

SolidWorks Corporation: CSWP Sample Exam

Certified SolidWorks Professional: Simulation Specialist (CSWP-FEA) **SAMPLE EXAM**

These questions are an example of what to expect on the Certified SolidWorks Professional Simulation Specialist exam.

How to take this sample exam:

1. To best simulate the condition of the real test, it is best NOT to print this exam. Since the Virtual Tester client window runs concurrently with SolidWorks you must switch back and forth between the two applications. Keeping this document open and consulting it on your computer while running SolidWorks is the best method to simulate the real test conditions.
2. The multiple choice answers should serve as a check for you to ensure that your model is correct while completing this exam. If you do not find your answer in the selections offered then there is most likely something wrong with your model.
3. Answers to the sample questions can be found on the last page of this document.

What you will need for the real CSWP-FEA exam:

1. A computer running SolidWorks 2011 and SolidWorks Simulation Professional or Premium, or the SolidWorks Student Edition.
2. The computer must have a connection to the internet.
3. Dual monitors will help, but are not necessary.
4. If you choose to run the Virtual Tester client on a different computer, you must have a way to transfer files to the SolidWorks computer, like a USB key or something similar.

The exam covers these areas:

1. Multiple choice questions about general topics in simulation and FEA, and SolidWorks Simulation
2. Manual calculations of loads and stresses in simple cases.
3. Several hands-on challenges in many of these areas of the SolidWorks Simulation:
 - Static, Frequency, Thermal studies
 - Working with Solid and Shell elements
 - Working with Beams
 - Definition of beams and trusses
 - Beam loads
 - Beam results
 - Applying loads and restraints
 - Planes of symmetry
 - Non uniform loads
 - Mesh controls
 - Use of configurations
 - Convergence of results
 - Result forces

Notes:

- For all hands-on questions, answers within 5% of the listed correct answer can be considered to be correct as well.
- For manual calculations, answers within 1% of the listed correct answer can be considered to be correct as well.

The sample exam begins below

Multiple Choice

Question 1:

Can SolidWorks Simulation take advantage of multiple processors and cores?

Question 2:

A force "F" applied in a static analysis produces a resultant displacement URES. If the force is now $2 \cdot F$ and the mesh is not changed, then URES will:

- A. Double if there are no contacts specified and there are large displacements in the structure.
- B. Be divided by 2 if contacts are specified.
- C. The analysis must be run again to find out
- D. Double if there is no source of nonlinearity in the study (like contacts or large displacement option).

Question 3:

What is a "compatible" mesh?

- A. A mesh where elements on touching bodies have overlaying nodes.
- B. A mesh for which shell and solid elements have the same number of degrees of freedom per node.
- C. A mesh where only one type of element (solid or shell) is used.
- D. None of these answers is correct

Question 4:

To compute thermal stresses on a model with a uniform temperature distribution, what type/types of study/studies are required?

- A. Static only.
- B. Thermal only.

- C. Both Static and Thermal.
- D. None of these answers is correct

Question 5:

A structure has a first natural frequency of 20 cycles/sec. What is the time period of the beam in seconds?

- A. $40 \cdot \pi$
- B. 0.05
- C. $0.05 \cdot \pi$
- D. $0.05/\pi$

Question 6:

In a static analysis, at a given node, the principal stresses P1, P2 and P3 are all equal to 50psi. What is the von Mises stress at that node equal to?

- A. 0
- B. 50
- C. 100
- D. 150

Question 7:

Imagine you have a symmetrical model and you take advantage of it. If you must apply one of the following loads/ boundary conditions to a face cut in half by the plane of symmetry, for which one(s) of them will you have to divide the value by 2?

- A. Force
- B. Pressure
- C. Bolt pre-load
- D. Prescribed non-zero displacement
- E. Temperature
- F. Heat flux density
- G. Heat power
- H. Convection coefficient

Manual Calculations

Manual Calculation 1:

Refer to image shown.

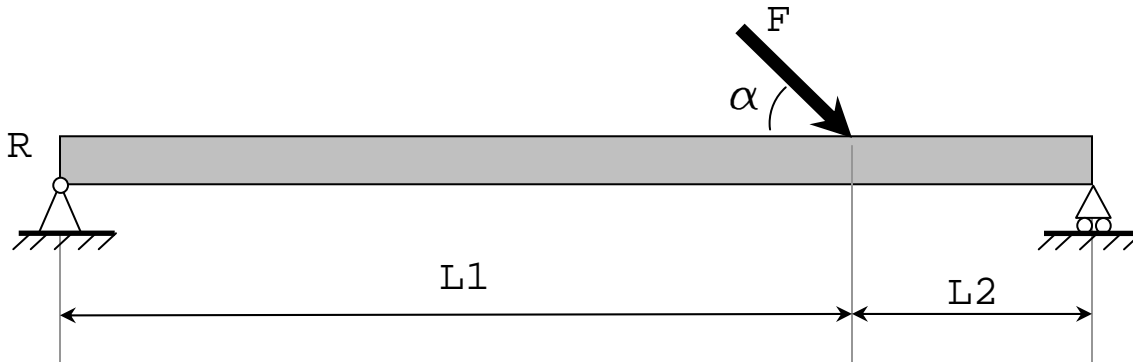
Unit System: English (IPS)

Decimal Places: 2

Use hand calculations, modeling is not necessary.

$L1 = 0.5$ $L2 = 0.2$ $\alpha = 45^\circ$ $F = 10$

What is the reaction force magnitude (lbs) at the support location R?



Manual Calculation 2:

Refer to image shown.

Decimal Places: 2

Use hand calculations, modeling is not necessary

The "Shaft" carries a torque that induces a shear force in the "Bolts".

Shear Stress in the 4 bolts (kN/m^2) $S = 40,000$

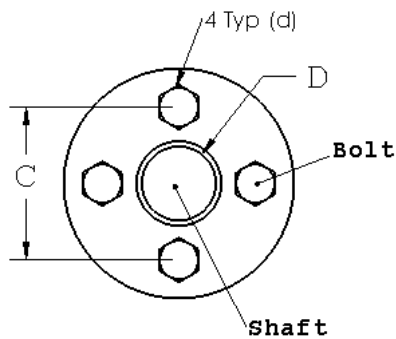
"Bolt" spacing (m) $C = 0.24$

"Bolt" diameter (mm) $d = 30$

"Shaft" diameter (m) $D = 0.15$.

Assume each "Bolt" carries the same shear force.

What is the Torque (kN-m) carrying capacity of the shaft?



Exercises

Exercise 1:

In the figure shown, what is the vertical displacement in the global Y direction (in inches) at the location of the red dot? Report your answer to 3 decimal places.

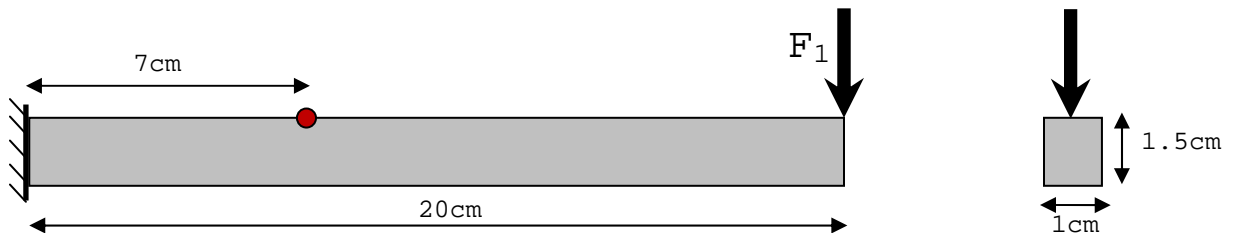
Material: Alloy Steel (SS) from SolidWorks material library

Elastic modulus = 2.1×10^{11} N/m²

Poisson's ratio = 0.28

$F_1 = 200$ Lbs

Use default high quality element size.



Exercise 2:

Use the model below. What is the damage at the location of the red dot (in percent) caused by 100,000 applications and removals of F_1 .

Apply a mesh control of 1mm with a growth ratio of 1.25 to the fixed face. Use default high quality element size.

Material: Alloy Steel (SS) from SolidWorks material library

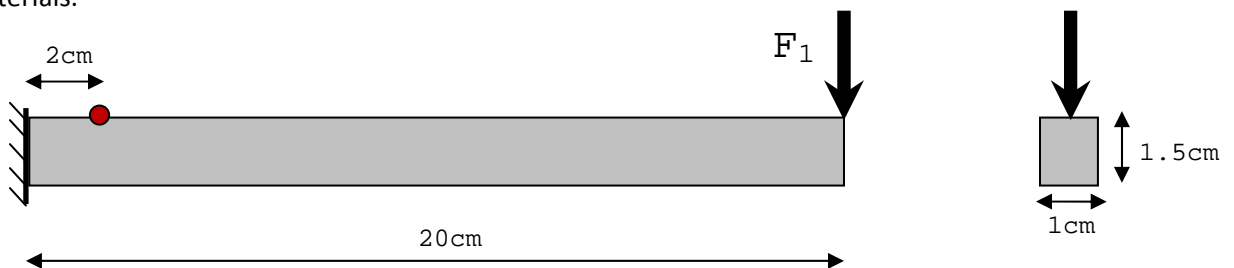
Elastic modulus = 2.1×10^{11} N/m²

Poisson's ratio = 0.28

$F_1 = 150$ Lbs

Use SN curve based on ASME method for Carbon steels.

Compute alternating stresses using von Mises stress and use the mean stress correction method best suited to ductile materials.



Exercise 3:

In the figure shown, what is the buckling load factor? Report your answer to 2 decimal places.

Material: Alloy Steel (SS) from SolidWorks material library

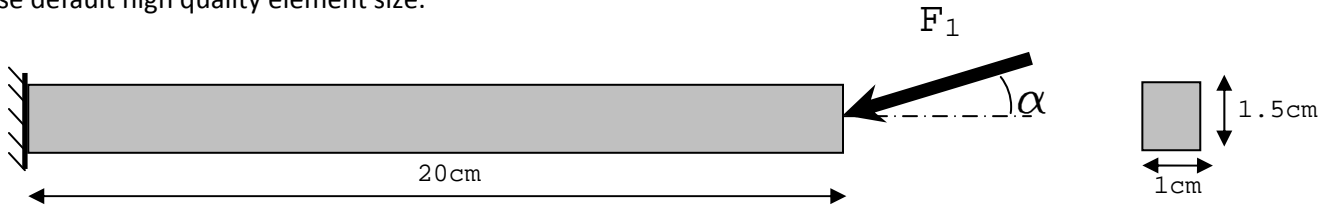
Elastic modulus = 2.1×10^{11} N/m²

Poisson's ratio = 0.28

$F_1 = 5000$ N

$\alpha = 5^\circ$

Use default high quality element size.



Exercise 4:

Analysis setup: Use model "QuarterEyeBar.x_t" in enclosed zip file "QuarterEyeBar.zip".

Materials: ABS for Eyebar, Aluminum 6061 Alloy for Bolt.

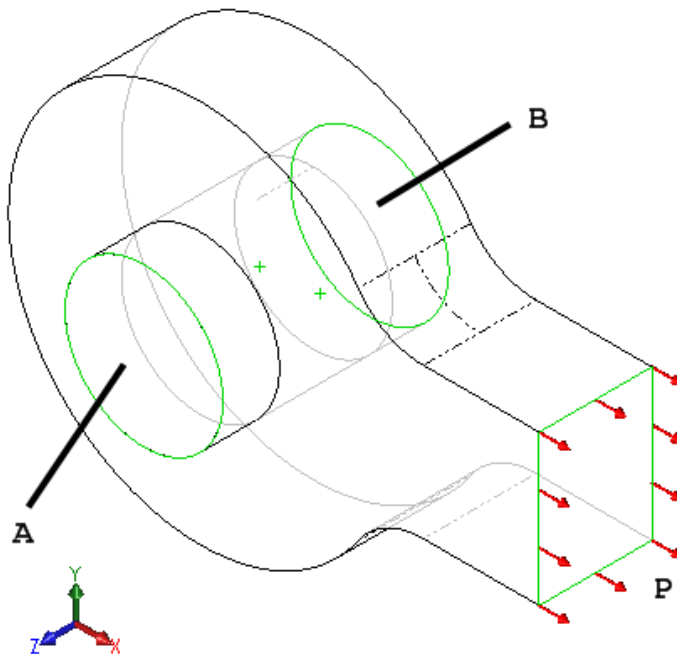
Restraints: Faces "A" and "B" are fixed. Use symmetry to reduce model size as much as possible.

Mesh: Solid, High quality, Default element size.

Modeling guidelines: Parts are not glued together. Do not use Soft spring, Inertia relief or Large Displacement options.

Pressure "P" (psi): 600.

What is the maximum nodal principal stress P1 (psi) in the assembly?



Exercise 5:

Use the same analysis setup. Pressure "P" (psi): 1000.

What is the maximum nodal von Mises stress (psi) on the "QuarterBolt" component?"

Exercise 6:

A fixed rectangular frame ABCD with dimensions: $L = 360''$ and $h = 180''$ is subjected to a horizontal force $W = 10 \text{ lb}$ acting on joint C. Calculate the support reactions and moments.

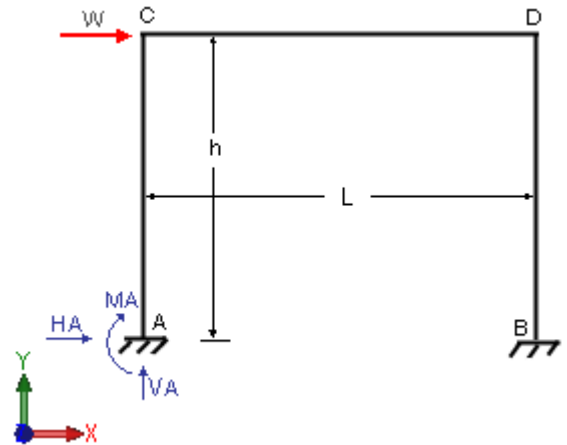
Material Properties: Modulus of elasticity = $30 \times 10^6 \text{ psi}$.

Cross-Section Properties: ISO Square Tube: $20 \times 20 \times 2$ (define from available cross sections)

Modeling guidelines: The frame members are treated as beam elements.

What are respectively?

- Vertical Reaction Force: V_A (lb)
- Horizontal Reaction Force: H_A (lb)
- Reaction Moment: M_A (lb.in)
- Axial stress in bar CD : σ (psi)



Answers

Multiple Choice:

1. Yes
2. D
3. A
4. A
5. B
6. A
7. A, C, G

Manual calculations:

1. 7.354 lbs
2. 13.57 kN-m

Exercices

1. 0.026 in
2. 95%
3. 3.24
4. 1640 psi
5. 1730 psi
6. $V_A = -1.875$, $H_A = -5.0$, $M_A = -562.5$, $\text{Sigma} = -24.127$