**ME 421 Advanced CAD**

**Pipe And Shield Design**

*FEA Analysis*

**Given:**

A 21 inch outer diameter pipe must be protected for a 8 foot long section. Unfortunately, there is only a 22 x 45 inch area to build the protective shield. The pipe runs directly through the center of this box. The pipe must be protected from a 150 psi load on the top surface (45 inch wide face) of the box. Design to a factor of safety of 1.5.

**Find:**

Use CATIA’s Generative Structure Analysis workbench to design a protective shield that will contain the pipe and will satisfy the given constraints. The shield should never come in contact with the pipe. The shield is to be constructed out of steel. You will need to consider the yield point of the steel (use 36260psi), the effect of buckling, the deflection, and the mass of the structure (apply an acceleration of 9.81 m/s² to the structure). Also try to minimize the amount of steel to be used (you can find the volume of the part by using the “Measure Inertia”  tool in the part workbench).

**Hint:**

You may modify the below part (file can be found on the website). Please note that this design does not work. Use a mesh no smaller than 0.4 in for your final calculation, however, you may use a larger mesh for your initial calculations.

T:\- Student Personal Folders\Alec Bowman\Catia Course\New Material\FEA Assignment\Drawing1.tif

**Deliverables:**

A word document documenting the decision making behind your solution as well as discussion of the maximum stress, the maximum displacement (use a scaling factor of unity), and the volume of steel. Include screen captures with both your Von Mises Stress state and your Displacement state. Verify that your design will not break or intersect the pipe.

**Questions:**

1. How could you use this type of FEA analysis in the real world?
2. What did you learn about the effects of element size?
3. What are two lessons learned about doing FEA analysis that you wish you knew  
   at the start of this project?