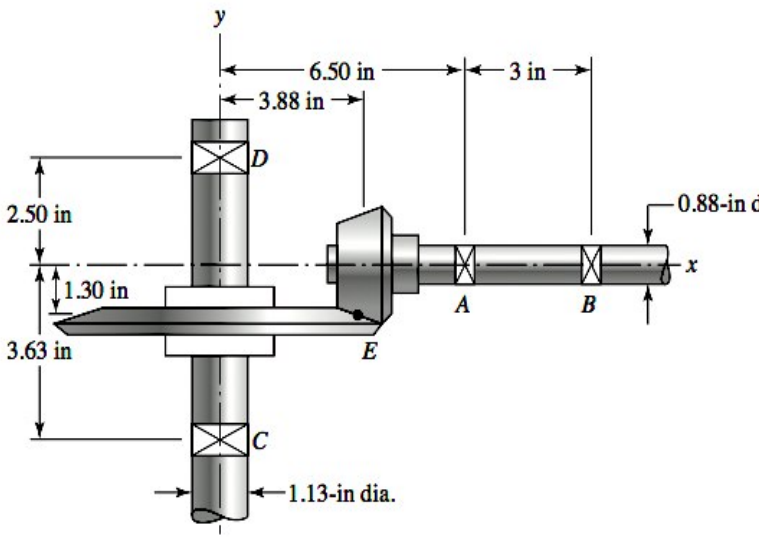
Tutorial 1
ME-351, 2013-14 2nd Semester

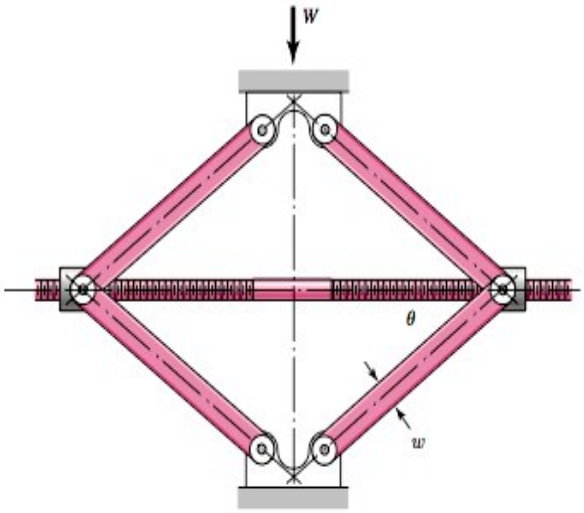
January 16, 2014

Problem 1.
In the figure (left), shaft *AB* transmits power to shaft *CD* through a set of bevel gears contacting at point *E.* The contact force at *E* on the gear of shaft *CD* is determined to be **F** = – 413 **i** – 1614**j** + 3596**k** N.

For shaft *CD*:

a) Draw a free-body diagram and determine the reactions at *C* and *D* assuming simple supports (assume also that bearing *C* carries the thrust load).
b) Draw the shear force and bending moment diagrams.
c) For the critical stress element, determine the torsional shear stress, the bending stress, and the axial stress.
d) For the critical stress element, determine the principal stresses and the maximum shear stress.





Problem 2:
The figure (right) shows a schematic drawing of a vehicular jack that is to be designed to support a maximum mass of 300 kg based on the use of a design factor n_d = 3.50. The opposite-handed threads on the two ends of the screw are cut to allow the link angle θ to vary from 15 to 70° . The links are to be machined from AISI 1010 hot-rolled steel bars. Each of the four links is to consist of two bars, one on each side of the central bearings. The bars are to be 250 mm long and have a bar width of w = 30 mm. The pinned ends are to be designed to secure an end-condition constant of at least *C* = 1.4 for out-of-plane buckling.

a) Find a suitable preferred thickness and the resulting factor of safety for this thickness.
b) Comment on the approach to be used when the length of bar chosen is 350mm.