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SS-38: From Monitoring to Management: Digital Twins and Predictive Modelling for the Resilient Maintenance of Transport Infrastructure

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Description

The safety and reliability of transport infrastructure, particularly railway and roadway bridges, depend increasingly on the integration of monitoring data, predictive models, and informed maintenance strategies. This Special Session focuses on bridging the gap between structural health monitoring, anomaly detection, and asset management through digital twin and AI-based approaches.

We invite contributions that demonstrate how enhanced sensitivity to incipient damage can be achieved through advanced data analytics and vibration-based monitoring, while maintaining robustness under varying environmental and operational conditions. Emphasis is placed on how these methods feed into performance indicators, predictive maintenance planning, and risk-informed decision-making within digital twin frameworks.

The session aims to advance the transition from monitoring research to proactive, resilient, and sustainable infrastructure management, fostering practical solutions that connect research, engineering, and asset management practice.

Topics of Interest

- Digital twin development, calibration, and updating for transport infrastructure.
- AI and machine learning for anomaly detection, damage identification, and deterioration forecasting.
- Vibration-based monitoring and data-driven detection of incipient damage under variable environmental and operational conditions.
- Fusion of SHM, NDT, and inspection data for predictive maintenance.
- Performance indicators, reliability assessment, and risk-informed decision-support tools.
- Uncertainty quantification and reliability- or risk-based maintenance optimization.
- Case studies and practical applications for bridges, tunnels, and transport networks.