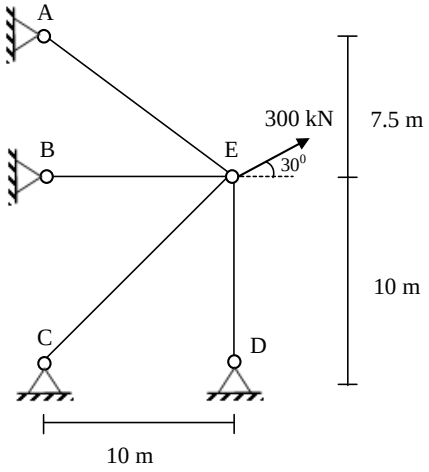
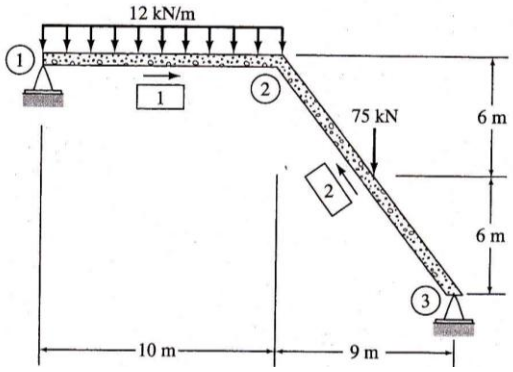
CE483
ADVANCED STRUCTURAL ANALYSIS
FALL SEMESTER 2014-2015
ASSIGNMENT #3 (DUE 30 DEC. 2014)

1. Determine the joint displacements, member axial forces and support reactions of the truss shown by using *the direct (matrix) stiffness method* for the following actions separately*:*
a) support settlement of 25 mm at C,
b) a temperature decrease of 15°C in members AE and CE whereas a temperature increase of 25°C in members BE and DE,
c) fabricated length of members AE and BE being 4 mm too short whereas fabricated length of members CE and DE being 2.5 mm too long.



The cross-sectional areas of members AE and CE are *4000 mm*^{2} whereas the cross-sectional areas for members BE and DE are *3000 mm*^{2}. Elasticity Modulus (E) is given as *200 GPa*. The coefficient of thermal expansion can be taken as α*=1.2x10*$^{-5}$ *1/*°C.

2. Determine the joint displacements, member local end forces and support reactions for the frame shown by using *the direct (matrix) stiffness method.* Also plot the axial force, shear force and moment diagrams. The joints are labeled in circles whereas members are labeled in boxes. The arrows indicate the positive directions of the member local axes.
b) Solve the same structure this time for a support settlement of 50 mm at joint 3.
c) Solve the same structure this time due to a linearly varying temperature increase of 40°C at the top surface and 10°C at the bottom surface of member 2 only.



Take *I=1.52x10*^{8} *mm*^{4}, *A=3.5 x10*^{4} *mm*^{2}, *E=30 GPa* and α*=1.2x10*$^{-5}$ *1/*°C.

3. The rigid frame shown in the figure has 3 active degrees of freedom (DOF) at joint *b*. By using the *static condensation technique*, condense out the rotational DOF to produce stiffness equations in terms of translational DOFs (horizontal and vertical deflections at *b*). Then solve for the latter. Assume E=200 GPa.