UNIVERSITY OF CALIFORNIA, BERKELEY
Fall Semester 2019

Dept. of Civil and Environmental Engineering
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CE 220 - Structural Analysis

Homework Set 8 (due 10/30/2019)

1. Problem (5 points)

Fig. 1 shows a two-span girder under a uniformly distributed element load w of 10 units. The girder has flexural stiffness EI of 60,000 units.

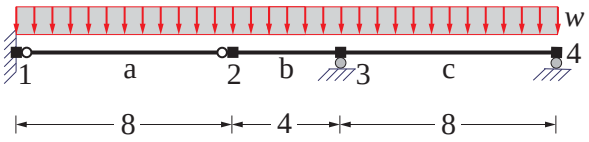

Figure 1: Two-span girder under uniform element loading

You are asked to answer the following questions:

1. Draw the bending moment distribution.
2. Determine the vertical translation at node 2 under the given loading.
3. Determine the hinge rotation at end j of element a under the given loading.

2. Problem (5 points)

The frame in Fig. 2 is subjected to a uniformly distributed load of w=10 units in element a. All elements have flexural stiffness EI=200,000 units. They can be considered inextensible.

You are asked to answer the following questions:

1. Determine the basic forces in all elements and draw the bending moment diagram.
2. Determine the horizontal and vertical translation at node 3.
3. Determine the vertical translation in the middle of element a.
4. Draw the deformed shape of the frame under the given loading.

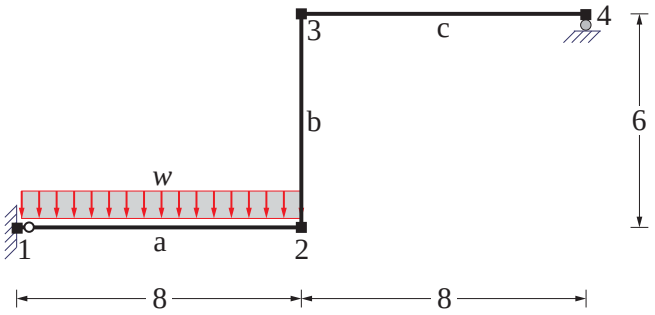

Figure 2: Frame under uniformly distributed load w in element a

3. Problem (5 points)

The braced frame in Fig. 3 is subjected to initial thermal curvatures of $\kappa_0 = 3 \cdot 10^{-3}$ in element a, $\kappa_0 = -2 \cdot 10^{-3}$ in element b and $\kappa_0 = -3 \cdot 10^{-3}$ in element c. The frame elements a, b and c have flexural stiffness $EI = 30,000$ and can be assumed as inextensible. The brace element d has axial stiffness $EA = 20,000$.
The computer analysis of the braced frame under the initial thermal curvatures in elements a, b and c gives the following basic force values for these elements:

$$\boldsymbol{q}^{(a)} = -94.81 \quad \boldsymbol{q}^{(b)} = 130.18 \quad \boldsymbol{q}^{(c)} = -35.37$$

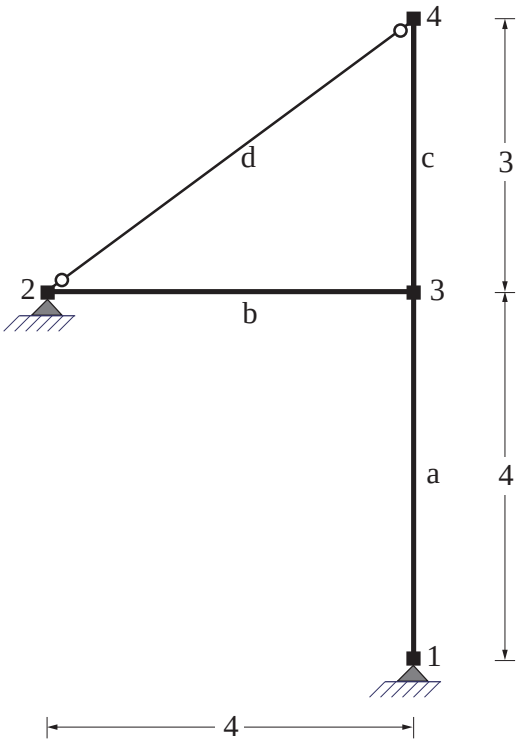

Figure 3: Braced frame under thermal curvatures

You are asked to answer the following questions regarding the response of the braced frame under the initial thermal curvatures of elements a, b and c:

1. Number the relevant free dofs and the basic forces of the structural model and establish the degree of static indeterminacy.
2. Draw the bending moment diagram.
3. Determine the relevant free dof displacements.
4. Draw the deformed shape of the structure.