LESSON OBJECTIVES

1. Derive or Memorize the formula that relates deformation, \( \delta \), to P, L, A, and E.
2. Compute the deformation of a prismatic axially-loaded bar due to discrete loads.
3. Compute the deformation of an axially-loaded bar for which integration is required (non-prismatic member or one with a distributed loading).
4. Compute the deformation of a simple truss or machine due to the axial deformation of its bars (this is based on previous lessons).
5. State Saint-Venant’s Principle (reading, only)

WEDNESDAY NIGHT’S CLASS: Room 327 (the regular classroom). We will go over Exam 1. We will go over “multiple-free-body-diagram Statics problems” “It’s not whether you get knocked down. It’s whether you get up.”

PHILPOT
- Philpot 5.1, 5.2, 5.3. Focus on examples 5.1, 5.2, MecMovie M5.3, M5.4

IN-CLASS PROBLEMS

1. **Problem:** Compute \( \delta_{AB} \), \( \delta_{BC} \), \( \delta_{CD} \), \( \delta_A \), \( \delta_B \)
   **Given:** Steel (E=10000 ksi)
   \( A_{AB} = 1 \text{ in}^2 \), \( A_{BD} = 2 \text{ in}^2 \)

   ![Problem Diagram]

   15 kip
   \( A \)
   2 ft
   4 kip
   4 kip
   \( B \)
   1.5 ft
   8 kip
   \( C \)
   1 ft
   8 kip
   \( D \)

2. **Problem:** Derive the displacement \( \delta_B \).
   **Given:** Pipe (Area = A) driven into the ground is being pulled out, leading to a distribution of force that is as shown.

   ![Problem Diagram]
HOMEWORK (DUE WEDNESDAY)

0. MecMovie M5.3, M5.4 (do not hand in)

1. A hollow steel (E=30000 ksi) tube (1) with an outside diameter of 2.75-in. and a wall thickness of 0.25-in. is fastened to a solid aluminum (E=10000ksi) rod (2) that has a 2-in.-diameter and a solid 1.375-in.-diameter rod (3). The rod is loaded as shown. Assume all materials remain elastic. Determine:
   a. The change in length of the steel tube (1)
   b. The deflection of joint D with respect to the fixed support at A.
   c. The maximum normal stress in the entire axial assembly.

2. The wooden pile shown has a diameter of 100-mm and is subjected to a load P=75kN. Along the length of the pile and around its perimeter, soil supplies a constant frictional resistance of w = 3.70 kN/m. The length of the pile is L=5.0m and its elastic modulus is E=8.3GPa. It remains elastic. Calculate:
   d. The force F_B needed at the base of the pile for equilibrium.
   e. The magnitude of the downward displacement of A relative to B.

3. Determine the horizontal and vertical movement of Point B. Given: both bars have cross-sectional areas of 1 in² and are made of steel (E=30000ksi). All bars are pin-ended and remain elastic.