

Programming assignment #4

Write a MATLAB function for the analysis of a 3D truss system shown in Figure 1. The truss system has a length L , width w , and is composed of N sections. The truss is supported by fixing all components of displacement at the three nodes located at ($x = 0$). A force couple is applied at the nodes located at ($x = L$) as shown in the figure. The forces in the force couple act parallel to the z -axis and have a magnitude of p at the top of the truss and $p/2$ at the bottom of the truss, specified in Newton.

Each truss element is made from PVC (polyvinyl chloride) ($\rho = 1380 \text{ kg/m}^3$, $E = 3.0 \text{ GPa}$) and has a hollow circular cross section with an outer diameter of 33 mm and an inner diameter of 26 mm. Assume that the acceleration due to gravity is $g = 9.81 \text{ m/s}^2$ along the negative y -axis.

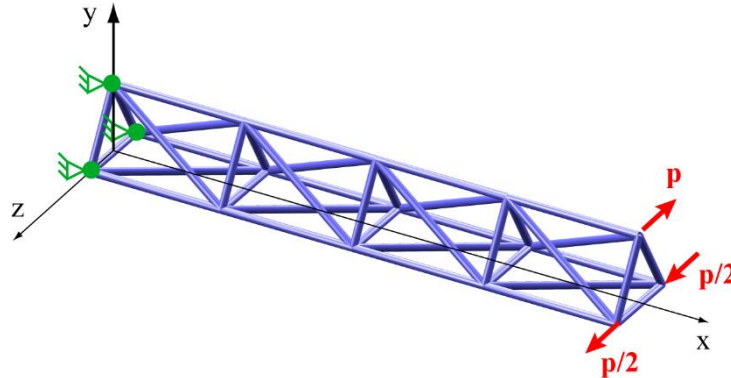


Figure 1. 3D view of truss system with 4 sections.

Instructions for programming and assignment submission:

- Code for generating the mesh is supplied in a MATLAB file named “**make_3dtruss.m**”. Do not submit this function along with your assignment, i.e., treat **make_3dtruss** as if it were a built-in MATLAB function.
- The file **must** define a function of the same name as the file name (but without the “.m”) , e.g.

```
function [d, stress] = asurite_hw4(N, L, w, p)
    if nargin == 0
        L = 12.0; % Total length of truss (in meters)
        N = 4;    % Total number of segments along truss.
        w = 2.0;  % Width of truss.
        p = 500;
    end
    mesh = make_3dtruss(N, L, w);
    % Write rest of code here.
end
```

- **Input arguments:** N: the number of sections along the truss, L: length of the truss along the x -direction, w: width of the bottom of the truss, p: magnitude of the couple force (in Newton).
- **Output arguments:** d: the nodal displacement vector (dimensions should be $3 \times n$ by 1, where n is the number of nodes), stress: axial stress within each element (dimensions should be ne by 1, where ne is the number of elements). Compute the element forces from the displacements along the tangent direction of each truss only, i.e., assume small deformations.