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ADVANCES IN MACHINE LEARNING FOR COMPOSITE MATERIALS

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ABSTRACT

Over the past few decades, many industrial sectors such as the aerospace, automobile, and renewable energy sectors have significantly benefited from the integration of high-performance composites. However, an outstanding challenge in modelling and designing composites is the computational cost of high-fidelity models. Recently, machine learning has emerged as promising techniques to enhance the efficiency and reliability of various approaches for modelling of composites [1]. These techniques offer a powerful approach to capture and understand the intricate behaviour of composite materials by leveraging vast datasets and identifying the underlying patterns. By training models on different sources of data, machine learning can accurately predict physical and mechanical properties, failure mechanisms, and durability; enabling efficient material design and reducing the need for extensive and costly experimental and computational testing [2]. Furthermore, machine learning can facilitate the optimization of composite processing parameters to reduce manufacturing defects. The application of machine learning techniques in composite materials not only enhances our understanding of these advanced materials, but also enables their broader utilization across industries such as aerospace, automotive, and renewable energy where lightweight and high-strength materials are in high demand. In this mini symposium, we will discuss the state-of-the-art developments in usage of machine learning techniques for modelling, design, and process optimization of composite materials. Contributions on a wide range of topics are encouraged, from traditional and physics-enhanced machine learning for surrogate modelling, to learning

and exploiting latent representations of material behaviour, generative learning for material optimization, efficient data assimilation and active learning.

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