

MECH 151, Finite Element Analysis  
Homework #1

1. Write a function called `truss2k` to compute an element stiffness matrix and a DOF list for a single truss element in two dimensions. A template appears on the class web site which you can use to get started. The result will be a  $4 \times 4$  element stiffness matrix which you will compute as follows:
  - (a) Find the element length from its node coordinates
  - (b) Get angle  $\theta$  from node coordinates, then  $\sin \theta$  and  $\cos \theta$ .
  - (c) Fill in  $\hat{k}$  (3.4.1)
  - (d) Fill in  $T^*$  (3.4.7)
  - (e) Compute  $k = T^{*T} \hat{k} T^*$  (no need to expand  $T^*$  into  $T$  as in the text)
2. Generate and print element stiffness matrices for the three elements shown in Fig. 3-15. Write a script that uses your function to do this:
  - (a) Fill in the arrays `nodes` and `elems`
  - (b) Loop over the three elements. Call your function inside the loop and print the stiffness matrix and the DOF list.
  - (c) Compare your element stiffness matrices against (3.6.8), (3.6.10).
3. Submit printed copies of
  - (a) Your `truss2k` function
  - (b) Your calling script
  - (c) Output from the command window