

# Special session on *Quantum Methods in Risk and Reliability*

**ESREL SRA-E 2025**  
**15-19 June 2025, Stavanger, Norway**

**Description:** This special session aims to explore the cutting-edge advancements in quantum computing and their potential to transform risk analysis, reliability engineering, and safety assessment. We invite researchers from academia and industry, engineers, and practitioners to present their innovative quantum-based approaches, applications, and case studies that aim to improve prediction, optimization, and decision-making processes in the context of risk and reliability. Participants will gain insights into the practical applications of quantum computing, the challenges in transitioning from classical to quantum methods, and the future potential of these groundbreaking technologies in making systems safer, more reliable, and more efficient.

**Motivation:** The traditional methods used in risk analysis and reliability engineering are being challenged by the increasing complexity of systems, the high-dimensional nature of data, and the uncertainties involved in real-world applications. Quantum computing promises to tackle these challenges more efficiently than classical methods, offering enhanced computational power and novel algorithms to solve complex problems, even though its full potential is not yet realized due to current hardware limitations. Quantum machine learning, quantum optimization, and quantum inference techniques are at the forefront of this technological revolution. Integrating quantum methods into the domains of risk and reliability represents a transformative shift. It provides opportunities to revisit known problems and traditional approaches by incorporating quantum advancements, offering the potential to enhance system safety, improve reliability, and strengthen the ability to manage uncertainties more effectively.

**Scope:** This special session covers a broad range of topics related to the application of quantum computing and quantum-inspired methods in risk analysis, reliability engineering, and safety assessment. We welcome contributions that focus on theoretical advances, computational models, practical implementations, and real-world case studies. Topics of interest include, but are not limited to:

- **Quantum Machine Learning:** Leveraging quantum computing to develop machine learning models for risk assessment, reliability prediction, and fault detection in complex systems.
- **Quantum Optimization:** Optimization of risk mitigation strategies, reliability models, and resource allocation under uncertainty using quantum and hybrid quantum-classical algorithms.
- **Quantum Natural Language Processing (QNLP):** Exploring the application of QNLP techniques in understanding and analyzing textual data relevant to risk and reliability, such as incident reports, safety logs, or technical documentation, improving risk analysis and decision-making processes.
- **Quantum Inference and Probabilistic Models:** Quantum-enhanced inference techniques for reliability evaluation, system diagnostics, and risk-based decision-making.
- **Comparative Studies:** Analysis of the advantages and challenges of using quantum versus classical approaches in solving risk and reliability problems.
- **Industrial Applications:** Case studies showcasing the implementation of quantum methods in industries such as oil and gas, aerospace, manufacturing, energy, and transportation, where reliability and risk assessment are critical.

**Please submit your abstract by October 15th, 2024 through the [conference website](#).**

## Organizers:

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