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Determination of ILSS of Composite Materials Using Micromechanical FEA Analysis

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Abstract : Inter Laminar Shear Stress (ILSS) is a main key parameter which quantify the properties of composite materials. These properties can ascertain the use of material for a specific purpose like aerospace, automotive etc. A modelling approach for determination of ILSS is presented in this paper. Geometric modelling of composite material is performed in TEXGEN software where reinforcement, cured matrix and their interfaces are modelled separately as per actual geometry. Mechanical properties of matrix and reinforcements are modelled separately which incorporated anisotropy in the real world composite material. ASTM D2344 is modelled in ANSYS for ILSS. In macroscopic analysis model approximates the anisotropy of the material and uses orthotropic properties by applying homogenization techniques. Shear Stress analysis in that case does not show the actual real world scenario and rather approximates it. In this paper actual geometry and properties of reinforcement and matrix are modelled to capture the actual stress state during the testing of samples as per ASTM standards. Testing of samples is also performed in order to validate the results. Fibre volume fraction of yarn is determined by image analysis of manufactured samples. Fibre volume fraction data is incorporated into the numerical model for correction of transversely isotropic properties of yarn. A comparison between experimental and simulated results is presented.

Keywords : ILSS, FEA, micromechanical, fibre volume fraction, image analysis
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