
1.0 Building Composites Models (“flatplate”)

This example illustrates how conventional laminated composite models using a laminated material description of the layup are prepared in MSC/PATRAN.

- 1 Open a new database using the default template database.
 - File New...
 - New Database Name : flatplate.db
 - Ok
- 2 Create a flat plate 1 m square using units of NEWTONS and MILLIMETERS.
 - Geometry
 - Create Surface XYZ
 - Vector Coordinates List : <1000 1000 0>
 - Origin Coordinates List : [0 0 0]
 - Apply
- 3 Create a mesh.
 - Finite Elements
 - Create Mesh Surface
 - Global Edge Length : 125
 - Element Topology : Quad4
 - Mesher : Isomesh
 - Surface List : Surface 1
 - Apply
- 4 Define loads and boundary conditions.
 - Loads/BCs
 - Create Displacement Nodal
 - New Set Name : d1
 - Input Data...
 - Translations : <0,0,0>

- Ok
- Select Application Region
 - Application Region : Surface 1.4 (edge)
 - Ok
- Apply
- Create Displacement Nodal
 - New Set Name : d2
 - Input Data...
 - Translations : <.,0>
 - Ok
 - Select Application Region...
 - Application Region : Point 2
 - Ok
 - Apply
- Create Pressure Element Uniform
 - New Set Name : p1
 - Target Element Type : 2D
 - Input Data...
 - Top Surf Pressure : 0.01 (10 kPa)
 - Ok
 - Select Application Region...
 - Application Region : Surface 1
 - Ok
 - Apply

5 Define ply material properties. The easiest way to do this is to run a session file which will create the required materials.

- Materials
 - Create 2D Orthotropic Manual Input
 - Material Name: ud_t300_n5208
 - Input Properties:

- Constitutive Model: Linear Elastic
 - Elastic Modulus 11: 181000
 - Elastic Modulus 22: 10300
 - Poisson Ratio 12: 0.28
 - Shear Modulus 12: 7170
 - Shear Modulus 23: 5000
 - Shear Modulus 13: 7170
 - Density: 1.6E-09
 - Thermal Expan. Coeff 11: 2E-08
 - Thermal Expan. Coeff 22: 2.25E-05
 - Reference Temperature: 20
 - Apply
- Constitutive Model: Failure Stress Tsai-Wu
 - Tension Stress Limit 11: 1500
 - Tension Stress Limit 22: 40
 - Compress Stress Limit 11: 1500
 - Compress Stress Limit 22: 246
 - Shear Stress Limit: 68
 - Interaction Term: -0.5
 - Bonding Shear Stress Limit: 50
 - Apply

OR

- File Session Play...
 - Play from file : materials.ses
 - Apply

6 Define laminate material properties.

- Materials
 - Create Composite Laminate
 - Material Name : laminate

- Text Entry Mode : Insert Material Names
- Insert Material Names: 16(ud_t300_n5208)
- Load Text into Spreadsheet
- Text Entry Mode : Overwrite Thickness
- Overwrite Thicknesses : 16(0.25)
- Load Text into Spreadsheet
- Text Entry Mode : Overwrite Orientations
- Overwrite Orientations : 4(0/90)
- Load Text into Spreadsheet
- Overwrite Orientations : 4(90/0)
- Load Text into Spreadsheet
- Apply

7 Define element properties.

- Element Properties
 - Create 2D Shell
 - Property Set Name : prop
 - Option 1 : Laminate
 - Option 2: Standard Formulation
 - Input Properties...
 - Material Name : m:laminat
 - Material Orientation : 0. (Real Scalar) (WRT element edge 1)
 - Ok
 - Application Region : Surface 1
 - Apply

8 Create an analysis input deck.

- Analysis
 - Analyze Entire Model Analysis Deck
 - Subcase Create...
 - Available Subcases : select Default

- Output Requests...
 - Form Type : Advanced
 - Output Requests : select STRESS
 - Composite Plate Opt : Ply & Elem. Stress
 - Modify
 - Ok
- Apply
- Cancel
- Apply

9 Run the analysis using MSC/NASTRAN.

- In your Unix shell window, type: `nastran flatplate.bdf`
- After completion, `mv flatplate.op2 to flatplate_res.op2`

10 Read in Analysis Results

- Analysis
 - Read Output2 Result Entities Translate
 - Select Results File...
 - Selected Results File : `flatplate_res.op2`
 - Ok
 - Apply

11 View Ply Results

- Results
 - Basic
 - Select Result Case : Default, Static Subcase
 - Select Fringe Result : Stress Tensor
 - Result Position : Layer 12
 - Result Quantity : XX
 - Select Deformation Result : Displacements, Translation
 - Apply

12 Quit MSC/PATRAN.

- File Quit

If you have difficulty with this exercise, examine or play the session file flatplate.ses after opening a new database.