

Title: Frontiers in Mathematical Modelling and Artificial Intelligence for Sustainable Systems

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Abstract

Developing sustainable systems requires innovative solutions to today's most important problems, such as climate change, resource management, energy transition, and urban planning. However, the socio-technical and ecological systems encountered in these areas, due to their complex structures and nonlinear interactions, necessitate methods that go beyond traditional analysis and modeling approaches. This mini-symposium aims to bring together the disciplines of Mathematical Modeling, Artificial Intelligence (AI), and Sustainability Science in solving sustainability problems. While mathematical modeling helps to understand and predict the functioning of systems, artificial intelligence offers significant opportunities for extracting meaningful information from large datasets, identifying patterns, and supporting decision-making processes under uncertainty. The session will address how the combined use of these two approaches can contribute to achieving the Sustainable Development Goals (SDGs). Focusing particularly on hybrid modeling approaches that combine physics-based models with the learning capacity of neural networks, the goal is to create new research opportunities in the field of sustainable development, contribute to a better understanding of complex systems, and develop more effective decision support mechanisms. In addition, the session aims to address studies that utilize artificial intelligence and mathematical modeling methods in sustainability-focused energy, environment, transportation, aviation, and space applications.

Key Themes and Topics

We invite contributions that address, but are not limited to, the following themes:

Digital Twins for Sustainability

Hybrid Physics-Informed Neural Networks (PINNs)

AI for Resource Optimization

Data-Driven Decision Making under Uncertainty

AI for Environmental Monitoring

Bias, Fairness, and Interpretability

Eco-Efficiency and Circular Economy

Sustainable Aviation and Space Systems

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