Deep Generative Models For Unsupervised Delamination Prediction In Aerospace Composite Panels

Mahindra RAUTELA, S. GOPALAKRISHNAN

With the rising demands of robust structural health monitoring procedures for aerospace structures, the scope of intelligent algorithms and learning techniques is expanding. Supervised algorithms have shown promising results in the field provided a large, balanced, and labeled amount of data for training. For some applications like aerospace, the data collection process is cumbersome, time-taking, and costly. Also, generating possible damage scenarios in a laboratory setup is challenging because of the complexity of the damage initiation and failure mechanism considering the uncertainties in the real-time operation. In this paper, we have proposed deep generative models for unsupervised delamination prediction as an anomaly detection problem. In this one-class-based model, the deep learning network is trained to learn the distribution of baseline signals. In the testing phase, damage signals and unseen baseline signals are fed into the trained network to predict the state of the structure, i.e., healthy or damaged. The network's performance is evaluated using confusion matrix, mean-absolute error, and coefficient of determination. It is seen that the proposed methods can successfully predict the delamination with high accuracy.