Special Issue

PDE-Based Neural Operator Learning for Material Modeling, Fatigue, and Fracture Mechanics

Message from the Guest Editors

The integration of machine learning (ML) into material modeling is transforming materials science. This Special Issue focuses on partial differential equation-based (PDE-based) neural operator learning, to improve material modeling across scales and support low-carbon learning pathways. By emphasizing physics-informed operator architectures for the accurate prediction of material behavior and fracture evolution, it focuses on how computationally intensive data-driven training, such as in convolutional neural networks, can be made more sustainable by reducing computational costs. PDE-based neural operators offer significant potential for advancing the prediction of complex phenomena, such as crack propagation and fatigue evolution, in multiphase materials like composites and concrete. These improvements enable the development of strategies for optimizing material use and reducing resource consumption. This Special Issue invites contributions at the intersection of materials science and ML, with a particular focus on PDE-based operator learning for material modeling and fracture mechanics. These advancements aim to drive sustainable innovation in engineering and manufacturing

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Message from the Editor-in-Chief

As the world of science becomes ever more specialized, researchers may lose themselves in the deep forest of the ever increasing number of subfields being created. This open access journal Applied Sciences has been started to link these subfields, so researchers can cut through the forest and see the surrounding, or quite distant fields and subfields to help develop his/her own research even further with the aid of this multi-dimensional network.

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