UNIVERSITY OF SASKATCHEWAN
DEPARTMENT OF MECHANICAL ENGINEERING
ME 450.3 FINITE ELEMENT ANALYSIS
MIDTERM EXAMINATION

Time: 1.5 hours
Open-book examination
Answer all questions

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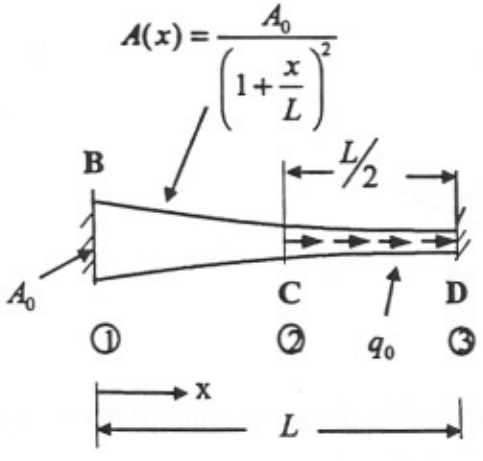
Q1. The bar of *variable area* shown is loaded between **C** and **D** by *a constant* distributed load q_0.

Use ***two elements*** to determine in terms of A_0, E, L and q_0:

a) the displacement of **C**,
b) the stresses in the elements,
c) the reaction forces at **B** and **D**,
d) the axial forces in the elements,
e) the forces acting on each element (using the ***K***'s for particular elements).

Are the results obtained in (**c-e**) consistent (show and compare the forces calculated)?
Sketch the displacements and the stresses in the bar.
Answer the following questions:

- Are the displacement results 'exact':
  i) at the nodes,
  ii) between the nodes?
- How accurate are the reactions and the stress results?
- Could the stress plot be made more accurate by utilizing the results obtained in (**c-e**)?



Q2. The temperature of element ② -③ in the truss loaded by force **P** as shown is raised by $\Delta T = 20^0 C$.

Using the bar elements determine:

a) The nodal displacements.

b) The reaction forces.

c) The axial forces in the elements.

d) The elongation of element ① -③ (use the transformation matrix).

e) The stress in the elements.

Check the equilibrium.

Use: $A = 100mm^2$, L=100mm, E=200GPa, $\alpha = 1.25 \cdot 10^{-5}\ ^1/_{^0C}$, **P**=1,000$N$