

# BRIDGING PHYSICS-BASED MODELING, ARTIFICIAL INTELLIGENCE, AND UNCERTAINTY QUANTIFICATION FOR DIGITAL TWINS

SHU-WEI CHANG<sup>\*</sup>, SEUNGHWA RYU<sup>†</sup>  
AND IKJIN LEE<sup>‡</sup>

<sup>\*</sup> Department of Civil Engineering, National Taiwan University, Taipei, Taiwan  
[changsw@ntu.edu.tw](mailto:changsw@ntu.edu.tw)  
<https://www.swc-lab.tw>

<sup>†</sup> Department of Mechanical Engineering, KAIST, Daejeon, Republic of Korea  
[ryush@kaist.ac.kr](mailto:ryush@kaist.ac.kr)  
<https://sites.google.com/site/seunghwalab/>

<sup>‡</sup> Department of Mechanical Engineering, KAIST, Daejeon, Republic of Korea  
[ikjin.lee@kaist.ac.kr](mailto:ikjin.lee@kaist.ac.kr)  
<http://idol.kaist.ac.kr/>

## ABSTRACT

Digital twins are emerging as a transformative paradigm for predictive modeling, real-time monitoring, and decision-making in engineering systems. Their development requires the integration of physics-based modeling, data-driven approaches, and robust uncertainty quantification.

This minisymposium aims to bring together researchers working at the intersection of computational mechanics, multiscale modeling, artificial intelligence, and uncertainty quantification to advance the next generation of digital twin technologies. Topics of interest include, but are not limited to, physics-informed machine learning, hybrid modeling approaches, reduced-order and multiscale models, data assimilation, uncertainty quantification and propagation, and applications to materials, structures, and complex systems.

By bridging fundamental modeling approaches with emerging AI techniques, this minisymposium seeks to foster cross-disciplinary discussions and promote the development of predictive, reliable, and scalable digital twins for engineering applications.