Department of Aeronautics & Astronautics, M.I.T.
16.001 - Materials & Structures

Quiz No. 2

Instructor: Raúl Radovitzky

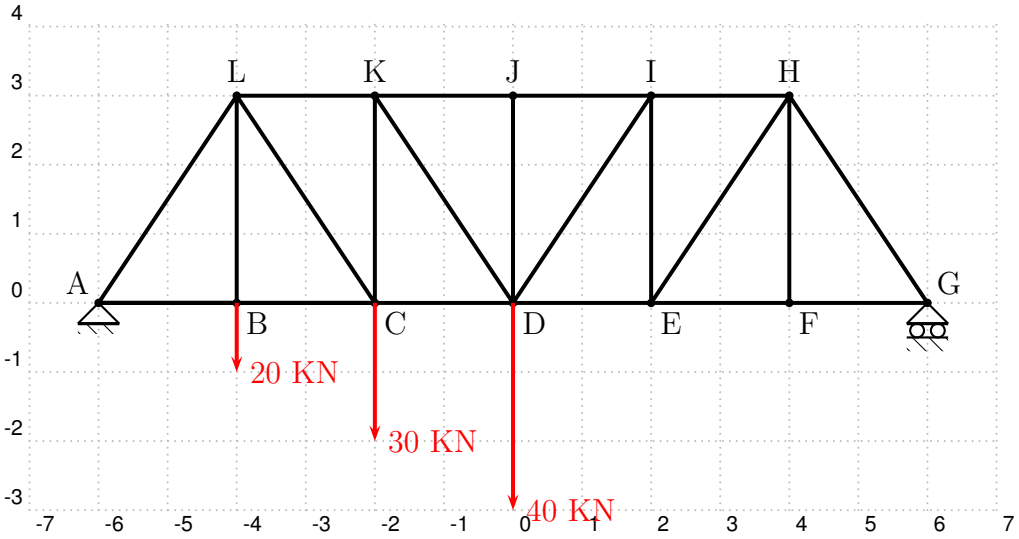
Student's name:_____

Question	Points	Score
1	15	
2	20	
Total:	35	

Letter grade: _____

Question 1 [15 points]

For the truss structure shown in the figure (Note: the units of the axes dimensions are not given but they are the same in both axes):

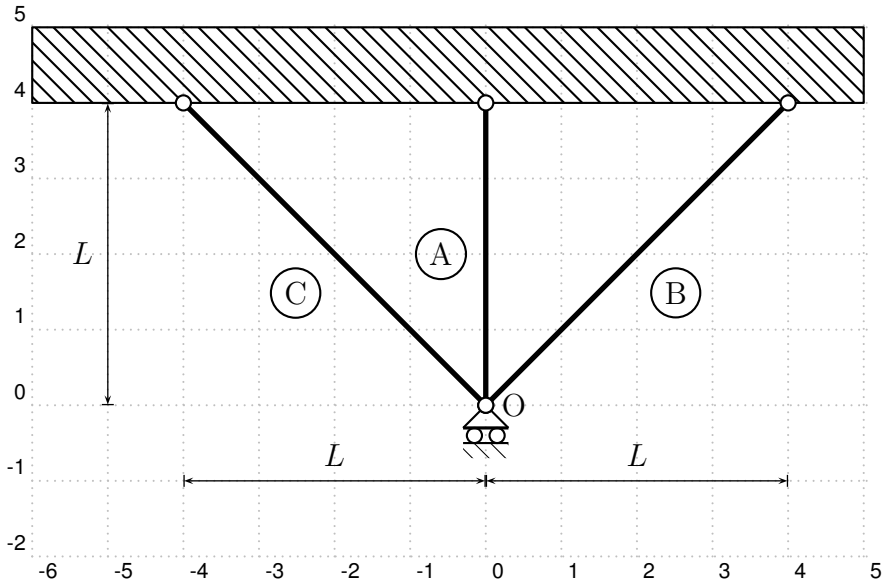


1.1 (5 points) Identify the bars whose internal load can be inferred directly from the figure without any calculation under the specific external loading the structure is subjected to: those that carry no load, those that carry a known non-zero load, and those that are guaranteed to carry the same load.

1.2 (10 points) Determine the force in members KJ, KD, CD.

Question 2 [20 points]

The system in the figure is made of bars with the same cross-sectional area A and the same elastic modulus E, but different coefficients of thermal expansion (CTE): $\alpha^A, \alpha^B, \alpha^C$. We want to analyze the effect of a temperature change $\Delta\theta$ on this system.



2.1 (5 points) Write the relevant FBD and corresponding equilibrium equations for this problem. What type of force system is this? How many relevant equations do you have? Which are the unknowns in this problem and how many are they? What type of static system is this? Why?

2.2 (5 points) Write the constitutive laws specialized to each bar (i.e. use the given parameters for each bar). How many new equations and unknowns do you have?

2.3 (5 points) Write the compatibility equations relating the displacement vector for point O: $\mathbf{u} = u_i \mathbf{e}_i$ for some cartesian basis of your choice, with the elongations of each bar. How many new equations and unknowns do you have?

2.4 (5 points) Do a final equation count. Explain how you would go about solving the system to find the forces and elongations of the bars and the displacement u_1. If time permits, do it.

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