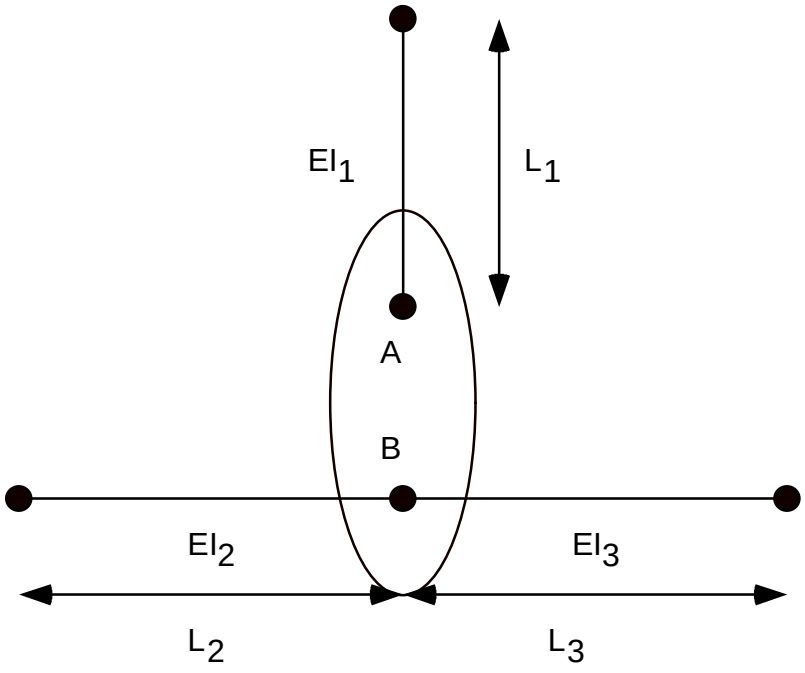
Short Note on HW#3

How to Choose the "percentage" of a flexible joint stiffness

1998 Winter

There are several unclear points in HW#3 for side frame analysis, especially in the MATLAB program. I apologize this, and also I appreciate your comments and input as well as your effort to understand the material.

1) In the MATLAB program, we must input the "percentage" of a flexible joint stiffness to the reference one. This is not the percentage, but this is the ratio of the real joint stiffness and the reference one. For example, if the rotational stiffness kqX is 70% of the reference stiffness, then input 0.7. If it is 80%, then input 0.8. If the joint is very stiff, and if it can be regarded as the rigid, then ratio must be "very" large, say, 10, 100, and so on. If it is 10, then the joint stiffness becomes 10 times of the reference.
2) The reference stiffness in the MATLAB program is defined as the average value of the rotational stiffness of two nodes connected by a flexible joint. If the two nodes joined are arranged similarly to the case of B-pillar and rocker joint as follows :



The rotational stiffness of the node A and B becomes

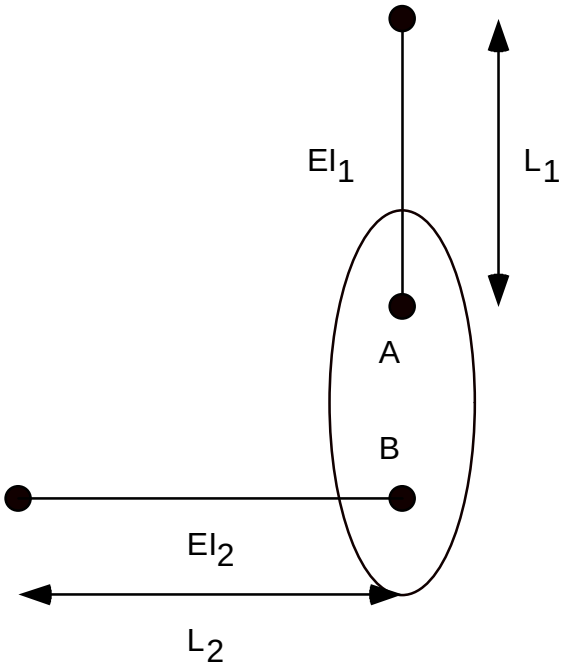
$$\frac{4EI_1}{L_1} \quad \text{and} \quad \frac{4EI_2}{L_2}+\frac{4EI_3}{L_3}$$

respectively, and then the reference rotational stiffness becomes

$$k_{qXref} = \frac{1}{2}\left(\frac{4EI_1}{L_1}+\left(\frac{4EI_2}{L_2}+\frac{4EI_3}{L_3}\right)\right).$$

Thus the input ratio is given by the ratio of the given rotational stiffness and the above reference value of the rotational stiffness.

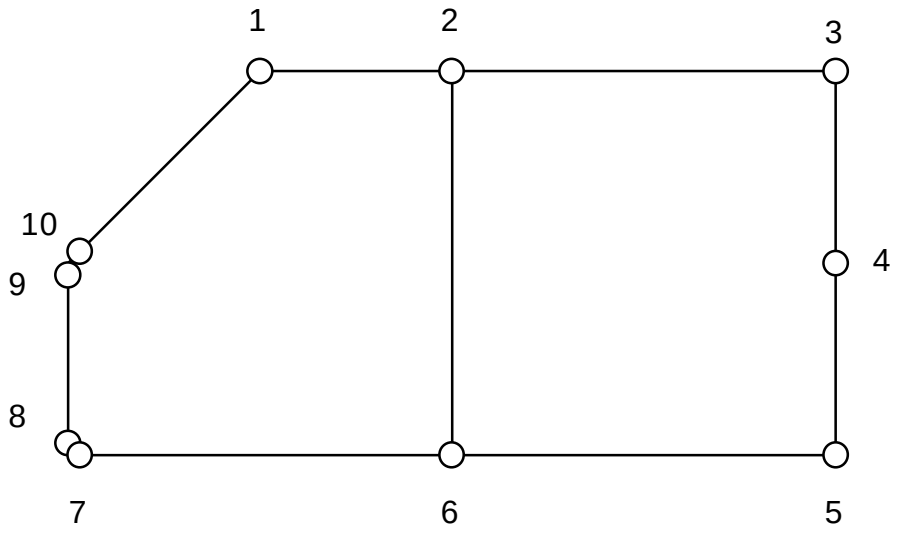
If the two nodes joining by a flexible joint are arranged as follows :



Then the reference stiffness becomes

$$k_{qXref} = \frac{1}{2}\left(\frac{4EI_1}{L_1}+\frac{4EI_2}{L_2}\right).$$

3) If you are using an old version of Student version of MATLAB, you may be able to form a square matrix only less than 32x32. I have already told by number of students at GM about this fact. Then you cannot make a “full” model of the beams and flexible joints. In this case, a possible analysis model may be as follows :



In this case, we can consider only two flexible joints.