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IDEALIZED TEXTILE COMPOSITES FOR EXPERIMENTAL/ANALYTICAL CORRELATION

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Textile composites are fiber reinforced materials produced by weaving, braiding, knitting, or stitching. These materials offer possible reductions in manufacturing costs compared to conventional laminated composites. Thus, they are attractive candidate materials for aircraft structures. To date, numerous experimental studies have been performed to characterize the mechanical performance of specific textile architectures. Since many materials and architectures are of interest, there is a need for analytical models to predict the mechanical properties of a specific textile composite material. Models of varying sophistication have been proposed based on mechanics of materials, classical laminated plate theory, and the finite element method. These modeling approaches assume an idealized textile architecture and generally consider a single unit cell. Due to randomness of the textile architectures produced using conventional processing techniques, experimental data obtained has been of limited use for verifying the accuracy of these analytical approaches.

This research is focused on fabricating woven textile composites with highly aligned and accurately placed fiber tows that closely represent the idealized architectures assumed in analytical models. These idealized textile composites have been fabricated with three types of layer nesting configurations: stacked, diagonal, and split-span. Compression testing results have identified strength variations as a function of nesting. Moire interferometry experiments are being used to determine localized deformations for detailed correlation with model predictions.