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Design of Composite Joints using Machine Learning Approaches

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Adhesively bonded joints have an advantage in joining dissimilar engineering materials due to their high structural efficiency and being lightweight. These joints are either between two opposite laminates or between a composite laminate and a metal structure. The aerospace and automotive industries have seen an increase in utilizing these adhesive joints in their engineering applications. Joint strength along with the failure mode (adhesive, delamination, etc.) is the most important parameter to evaluate when understanding the capability of the adhesive joint. In this paper, a regression and a classification machine learning (ML) model are utilized to predict the failure load and the failure mode of single lap adhesive joints. This work compiled 103 single lap joint samples with different geometric and material parameters. An Artificial Neural Network (ANN) model and a Random Forest (RF) model were developed to accurately predict the joint's failure load and failure mode. These models allow us to explore the complex, mathematical relationship between the input parameters and the overall joint strength.