

SE104 Homework 3

1. What are the common and the different features of “objective” and “constraint” defined in our course? What is a “free variable”?
2. During walking, the friction forces on shoes cause shear stresses. During cutting, the blades of scissors cause shear stresses in paper. Find two more examples in everyday life that a material is directly subjected to shear stresses.
3. A bar is 15 cm long, 4.2 mm thick, and 12.0 mm wide. The shear modulus of its material is 10 GPa and the Poisson’s ratio is 0.25. The bar is subjected to an axial loading of 50 ton force, along the longest dimension. The deformation is mainly plastic deformation. (a) What is the Young’s modulus of the material? (b) What are the engineering stress and engineering strain along the loading direction? (c) What are the true stress and true strain along the loading direction?
Note: Question c is for the next homework assignment (HW 4).
4. In the setting of SE104, what information do we need to fully describe the loading condition of the material in a structure? What information do we need to fully describe the mechanical behavior (i.e. the deformation) of the material in a structure?
5. What is the major difference between elastic and plastic deformations of a material?