

## Assignment 4

### 1. Code for dynamic analysis of truss structure

Consider the truss structure consisting of two truss elements and a point mass attached to the structure at node 1 as is shown in Figure 4.1. The mass of the point mass at node 1 is  $M$ . Each of truss elements has the length  $L$ , the elastic modulus  $E$ , and the cross section area  $A$ . It is assumed that the structure is subjected to large displacement and large strain, but keeping the elasticity. It is also assumed that the truss element has only stress normal to the cross section, and the stress is constant along the element.

Note: this structure was considered in Assignment 2 and 3.

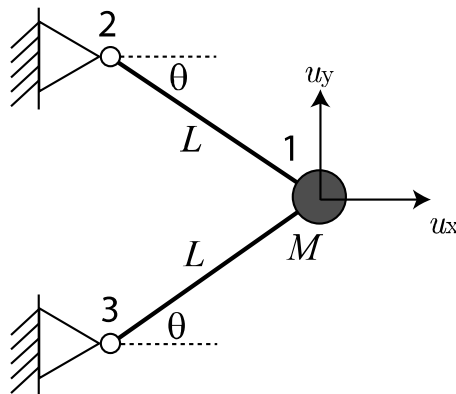


Figure 4.1. Considered truss structure with a point mass.

- 4.1) Create a nonlinear finite element code in MATLAB for the dynamic analysis of the point mass motion. Neglect damping and the gravity force acting to the point mass and the structure. Use the Newmark's method with  $\delta = 1/2$  and  $\alpha = 1/4$ , see pp.826 (Bathe, 1996).
- 4.2) Draw the time history of the displacement of the point mass, assuming that  $E = 200kN/mm^2$ ,  $A = 100mm^2$ ,  $L = 1000mm$  and  $\theta = 30^\circ$ . Assume  $u_x = 0$ ,  $u_y = -L \sin \theta$  and  $\dot{u}_x = \dot{u}_y = 0$  for the initial condition.

Note: The MATLAB code should be submitted as an .m file in an electronic format.