Abstract
A multiscale framework is developed to predict the development of damage in composites at the fiber-matrix scale and textile scale. The textile scale analysis includes variability and thermal dependence of strength in the carbon-fiber tows that is characterized through analysis of random microstructural realizations of the fiber-matrix. The textile scale model includes features to account for a variety of damage mechanisms, including discrete cracking and microdamage development in tows, crack opening in pockets of neat matrix, and interfacial failure between adjacent tows and between the tows and matrix pocket.

Failure evolution within the textile is characterized for a variety of in-plane loadings. This characterization is then utilized to develop a micromechanics-based continuum damage model that can be applied at the scale of engineering structures to predict the evolution of damage and resulting material degradation in textile composites.