PERFORMANCE EVALUATION OF 2.5D NEEDLE-PUNCHED COMPOSITES

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ABSTRACT

With the continuing increase of composite components being introduced into the commercial industry such as aerospace and wind energy, discovering new manufacturing methods or materials to improve the performance of traditional 2D composite laminates can be highly advantageous for a business. In the case of 2D composites, a major weakness is the out-of-plane mechanical properties where delamination can be induced under high stresses. To improve on the out-of-plane mechanical properties, a needle-punching manufacturing process was utilized to orient fibers in the out-of-plane direction for composite laminates. Composite test panels will be manufactured by vacuum assisted resin transfer molding (VARTM) techniques with use of a low viscosity resin and subsequently machined by water jet or wet-tile saw. A comparison of several factors are evaluated as follows: various fabric weaves, the ration of woven to non-woven webbing layers, alternate layup configurations, orientation through needle-punch operation and different levels of needle-punch density. Non-destructive and mechanical testing will be performed to evaluate the in-plane properties, out-of-plane properties, and impact properties of needle-punched composites.