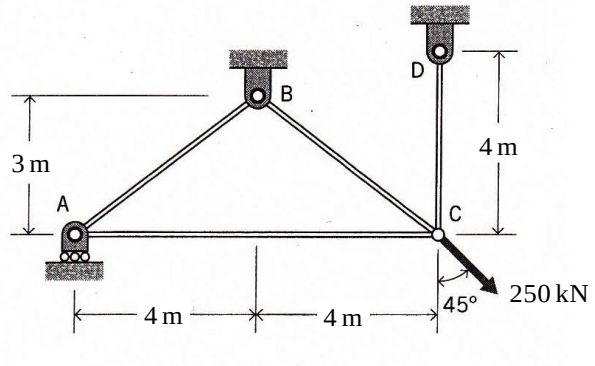
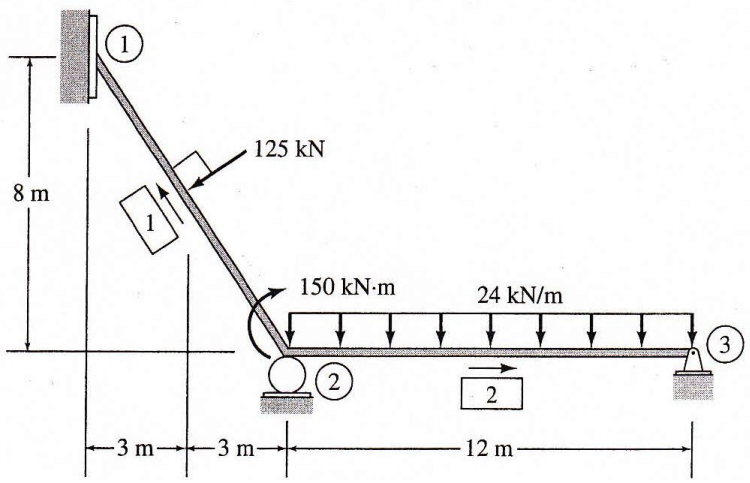
CE483
ADVANCED STRUCTURAL ANALYSIS
FALL SEMESTER 2014-2015
ASSIGNMENT #2 (DUE 9 DEC. 2014)

NOTE 1: Perform the solution of the following problems by manual (hand) calculations. You can get any assist from computer programs like MATLAB, MATHCAD, etc. for mathematical (matrix) operations. You are not allowed to use commercial structural analysis software (like SAP2000) during the solution. You can use such programs for verification of your results (optional).
NOTE 2: You can also use "*MASTAN2*", which is a freeware and easy-to-use structural analysis program, for the verification of your results instead of using a complicated software like SAP2000. The program can be downloaded from the web site indicated below freely.
http://www.mastan2.com/

1. Determine the joint displacements, member axial forces and support reactions for the truss shown by using *the direct (matrix) stiffness method*. The cross-sectional areas of members AC and CD are *4000 mm*^{2} whereas the cross-sectional areas for members AB and BC are *3000 mm*^{2}. Elasticity Modulus (E) is given as *200 GPa*.

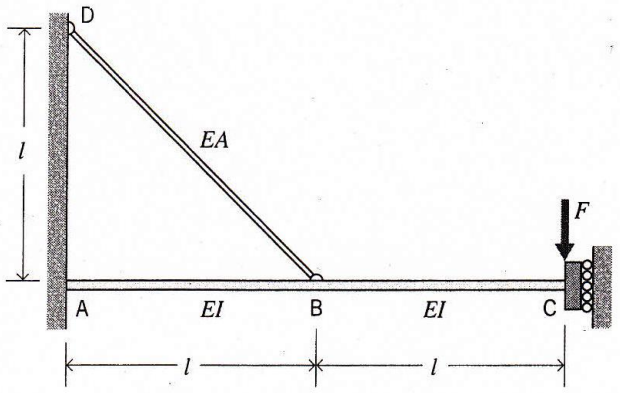


2. Determine the joint displacements, member local end forces and support reactions for the frame shown by using *the direct (matrix) stiffness method.* Also plot the axial force, shear force and moment diagrams. The joints are labeled in circles whereas members are labeled in boxes. The arrows indicate the positive directions of the member local axes. Take *I=7.62x10*^{8} *mm*^{4}, *A=1.3 x10*^{4} *mm*^{2} and *E=200 GPa*.
Note: Do not use modified stiffness formulation.



3. The structure shown in the figure is composed of an axially rigid beam ABC and a truss member BD. There is a fixed roller (guide) support at C. Assume that the axial stiffness of the truss member is $EA = 3\sqrt{2}EI/L^2$. Find the internal forces by using *the direct (matrix) stiffness method.*

Given: *EI=20,000 kNm^2, L=3 m, F=120 kN*



4. Determine the joint displacements, member local end forces and support reactions for the grid shown by using *the direct (matrix) stiffness method*. The mechanical properties of the grid are given as follows: *E=200 GPa, G=76 GPa, I=3x10^8 mm^4, J=7x10^6 mm^4.*