Mini-symposium MS3

Hybrid Paradigms in Oscillatory Dynamics: Deterministic, Stochastic, Fractional, and AI/Machine Learning-Enhanced Modeling and Control

The mini-symposium aims to bring together researchers working at the intersection of classical nonlinear dynamics and emerging data-driven paradigms. The focus is on the theoretical foundations, computational strategies, and experimental validation of complex oscillatory systems that exhibit memory, uncertainty, and hybrid behaviors across scales.

Topics include deterministic and stochastic modeling of nonlinear oscillators, fractional-order dynamics for systems with hereditary and viscoelastic effects, and modern control techniques integrating physics-based formulations with machine learning (ML) and artificial intelligence (AI). Contributions exploring reduced-order modeling, physics-informed neural networks, data-driven identification, and learning-based control architectures for oscillatory and vibro-impact systems are especially welcome.

The symposium also encourages studies on uncertainty quantification, stochastic resonance, synchronization, and bifurcation analysis, as well as practical applications in mechanical, aerospace, civil, and energy engineering. By fostering interaction between traditional and learning-driven approaches, this mini-symposium seeks to outline the next generation of modeling and control strategies for nonlinear oscillatory systems in science and engineering.

Organizers:

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