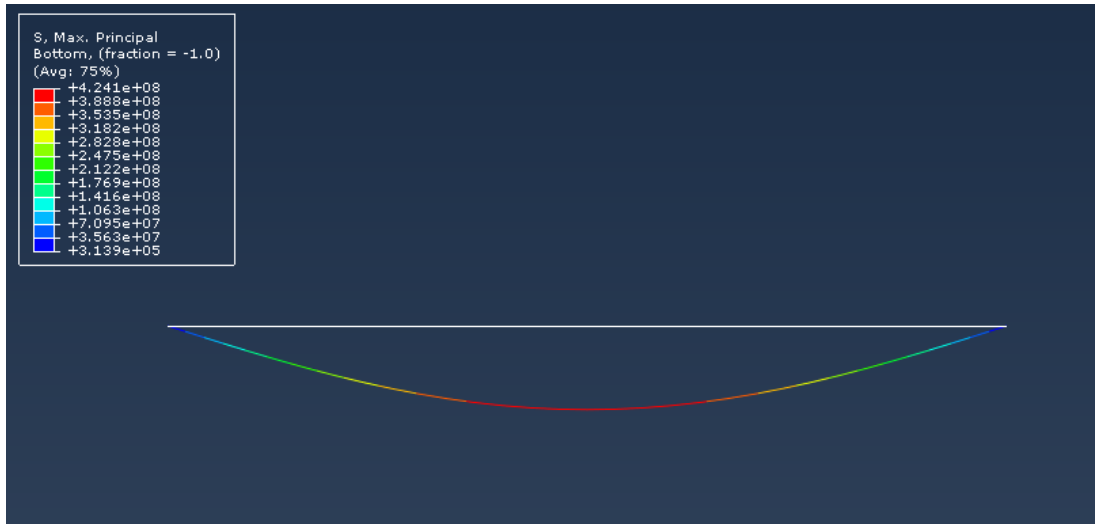
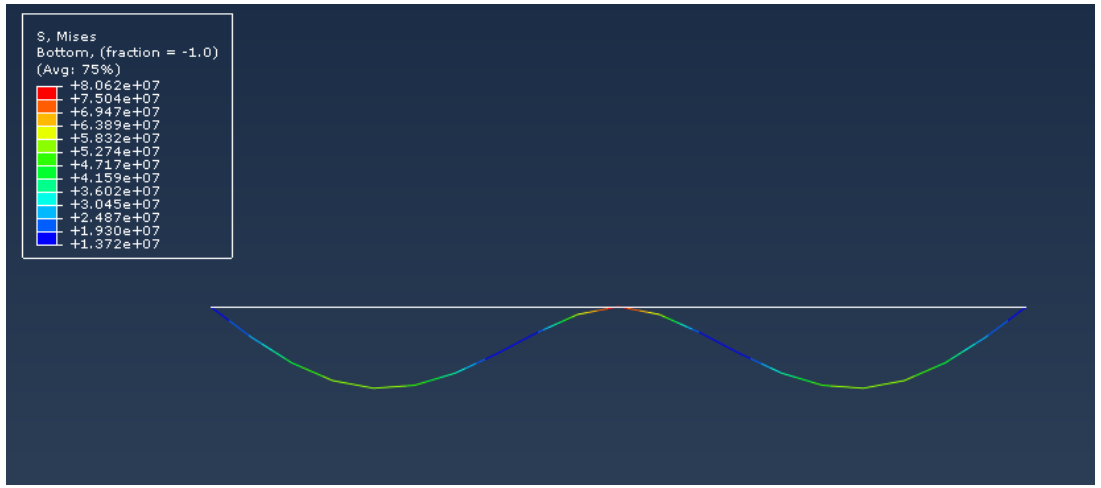
Jack Dibachi
ME 154
Final Abaqus HW Problem 1
6 December 2019





Determine if the bottom plate of the steel pile will yield, given two rows of support blocks on the bottom of the steel pile. If the bottom plate yields, how many additional rows of support blocks are required to prevent yielding? Where should they go?

Answer:
Treating the rows of support blocks as simple hinged supports, assuming static friction restricts lateral movement, the bottom plate experiences the following distributed load:

```
(8000kg/m^3)*4m*3m*0.025m*9.81m/s^2 = 23544N
w = 23544N*20/3m = 156960 N/m
```

As simulated with the above conditions, the bottom plate has a maximum stress of `424 MPa`, which exceeds the yield strength of steel at 370 MPa. By placing one additional row of support blocks in the middle of the pile, the maximum stress can be reduced to `99.75 MPa`, preventing the bottom plate from yielding.

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Final Abaqus HW Problem 2
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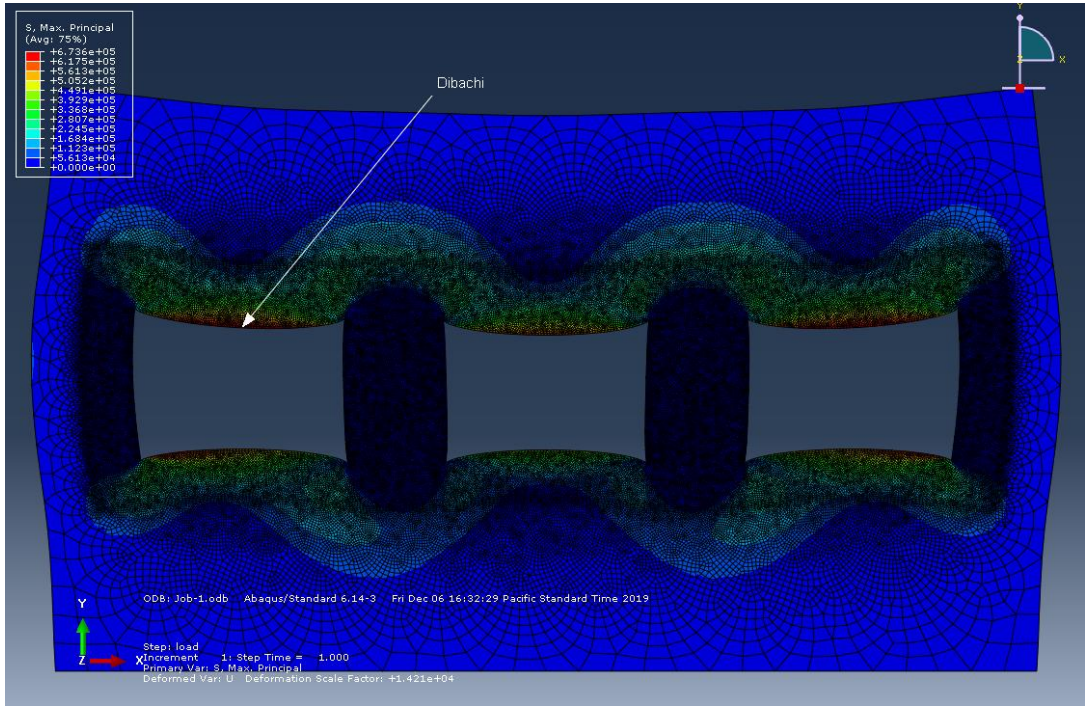

Analyze the stress for a support block. Assume the approximate pressure applied is 515 kPa. Indicate the location in a block for the largest principal stress. Identify whether the block will fail.

Answer:
For a uniform pressure applied to the top of the cast iron block, the maximum principal stress can be plotted and identified at the region indicated in the figure. The maximum stress identified is `673.6 kPa,` which is significantly less than the yield strength of cast iron, at 275 MPa. Additionally, the maximum Mises stress is `5.54 MPa`, which is still significantly less than the yield strength of the cast iron. Thus, the block will not yield under the loading conditions.

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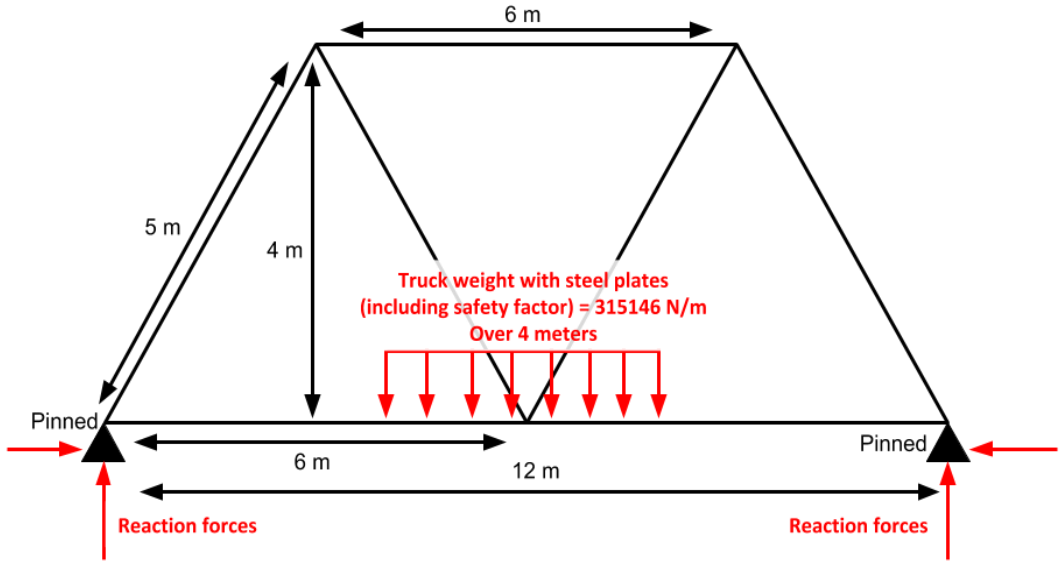

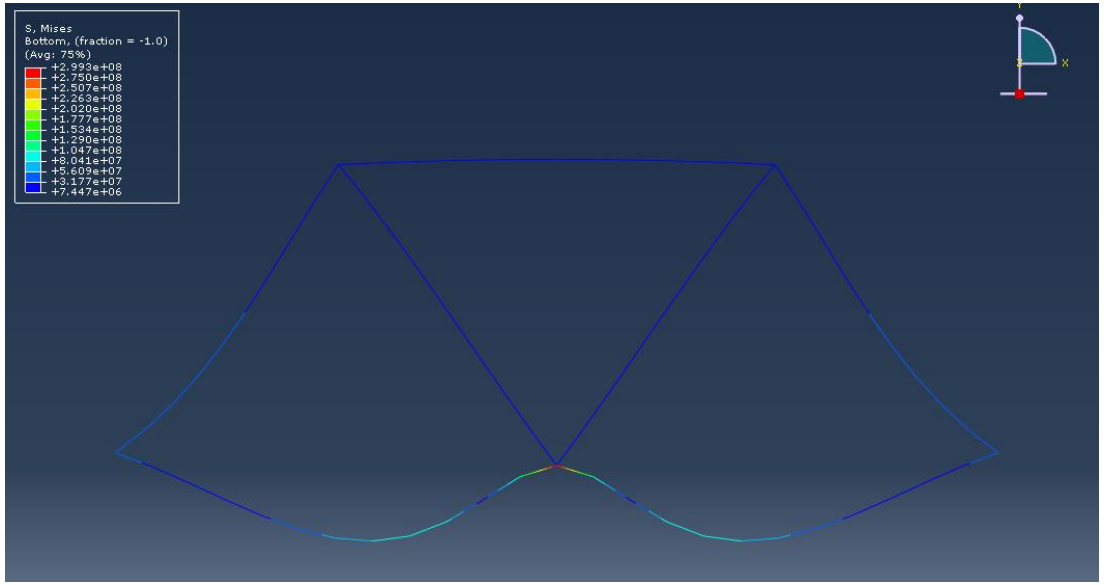

Propose a 12-meter long simply supported truss bridge which can withstand the weight of a 1000kg, 4-meter-long truck loaded with 21 steel plates. Use a Factor of Safety of 5.

Answer:
The distributed load resulting from the weight of the truck and its cargo is calculated as follows:
`(1000kg+(21*4m*3m*0.025m*8000kg/m^3))= 51400kg`
`51400kg*9.81m/s^2*(1/4m)*FoS/2 = 315146 N/m`
Given the bridge must span 12 meters, the pictured geometry is determined, and beams are given cross-sections of 0.04 m^2, as determined by the following:
`20000kg/8000kg/m^3 = 2.5 m^3`
`2.5m^3/((3*6m)+(4*5m)) = 0.066 m^2` max cross section
Placing the distributed load in the middle guarantees the highest loading scenario, so the pictured analysis demonstrates the bridge never exceeds the yield strength of 370 MPa. The maximum stress with the safety factor already accounted for is `299.3 MPa.`