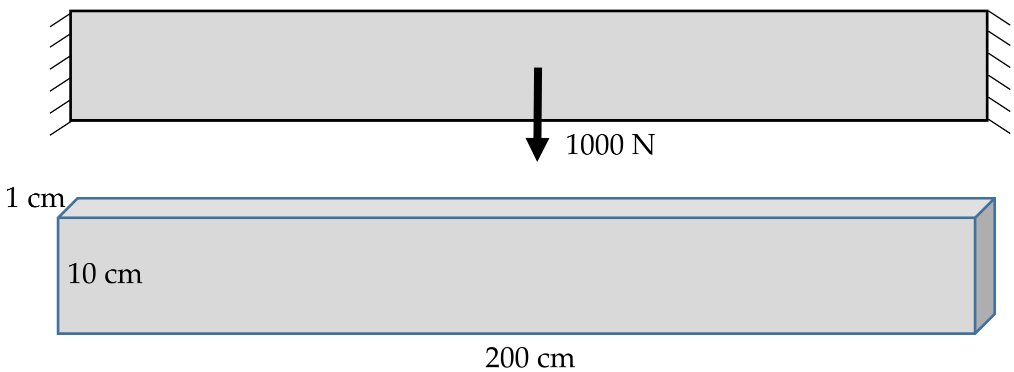
ME 260: Structural Optimization: Size, Shape, and Topology		
Assigned: Oct. 8, 2021	Quiz 4	Due: Oct. 12, 2021

Question 1 (2 points) [to be submitted by email by Oct. 12, 2021]

Take a fixed-fixed beam of length 2 m and of rectangular cross-section of 1 cm × 10 cm (breadth and depth). You are allowed to vary only the depth between 0 and 10 cm along the beam. Assume a concentrated load of 1 kN in the middle, as shown in the figure. The objective is to minimize the displacement at the midpoint where the force is applied subject to the constraint that the volume of the beam does not exceed 800 cm^3.



a) State and solve this problem analytically by writing down the design equation and adjoint equation along with their boundary conditions and then obtain the optimality criterion.
b) Modify the beam optimization code for depth-optimization from the current width-optimization to solve it using the optimality criterion method.
c) Compare your solution with that obtained using Yinsyn code.

Question 2 (1 point) [Conducted using Poll Everywhere in the recitation class on Oct. 8th]

(i) The equation that we get when we differentiate the Lagrangian w.r.t. a state variable in a structural optimization problem posed in the framework of calculus of variations.
   a. Design equation
   b. Adjoint equation
   c. Complementarity condition
   d. Feasibility condition

(ii) The governing equation and adjoint equation have the same differential operator.
   a. True
   b. False

(iii) The loading term in the adjoint equation is…

a. Partial derivative of the objective function w.r.t. the design variable
b. Partial derivative of the resource constraint w.r.t. the design variable
c. Partial derivative of the objective function w.r.t. the state variable
d. Partial derivative of the resource constraint w.r.t. the state variable

(iv) Consider a structural optimization problem with one constraint. When we interchange the objective function and the constraint, the solution changes.

a. True
b. False