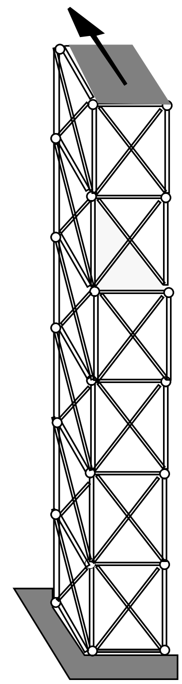
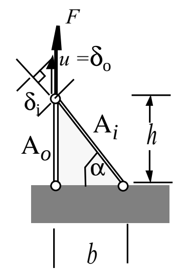
Class Exercise #13   1.050 Solid Mechanics
Fall 2003





To develop a two-dimensional model of the truss-beam, end-loaded as shown, we want to account for the top (and bottom) diagonal member contributions to the bending stiffness by increasing the cross-sectional area of the longitudinal members.

The figure at the far right shows a diagonal member of cross-sectional area A_i and a longitudinal member of cross-sectional area A_o. We impose a displacement,. u., then determine the stiffness of the two members so joined. With this, we can replace the two members by a single longitudinal member with now a bigger area. The question is, how much bigger.

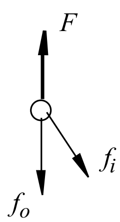
Compatibility of deformation gives

$$\delta_o = u$$

and

$$\delta_i =$$

Equilibrium of the isolated node gives (ignoring the imbalance of forces in the x direction - an imbalance taken care of by the transverse member not shown in the figure).



And **Force/Deformation** is

$$f_i = k_i \cdot \delta_i \qquad \text{where} \qquad k_i = ""$$

and

$$f_o = k_o \cdot \delta_o \qquad \text{where} \qquad k_o = ""$$

Expressing equilibrium in terms of the displacement u, we write;   *F= K u,*

where $K =$

So the appropriate area for one longitudinal member is

*A = Ao *(!+ ?)*