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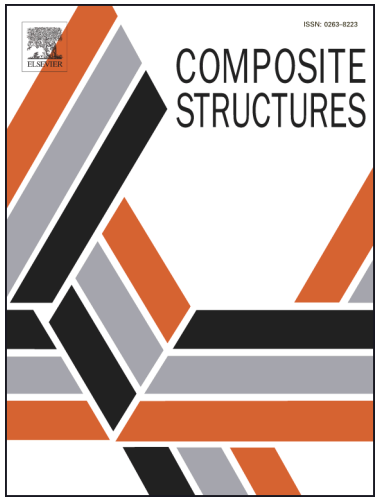


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J.Y. Ang, M.S. Abdul Majid, A. Mohd Nor, S. Yaacob, M.J.M. Ridzuan

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# First-ply failure prediction of glass/epoxy composite pipes using an artificial neural network model

J.Y. Ang[a], *M.S. Abdul Majid[a], A. Mohd Nor[b], S. Yaacob[c], M.J.M. Ridzuan[a]

[a] *School of Mechatronic Engineering, Pauh Putra Campus, Universiti Malaysia Perlis, Arau, 02600 Perlis, Malaysia.*
[b] *School of Manufacturing Engineering, Pauh Putra Campus, Universiti Malaysia Perlis, Arau, 02600 Perlis, Malaysia.*
[b] *Universiti Kuala Lumpur Malaysian Spanish Institute (UniKL MSI), Kulim Hi-Tech Park, 09000 Kulim, Kedah*

[1]*jiayi89@msn.com*, [2]***shukry@unimap.edu.my****, [3]*azuwir@unimap.edu.my*, [4]*sazali.yaacob@unikl.edu.my*, [5]*ridzuanjamir@unimap.edu.my*

## Abstract

An artificial neural network (ANN) model was developed to predict the onset of failure of glass fibre reinforced epoxy composite pipes under multiaxial loadings. The developed ANN model used input/output experimental data for training and classification. The model was expected to predict the first-ply failure within the pipe composite laminates under various biaxial stress ratios. The biaxial failure envelope was then illustrated by plotting the failure points in a graph showing axial stress versus hoop stress. During the model's construction, the best entire mean classification accuracy rate achieved was within the range of 95% to 99.66%. Validation with experimental findings indicated good agreement with the model's predictions, with less than 30% variation. The results suggest that the ANN model can be extended to yield useful predictions of the onset of failure in composite pipes under a range of stress conditions. This can be utilised as an internal means for pipe rating prior to the required standard ASTM qualification process.

**Keyword:** Artificial neural network; glass fibre; composite pipes; modelling; stress.

*Corresponding author. Tel: +6012 7367500
E-mail address: shukry@unimap.edu.my

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