Middle East Technical University

Department of Civil Engineering

Fall 2014

**CE 425 Introduction to Finite Elements**

Assignment # 2 (due October 27, 2014 till 10:00)

1. For the given structure by using stiffness method:
2. Discretize the structure and show degrees of freedom and local coordinate system of every element
3. Calculate the element stiffness matrices.
4. Calculate the structural stiffness matrix and force vector for the given degrees of freedom.
5. Compute the nodal displacements

10 kN

3

1

2

3.5 m

8 m

5 kN/m m

Take EI=1 kN.m2 for all elements and assume axial rigidity.

1. Develop an algorithm (using Matlab, Mathcad, etc.) that computes the element stiffness matrix for the given element in structural (global) coordinate system (XY axis). Take EI=1 kN.m2 and EA= 0.1

X

Y

i

j

3.5 m

8 m

* It is recommended that your algorithm uses the following data format.

**Input:**

* Xstart, Ystart : Coordinates of the start node
* Xend, Yend  : Coordinates of the end node
* E : Elastic Modulus
* I : Moment of Inertia
* A : Member Area

**Output:**

* k : Element stiffness matrix in element (local) coordinates
* R : Rotation matrix
* kstr : Element stiffness matrix in structural (global) coordinates
* If we add the member shown to the structure shown in Question 1, what would be the new structural stiffness matrix? What are the new displacements?

1. Compute the nodal displacements for the given structure?

Assume that all members are axially rigid.

E = 20000 MPa

I= 5.4 x 109 mm4

B

W=10 kN/m

A

2m

8m

1m

3m

D

C