Advanced Training in Laminated Composite Analysis

Objectives:

1) Defining and assigning laminate orthotropic material properties in 2D & 3D.
   a. Representing proper ply orientations and principal directions.
   b. Using the automatic laminate stack builder for ply-by-ply and sub laminate (homogenized) representations.
   c. Reducing thru-thickness DOF for thin solids, such as plies and adhesive bonds, via q-Discretization.
2) Recommendations for modeling adhesive bonded joints and repairs.
3) Incorporating nonlinearities in the analysis of laminated composite structures.
   a. Material nonlinearities for plasticity in adhesively bonded structures.
   b. General nonlinearities for representing finite deformations in thin domains.

Session I (4 hrs)   Laminated Composites Overview, 2D Composites, Automation

❑ Lecture: "Laminated Composites Overview" (a-Laminated Composites Overview.pptx).
❑ Discussion: Definition and Assignment of Laminated Composites in 2D and 3D.

   1. Reference: b-Definition and Assignment of Laminated Composites.pptx

❑ Exercise: Construct a 2D laminated composite single lap joint, define/assign laminate orthotropic materials to adherends and elastic-plastic materials to adhesive, assign loads/constraints, perform general nonlinear analysis, and assess bondline shear stresses.

   1. Reference: c-2D Laminated Lap Joint Example.pptx

❑ Demo/Exercise: "Automation of Composites Analysis via COM API" (Composites.xlsm)

Session II (4 hrs)   3D Laminated Composites

❑ Exercise: Construct a 3D laminate composite panel with a racetrack cutout, define/assign laminate orthotropic materials to panel, assign loads/constraints, compute a linear elastic solution, and plot/extract principal strains at the racetrack cutout.

   1. d-3D Laminated Racetrack Cutout Example.pptx

❑ Discussion: "Best Practices for Modeling Laminated Composite Bonded Joints"

   1. e-2D Laminated Composite Bonded Lap Joint Best Practices.pptx

❑ Exercise: Construct a 3D laminate composite bonded splice joint, define/assign laminate orthotropic materials to splice plates and elastic-plastic materials to adhesive, assign loads/constraints, and compare linear and nonlinear solution results.

   1. f-3D Laminated Bonded Splice Joint.pptx