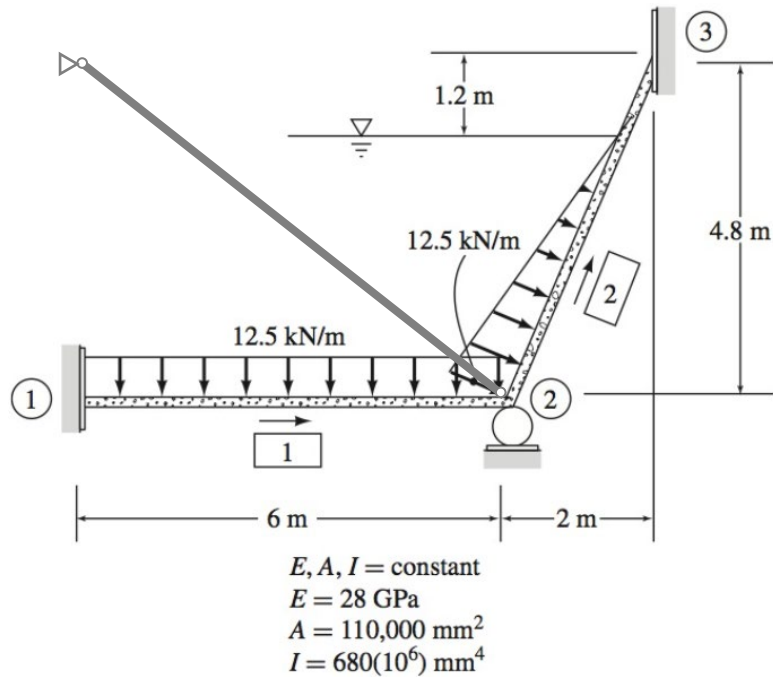![The University of Toledo logo](UT TOLEDO 1872)

Department of Civil and Environmental Engineering

CIVE 4320/5320 – Computer-Aided Analysis of Structures
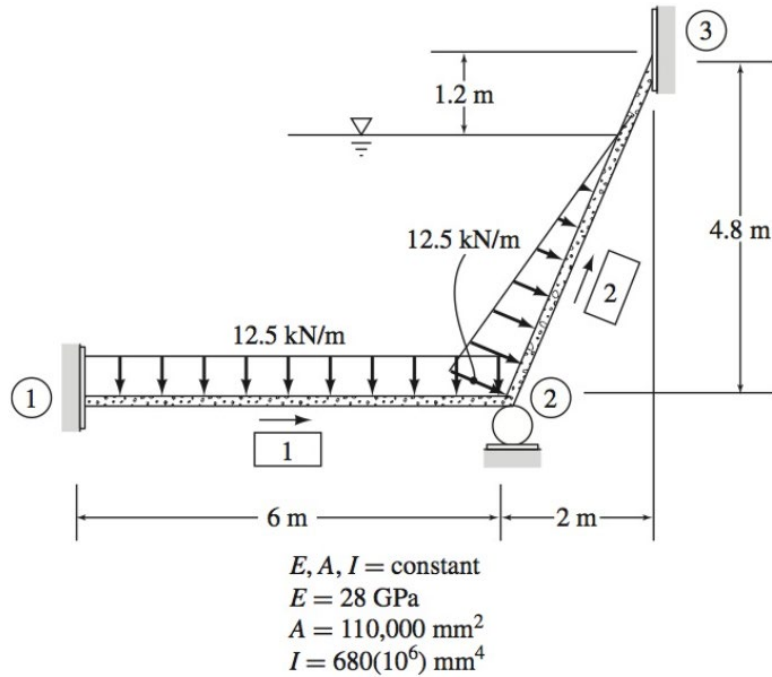Tutorial 4 Example (Matrix Stiffness Method: Special Topics)

1. Use SAP2000 to determine the joint displacements, member local end forces, and support reactions for the frame shown.

$E, A, I = $ constant
$E = 28$ GPa
$A = 110{,}000$ mm^2
$I = 680(10^6)$ mm^4

2. Determine the joint displacements, member axial forces, and support reactions fort the frame shown, due to the combined effect of the loading shown and a settlement of 10 mm of support 2.

$E, A, I = $ constant
$E = 28$ GPa
$A = 110{,}000$ mm^2
$I = 680(10^6)$ mm^4
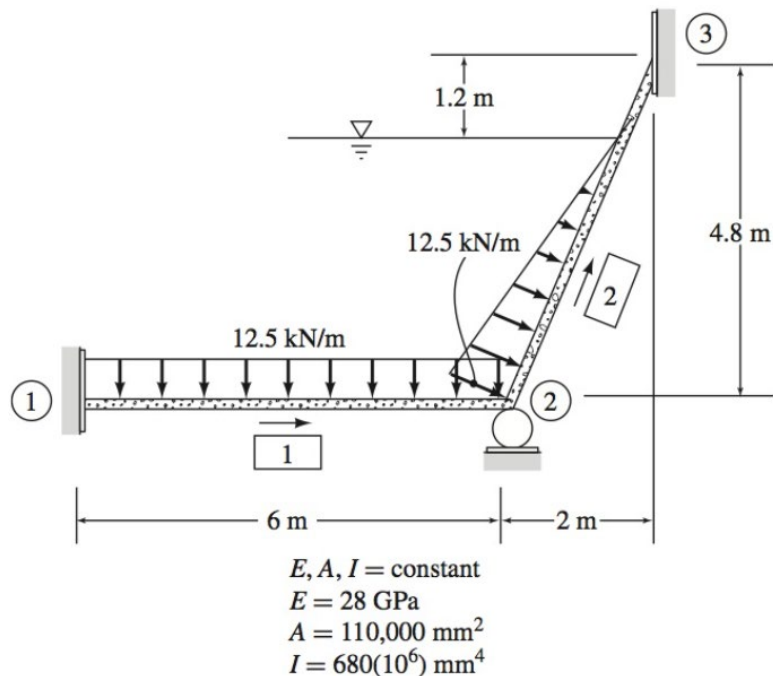
3. Determine the joint displacements, member end forces, and support reactions for plane frame shown, due to temperature increase of 50°C in the two members. Take $\alpha = 1.34 \times 10^{-5}$ °C^{-1}

1.2 m

12.5 kN/m

4.8 m

2

12.5 kN/m

1

2

1

6 m — 2 m

$E, A, I = \text{constant}$
$E = 28 \text{ GPa}$
$A = 110{,}000 \text{ mm}^2$
$I = 680(10^6) \text{ mm}^4$

4. Determine the joint displacements, member end forces, and support reactions for the plane frame shown due to a linearly varying temperature increase of 55°C at the top surface and 5°C at the bottom surface of all the members. $\alpha = 1.47 \times 10^{-5}$ °C^{-1} and $d = 331.66$ mm.

1.2 m

12.5 kN/m

4.8 m

2

12.5 kN/m

1

2

1

6 m — 2 m

$E, A, I = \text{constant}$
$E = 28 \text{ GPa}$
$A = 110{,}000 \text{ mm}^2$
$I = 680(10^6) \text{ mm}^4$