

## Thermo-mechanical behavior of a few ply woven composites

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Polymer matrix woven composites have been used for aerospace and automotive structures due to the symmetrical and balanced properties along with advantages in handling and fabrication. Their use in ultra-thin deployable space structures is of current interest, where it is envisaged that a laminate will consist of only a small number of plies.

This paper studies thermo-mechanical behavior of plain weave composites by developing finite element models and by using experimental techniques. Plain weave carbon and E-glass fibers with polymer matrix are considered for the study. Finite element models are developed to estimate the material properties of plain weave composites, including extension and bending properties. The models based on unit cell and with different size are developed, and the effect of model size on the properties is obtained as given in Figures 1 to 3. Figure 1 shows the effect of model size on elastic modulus of a single ply T300/LTM45 plain weave composite. The elastic modulus is slightly affected by the model size; it seems that results converge if a length/width ratio is bigger than three. Figure 2 shows the effect of model size on the bending stiffness; there is no significant difference on the stiffnesses because longitudinal fibers play a significant role in the stiffness. Figure 3 shows transverse strain versus longitudinal strain for two models with different sizes; the Poisson's ratio is calculated from the slope of the curve,

showing nonlinear behavior. Two linear estimates can be made for longitudinal strain before and after 0.3 %, showing nonlinear behavior. Two linear estimates can be made for longitudinal strain before and after 0.3 %,

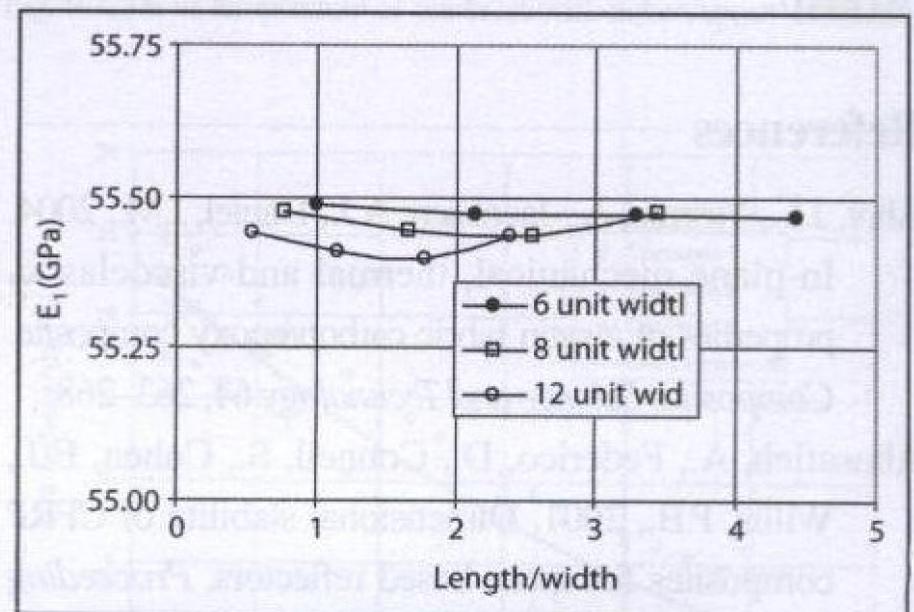


Fig. 1. The effect of model size on elastic modulus

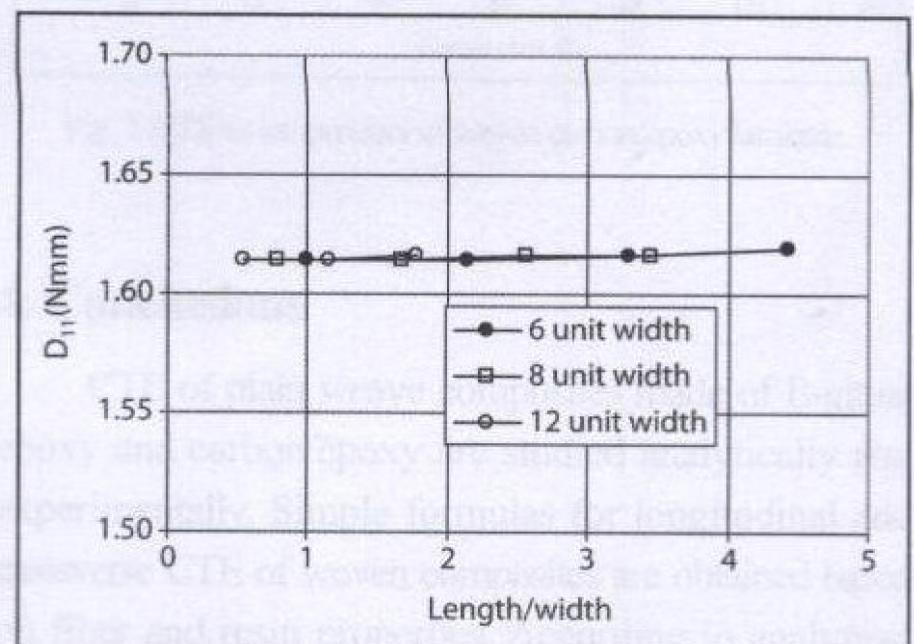


Fig. 2. The effect of model size on bending stiffness