Contribution ID: **408** Type: **Presentazione orale**

A physics-guided neural network for predicting mode-I stress intensity factors in edge-cracked plates

Thursday 3 September 2026 16:00 (15 minutes)

In recent years, data-based models have been employed across various disciplines owing to their ability to reduce time and cost while maintaining high accuracy. However, fully capturing the intricacies of complex phenomena often requires large volumes of data. This limitation motivated the researchers to develop models that respect the physical laws while benefitting from the strengths of the data-based models. In fatigue and fracture mechanics, such models have been implemented to predict stress intensity factors (SIFs), crack propagation rates as well as the remaining useful life. In this study, a physics-guided neural network (PGNN) is proposed to predict the SIFs of edge cracks in 2D under mode-I loading conditions. The model is trained on the data from the finite element method (FEM) simulations, which were carried out to account for the variations in key geometric parameters including plate dimensions, normalized crack length (a/W) and normalized crack location. The proposed PGNN predicts the SIFs with significantly higher accuracy than its pure data-based counterparts. The enhanced performance stems from the incorporation of analytical relations within the model, which provide physics-based guidance and enable more effective modelling of the underlying behaviour of the problem. The present work serves as a preliminary step to establish the proposed methodology with future extensions aimed at more complex geometries, crack configurations and loading conditions.

Primary author: MEHMOOD, Atif (Politecnico di Milano)

Co-authors: SBARUFATTI, Claudio (Politecnico di Milano); GIGLIO, Marco (Politecnico di Milano)

Presenter: MEHMOOD, Atif (Politecnico di Milano)

Session Classification: Fatica e Frattura

Track Classification: Fatica e Frattura