel methods in emerging fields, such as nano-manufacturing, 3D additive manufacturing, augmented reality, service systems, autonomous systems, etc., are strongly encouraged.

Design of Experiments and Uncertainty Quantification (DOE&UQ)

The Design of Experiments and Uncertainty Quantification department welcomes submissions that advance new methodologies in the design and analysis of experiments, including physical, computer, and online experiments. The specific methodological contribution may include, but not limited to, design, analysis and uncertainty quantification of cyber-physical experiments, online experiments, sequential experiments, computer experiments with calibration, showing the

benefits of reducing experimental or computational expenses to enhance accuracy, robustness, security, fairness, and efficiency of the developed models. We especially welcome papers that bridge physical experiments and computer experiments, and decision-making through the use of digital twins and the close loop of data-modeling-decision. There is no restriction in terms of application domains.

Reliability Engineering (RE)

The Reliability Engineering department publishes research in modeling and design of system reliability, reliability test planning, lifetime data analysis, and optimal maintenance decision making. This department solicits papers in a broad range of areas including, but not limited to, system reliability modeling and analysis, lifetime data analysis under multiple failure modes, optimal reliability test planning, degradation modeling, and residual lifetime prediction, and optimal reliability design and maintenance decision making. The methodologies are mainly related to Markov Chain and network models, statistical methods and Bayesian analysis, stochastic simulations, optimization, and risk analysis. Papers that advance methodology and practice by developing new methods, analytical frameworks, and computationally tractable algorithms and solutions to improve complex engineering systems reliability are encouraged. Considering the big data opportunity under the increasing use of IoT technology, we especially welcome interdisciplinary research to create new models and adaptive residual lifetime estimation methods for optimal inspection sampling and maintenance decision-making through dynamically incorporating a system's in-field operating conditions and performance.

System Informatics and Control (SIC)

The System Informatics and Control department welcomes submissions that emphasize system modeling, informatics, systems monitoring and control. The specific methodological contributions may include, but not limited to, system-level modeling and data analytics, engineering-driven statistical modeling and machine learning methods for optimizing system operations or control decisions such as supervised control strategies, predictive control, cautious control, integration of engineering process control (EPC) and statistical process control (SPC), simultaneous real-time modeling and adaptive process control, development of new metrics for system-level anomaly detection and robust control responding to unexpected changes and anomalies. We especially welcome papers that focus on system modeling and analysis of structured and unstructured high-dimensional data that are collected during system operations or from human-system interactions for knowledge discovery. We also promote papers that develop control solutions under Bayesian optimization framework or integrated Bayesian optimization and reinforcement learning, for optimal sequential decision making in various kinds of autonomous systems.