A STUDY ON THE FAILURE PREDICTION OF COMPOSITE LAMINATES IN BENDING

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Failure prediction for composite materials under given loading conditions is important for efficient design in structural applications. Over the past several decades, there are numerous failure criteria proposed to more accurately predict the failure composite laminates. A lot of research was conducted to evaluate and validate the failure prediction capability for failure criteria. The most failure criteria are studied for in-plane loading conditions. Mechanical behavior of composite laminates varies depending on the loading conditions. Even if failure criterion is accurate under the in-plane loads, it cannot be accurate for out-of-plane loads such as bending. In many industrial structures, composite laminates is under out-of-plane load as well as in-plane loads. For the structural stability of the composite structures, it is important to accurately predict failure of composite laminates under bending.
In this study, the failure prediction of composite laminates under bending is investigated. The non-linear finite element analysis using Arc-length method is performed. 2D strain-based interactive failure theory [1] that is more accurately final failure of composite laminate under multi-axial loading is applied to predict the final failure of composite laminates under bending. In order to compare the accuracy of the failure predictions, a 3-point bending test are performed for un-symmetric cross-ply $[0/90]_8$ and quasi-isotropic $[0/\pm45/90]_{2s}$ composite laminates. Also, it is compared with the other failure criteria such as maximum strain, maximum stress and Tsai-Wu theories. Finally, the predicted results using 2D strain-based interactive failure theory more agree well with the experiment than other failure theories.

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References
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