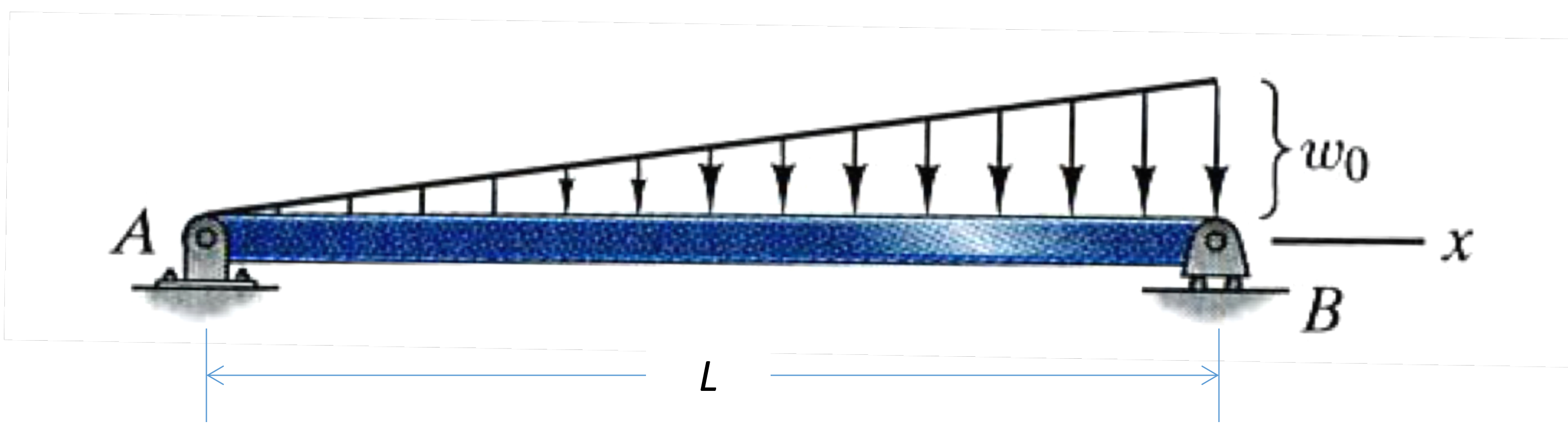
Recitation 4

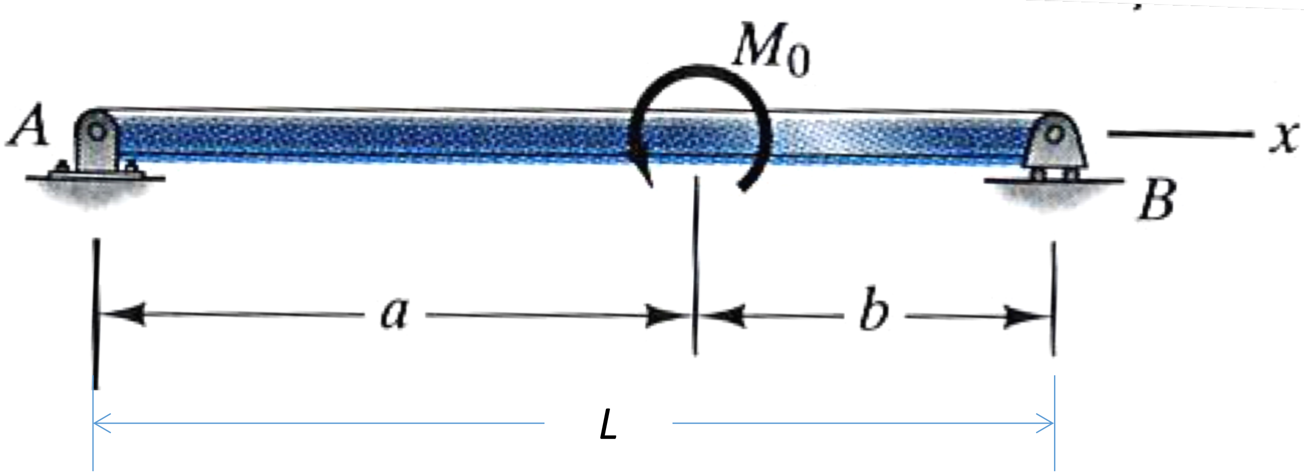
Problem 1a

- Write a fourth-order differential equation for the deflection (d^4v/dx^4).
- Write the boundary conditions needed to fully solve the equation for the deflection as a function of *x* from the fourth-order differential equation.
- Write the matching conditions (if any) needed to fully solve the equation for the deflection as a function of *x* from the fourth-order differential equation.



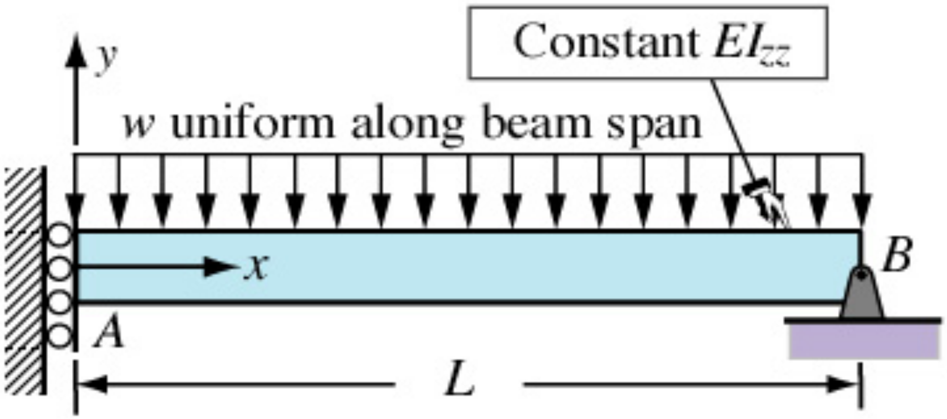
Problem 1b

- Write a fourth-order differential equation for the deflection (d^4v/dx^4).
- Write the boundary conditions needed to fully solve the equation for the deflection as a function of *x* from the fourth-order differential equation.
- Write the matching conditions (if any) needed to fully solve the equation for the deflection as a function of *x* from the fourth-order differential equation.



The point moment M_0 shown is counter-clockwise.

Problem 2

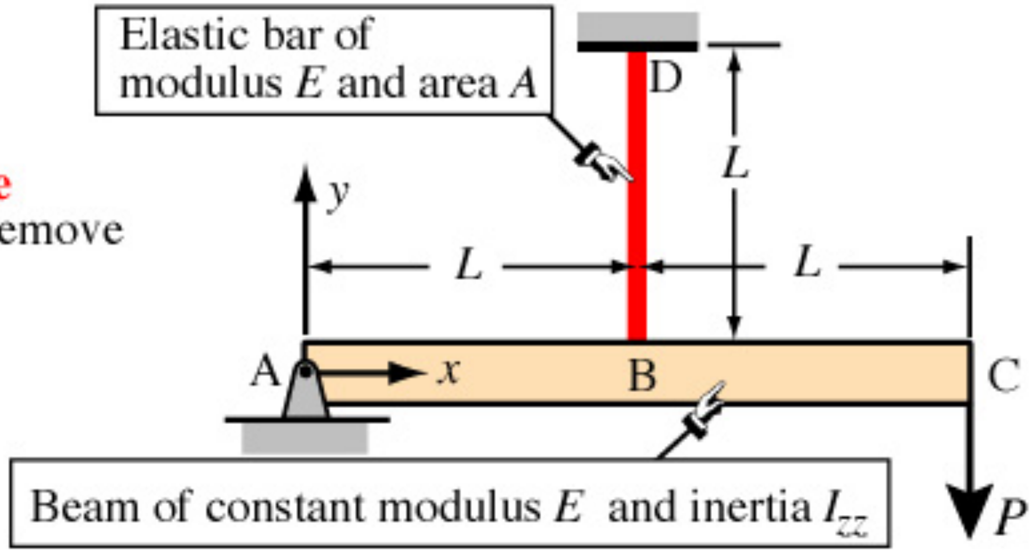


Boundary conditions:
End A can deflect but cannot rotate
so $V_{yA} = V_y(0) = 0$, $v'_A = v'(0) = 0$
End B is simply supported so
$M_{zB} = M_z(L) = 0$, $v_B = v(L) = 0$

Solve by both 2nd and 4th order methods, and compare effort. Requested: $v(x)$ and $v_A = v(0)$ in terms of w, L, and EI_{zz} . Challenge is how to apply the B.C.s given above.

Problem 3

Note that structure is
statically determinate
(visualization: if you remove
the bar, it collapses)



Beam AC is simply supported at A and propped by an *elastic* bar BD at half span B. Beam AC has constant bending inertia I_{zz}, bar BD has constant cross section A, and both members have the same modulus E. A point load P is applied at the free end C as shown in the Figure.

Using any method, find in terms of E, A, I_{zz}, L, and P:

(a) axial force F_{BD} in bar BD (hint: structure is *statically determinate*)
(b) vertical deflection v_B at B (hint: it is controlled by the bar elongation)
(c) vertical deflection v_C at C (hint: find bending moment $M_z(x)$, integrate it twice, and apply deflection conditions at A and B)

Partial answers: $v_B = -2PL/(EA)$, $v_C = -4PL/(EA) - 2PL^3/(3EI_{zz})$