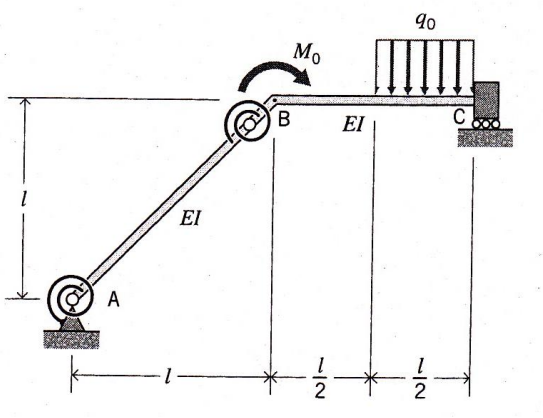
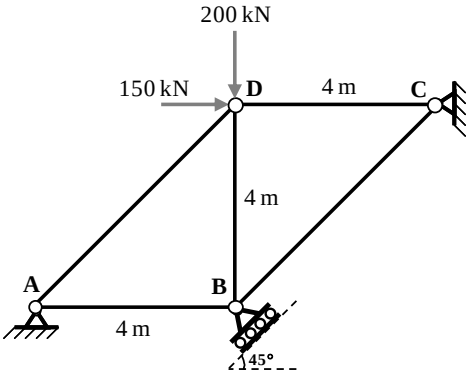
CE483
ADVANCED STRUCTURAL ANALYSIS
FALL SEMESTER 2014-2015
ASSIGNMENT #4 (DUE 19 JAN. 2015)

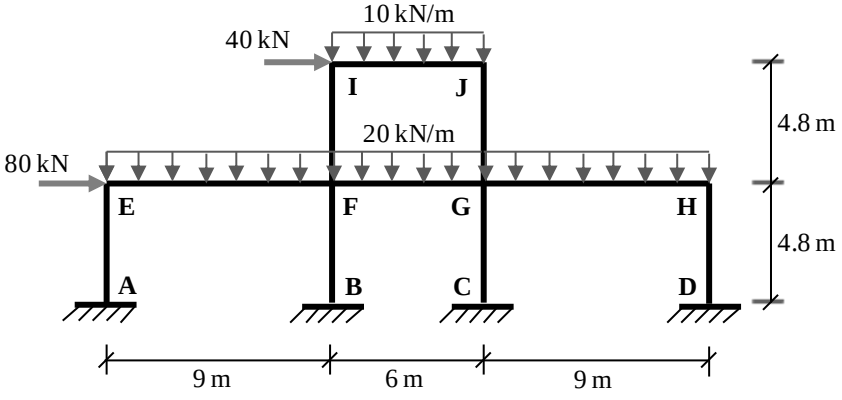
1. The structure has a pin support at A and a fixed roller (guide) at C. The joints at ends A and B of beam AB are modeled as hinges with rotational springs, for which $M_s=k\Delta_s$; where k is the spring constant and Δ_s is the deformation (angle change). If the structure is subjected to a uniform load with q_o applied to the half of beam BC and a moment $M_o=5q_oL^2/8$ applied to joint B, find internal forces in the structure and draw the bending moment diagram. Assume $k=2EI/L$. Members AB and BC can be assumed as axially rigid.
Given input values: q_o= 8 kN/m, L=4 m, EI=40,000 kN/m^2



2. Analyze the truss system given by using the *Direct Stiffness Method*. There is an inclined roller support at B, whereas there are pin supports at A and C. Both horizontal and vertical loads act at joint D. Assume *E=200 GPa* and *A=2000 mm^2* for all members.



3. Considering the given frame subjected to gravity + earthquake loading,
a) determine the approximate internal forces and moments for all members by using simplified vertical load analysis + portal method,
b) determine the approximate internal forces and moments for all members by using simplified vertical load analysis + cantilever method,
c) solve the same frame by using any structural analysis platform (i.e. MASTAN, SAP2000, etc.). Compare and discuss the results.



4. Considering the continous beam given,

a) draw the quantitative influence lines for the following actions: vertical reactions at supports B, E and G; shear and bending moment at C and shear at internal hinge D.

b) determine the maximum negative shear and positive moment at C due to a concentrated live load of *150 kN*, a uniformly distributed live load of *30 kN/m* and a uniformly distributed dead load of *15 kN/m*.

c) assume that there is no internal hinge at D (i.e. the beam becomes indeterminate). Draw the qualitative influence lines for the same actions in part (a). Discuss the differences between these two sets pf influence lines briefly.