Thin ply composites have been under the microscope of the researchers for around two decades since Kawabe introduced the thin ply technology, in the Industrial Technology Center in Fukui, Japan. With the advancement of the technological aspects of manufacturing carbon fiber composites the two spreading has improved so much as to reduce the thickness of a conventional ply up to even six-fold.

Over the years carbon fiber composites have gained interest in space structures for reinforcement purposes in antennas, as structural elements that stores strain energy and support the deployment of deployable structures, and in reflector concepts.

Now thin-ply composites are gaining attention for utilizing in small scale cube satellites in deployable structures. Since the deployable structures takes larger space compared to the satellite, they have to be stowed in a smaller volume for logistic purpose. Therefore, achieving light weight structures and increasing the packing efficiency will improve the performance of the payload. With this perspective thin-ply can make a significant improvement on deployable space structures. But during stowage the deployable structures are subjected to stress relaxation due to viscoelastic effects reducing the strain energy, hindering the deployment and the stability of the structures.

This study will focus on evaluating viscoelastic properties of thin-ply composites using a two-step homogenization process. A representative unit cell is extracted from the laminate and the geometry is constructed by using data extracted from micrographs. The tow is homogenized to a fiber filament model in the micro scale and the time dependent properties of the matrix is used to compute viscoelastic properties of the tow. Incorporating the properties of the viscoelastic tow to the unit cell model, the viscoelastic behavior is determined for the laminates. The effects laminate orientation, high curvatures and ply arrangements are studied for the laminates considered in the study.

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Approved for distribution by Dr. Kawai Kwok, Committee Chair, on October 8, 2019.

The public is welcome to attend.