Ahmedabad University

WORKING PAPER

Prediction of Tensile Strength of Friction Stir Welds Using Artificial Intelligence

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Title: Prediction of Tensile Strength of Friction Stir Welds Using Artificial Intelligence

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Abstract (150 words, Font 12): Friction stir welding (FSW) is a solid-state joining technique where the joint strength is influenced by three process parameters, namely, spindle speed (N), welding speed (V) and plunge force (Fz). The modelling of complex relationships between the process parameters and joint strength requires many experiments, which is challenging. To tackle this problem, deep learning (DL) techniques, namely, deep multilayer perceptron (DMLP) and long short term memory (LSTM) network have been proposed here. The DL networks were first trained with the FSW experimental data and then, the pre-trained models were used for predicting the weld strength. It was found that the DMLP and LSTM models provided lower prediction errors i.e. 5.69 and 7.63, respectively and can be effectively utilized for determining weld quality. The proposed DL-based techniques were further compared with the traditional shallow artificial neural network (SANN) models and found to be superior in determining between the weld-strength accurately.

Purpose: To tackle the requirements of many experiments, which is challenging and time consuming, deep learning (DL) techniques, namely, deep multilayer perceptron (DMLP) and long short term memory (LSTM) network have been proposed.

Design/Methodology/ Approach: AI models

Findings: DMLP and LSTM models provided lower prediction errors i.e. 5.69 and 7.63, respectively and can be effectively utilized for determining FSW weld quality

Research Limitations/ implications: The research applicability is limited to FSW of AA2219-T87 having thickness around 8 mm. The application is in space vehicles.

Originality/ Value: LSTM network for strength prediction of FSW joint

Keywords: Friction stir welding, Deep learning, Deep Multilayer perceptron, Long-short-term memory networks

Description: Paper is submitted to a journal