

Problem M17

An aircraft wing structure is being designed. You are responsible for "sizing" a rectangular panel of the wing skin (in this case sizing means specifying the thickness). The material to be used is Aluminum 7075 T6, which has a uniaxial yield stress of 500 MPa. The loading is specified in terms of line forces (i.e. forces per unit length in the x-y plane), N_x , N_y , S_{xy} , where N_x and N_y are tensile line forces and S_{xy} is the shear loading. These line forces are derived from the estimated design loads on the airframe due to different flight conditions, gust loading etc. The three critical load cases for this component are thought to be:

Load case	N_x (kN/m)	N_y	S_{xy}
1	+250	-500	+200
2	+300	+500	-400
3	+600	-300	0

Calculate the required thickness of the wing skin for this component so that it will survive all three loading conditions. Assume that the material obeys Von Mises Yield criterion, assume that the out of plane (z direction) loading is negligible) and apply a factor of safety of 1.5 to your results.

