



# ICEDyn

INTERNATIONAL CONFERENCE ON STRUCTURAL ENGINEERING DYNAMICS

Special Session on

## **Monitoring and control of dynamic systems using machine learning techniques**

The integration of Machine Learning (ML) models into the monitoring and control of dynamic systems has significantly enhanced the understanding and optimization of system behaviour, particularly in engineering applications. By exploring large datasets, such as sensor data and system responses, various learning algorithms, including supervised, semi-supervised or unsupervised methods, are applied to model system behaviour, forecast future states and classify anomalies. This approach is relevant in applications such as vibration control, operational and condition monitoring, fault detection in complex mechanical systems, and structural health monitoring (SHM), where real-time decision-making is essential for optimizing performance and ensuring safety.

The session explores the role of advanced ML techniques, including deep learning, reinforcement learning, and hybrid models, physics enhancing ML, generative networks in improving system reliability and efficiency towards monitoring its integrity during operation and supporting in designing efficient dynamic controls systems. Challenges such as data quality, feature extraction, model interpretability, curse of dimensionality, and computational efficiency are significant in integrating ML into dynamic systems. This session will not only address these challenges but also explore potential solutions to overcome them. This special session offers a platform for discussing the transformative potential of ML in real-time monitoring and control of dynamic systems, fostering more resilient, adaptive, and intelligent engineering applications.

We invite contributions, from foundational research to advanced applications, providing a valuable opportunity for researchers and practitioners to engage with leading experts. This forum will facilitate rich discussions, paving the way for innovative approaches to the real-time optimization and control of dynamic systems into the following critical topics:

- Performance evaluation and real-world impact of ML in SHM of structures and dynamic systems.
- The use of physics enhanced ML models and improved dynamic system modelling and identification.
- Technical and practical challenges of implementing ML in dynamic systems monitoring and controlling.
- Direct and Inverse design of dynamic and control systems supported by ML, Deep Learning, and generative adversative intelligence.

This special session is proposed by:

### **Prof. Dr. Marcela Rodrigues Machado**

Department of Mechanical Engineering, University of Brasília, Brazil

[marcelam@unb.br](mailto:marcelam@unb.br)

### **Prof. Dr. Rafael Teloli**

Department of Applied Mechanics, D-SMART, Supmicrotech - ENSMM, Institut FEMTO-ST, France

[rafael.teloli@femto-st.fr](mailto:rafael.teloli@femto-st.fr)