Example Problems:

1. **Simple 2D panel analysis**

You are analyzing a 6in square panel made of unidirectional Glass/Epoxy. It’s loaded with a 3000lb force in the x direction, and a 1200lb force in the y direction. The layup for the panel (from the top down) is [45/-45/0/90/0/-45/45] (degrees from the x direction). Each ply is 0.02” thick. What is the margin of safety for each layer in the laminate?

Steps:

1. Convert the loads from forces into running loads (running load is force/width). This gives you Nx = 500lb/in and Ny = 200lb/in.
2. Use the program CLTbasic.m with the following inputs:

A number and numbers on a white background

Description automatically generated

1. Running the program yields this result:

A screenshot of a computer program

Description automatically generated

1. **Flat Panel loaded in compression**

You are analyzing a panel made of unidirectional Graphite/Epoxy loaded under 2700lb of compression. The panel dimensions are 5in on the loaded edge, and 14in on the unloaded edge. All edges are clamped. Using the same layup as the problem above, find the MS against plate buckling.

Steps:

1. Convert the load from a force into a running load (running load is force/width). This gives you Nc = 540 lb/in and Ns = 0lb/in.
2. Use the program FlatPanelStability.m with the following inputs:

A black and white text

Description automatically generated with medium confidence

1. You will see this plot appear:

A screenshot of a graph

Description automatically generated

Since you have clamped edge constraints, click the intersection between the red dotted line and the uppermost dashed line on the plot. This is the line associated with case A and clamped loaded edges.

1. You will see this plot appear:

A graph on a paper

Description automatically generated

Click the intersection between the dotted red line and the upper line on the plot. This is the line associated with clamped edges.

1. The program will output this result. If yours doesn’t match exactly it’s fine, there is always some error associated with choosing a point on the plots.

A number of numbers on a white background

Description automatically generated

1. **Curved panel (not cylinder) loaded in compression:**

You are analyzing a panel made of unidirectional Glass/Epoxy loaded with 30 kips of compression. The panel is 20 inches long, has a radius of 16 inches, and an arc length (on the curved edge) of 14 inches. The layup is [0/90/45/-45/90/0] with a layer thickness of 0.02in. All edges are simply supported. Find the MS against plate buckling.

1. Convert the load from a force into a running load (running load is force/width). This gives you Nc = 2142.857 lb/in and Ns = 0 lb/in/
2. Use the program CurvedPanelStability.m with the following inputs:

A white background with black numbers and letters

Description automatically generated

1. You will see this plot appear:

A diagram of a curve

Description automatically generated

Click the intersection between the dotted red line and a point near the upper line on the graph. That is the line for an r/t of zero, and our r/t value is much closer to 0 than 500.

1. You will see this plot appear:

A graph on a paper

Description automatically generated

Click the intersection between the red dotted line and the line for an a/b of 1.428 (somewhere between the line for a/b=1 and a/b=1.5).

1. The program will output this result. If yours doesn’t match exactly it’s fine, there is always some error associated with choosing a point on the plots.

A black text on a white background

Description automatically generated