

## MAE 404/503 Finite Elements in Engineering

### Programming assignment #1

Write a MATLAB function that generate the **nodal coordinates** and **connectivity matrix** for a 1D finite element mesh made up of two-node elements as shown in Figure 1 below.

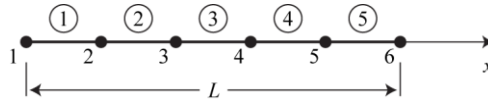


Figure 1. Node and element numbering for a 1D finite element mesh.

#### Instructions for programming and assignment submission:

- Submit a single file (MATLAB code). The file name must be in the format “asurite\_hw1.m”. Note that the separator is an underscore and you must substitute your ASU login. For example: “asurite” → “jdoe123”.
- The file **must** define a function of the same name as the file name (but without the “.m”) , e.g.,

```
function [node_coords, connectivity] = asurite_hw1(ne, L)
    % Code goes here to define nodes & connectivity.
end
```

- Make sure you also replace “asurite” in the function name with your ASU login.
- L is the total length of the domain, and ne is the number of elements.
- The function must return two variables. The first must be a  $1 \times nn$  matrix of nodal coordinates (where nn is the total number of nodes). The second must be a  $2 \times ne$  matrix, where each column contains the nodes contained in the corresponding element. For example, given inputs  $L = 12$  and  $ne = 5$ , and the correct outputs would be:

$$\text{node\_coords} = [0 \quad 2.4 \quad 4.8 \quad 7.2 \quad 9.6 \quad 12], \quad \text{and} \quad \text{connectivity} = \begin{bmatrix} 1 & 2 & 3 & 4 & 5 \\ 2 & 3 & 4 & 5 & 6 \end{bmatrix},$$

where, e.g., the first column of connectivity is [1;2] which are the nodes contained in element 1.

- Nodes and elements must be ordered left-to-right and sequentially as shown in Figure 1 and the location of node 1 must be located at  $x = 0$ .
- Your code must give the correct outputs for any reasonable values of ne and L. If your code only works for one specific case, you will get zero credit.

**Your submission will be graded electronically. Failure to comply with the above instructions will result in zero credit.**

**Viewing your grade:** You will receive an email with the subject line: “MAE 404/598 Computer homework grade link”. This email will contain a link to view your scores that is different from the submission link below. Scores for this assignment are either “0” for incorrect or “1” for correct.

Submit your assignment to <http://sparky.fulton.asu.edu/fem/>

Due date: Jan 15 at 11:59 pm.

You may submit as many times as you need. Your most recent submission will count for your grade.