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SS-04: Advances in Time-Dependent Reliability of Complex Systems

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Description

Modern engineering systems, from critical infrastructures and transportation networks to cyber-physical and socio-technical systems, are increasingly characterized by high complexity, interdependencies, and dynamic environments. The reliability of such systems is not static; it evolves over time due to degradation, maintenance, operational conditions, and external stressors. Understanding and modeling the time-dependent reliability of complex systems has therefore become a central challenge in safety and risk science.

This special session aims to bring together researchers and practitioners to discuss recent theoretical advances, methodological innovations, and practical applications related to the time-varying reliability of complex systems.

The special session seeks to provide a forum for interdisciplinary exchange, fostering collaboration across academia, industry, and government institutions. By focusing on the temporal dimension of reliability, it aims to contribute to the development of methods and tools that can better capture system dynamics, improve predictive accuracy, and enhance decision-making for safety and resilience.

Topics of Interest

- Stochastic modeling of degradation and failure processes
- Dynamic Bayesian networks and probabilistic graphical models for reliability analysis
- Physics-informed and data-driven approaches to reliability prediction
- Reliability of systems with evolving topology, interdependencies, and cascading failures
- Machine learning and artificial intelligence (AI) for prognostics and health management (PHM)
- Time-dependent risk assessment under uncertainty and limited data
- Applications in energy systems, transportation, manufacturing, and critical infrastructures