

Special Session Proposal

Title:

Physics-Informed Machine Learning for RAMS

Organizer(s):

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Description:

The effective use of Machine Learning within frameworks for the assessment in practice of system Reliability Availability Maintainability and Safety (RAMS) is often limited by the scarce data available, which does not allow fully capturing the physics governing the system behavior. To overcome these limitations, Physics-Informed Machine Learning (PIML) has been developed to integrate physical laws into the Machine Learning models. PIML promises accurate predictions and alignment with real-world system behavior, enabling robust, trustworthy and generalizable AI solutions for RAMS applications.

This special session aims to convene experts from academia and industry to share recent advancements in PIMLs, and their specific applications to RAMS across various industries. Main topics are (but not limited to):

Methods:

- Physics-informed Neural Networks
- Physics-Informed Data Augmentation
- Physics-Informed Architecture Design
- Physics-Informed Loss Function
- Physics-Informed Residual Modeling

Applications:

- Multi-Scale Modeling
- Surrogate modeling
- Sensitivity Analysis
- Critical Parameter Estimation
- System Optimization
- Anomaly Detection
- Fault Diagnostics
- Fault Prognostics
- Predictive Maintenance