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EQUATION DISCOVERY AND PHYSICS-INFORMED LEARNING FOR ENGINEERING SYSTEMS

YUKI ARAI[*], YOSHITAKA WADA[†]

[*] Kindai University
3-4-1, Kowakae, Higashiosaka, Osaka, JAPAN
yuki.arai@mech.kindai.ac.jp

[†]Kindai University
3-4-1, Kowakae, Higashiosaka, Osaka, JAPAN
wada@mech.kindai.ac.jp

ABSTRACT

Recent advances in data-driven modeling and artificial intelligence have enabled the discovery of governing equations directly from data, opening new possibilities for understanding and predicting complex engineering systems. Equation discovery techniques, such as sparse regression (e.g., SINDy), symbolic regression (e.g., AI Feynman), and physics-informed neural networks (PINNs), provide powerful tools to uncover hidden physical laws and construct interpretable models from limited or noisy data.

This minisymposium aims to bring together researchers working on equation discovery and physics-informed learning in the context of engineering applications. Particular emphasis will be placed on the integration of data-driven methods with physics-based modeling for digital twin technologies, where interpretability, generalization, and robustness are essential.

Topics of interest include, but are not limited to:

・Equation discovery and symbolic regression methods for engineering systems

・Physics-informed machine learning and hybrid modeling approaches

・Discovery of governing equations for nonlinear, multiscale, and coupled phenomena

・Applications to solid mechanics, fracture mechanics, fluid dynamics, and multiphysics problems

・Integration of equation discovery with numerical simulation and high-fidelity models

・Uncertainty quantification and robustness of discovered models

By bridging the gap between data and governing equations, this minisymposium aims to advance the development of interpretable, reliable, and efficient digital twins for next-generation engineering systems.