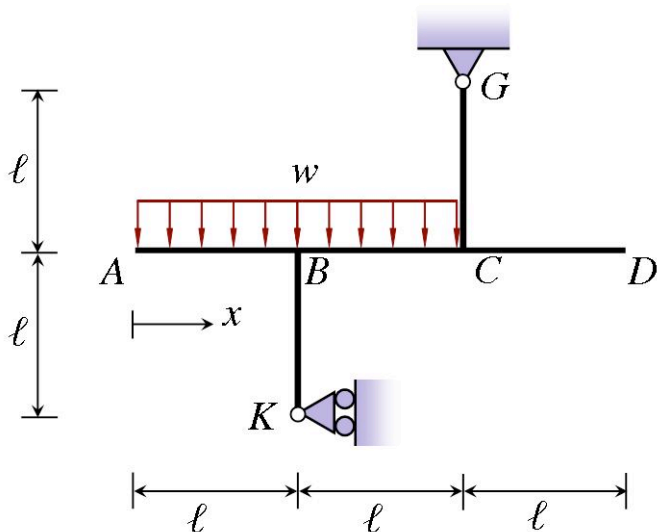


Midterm Examination, Mon 28 Feb, 18:30-20:30

Question 1 (10 marks)

The structure in the figure on the right is subjected to a uniformly distributed load between A and C. For the horizontal member ABCD,

- draw the diagram of the axial force N ,
- draw the diagram of the shear force V ,
- draw the diagram of the bending moment M ,
- calculate the maximum value of the bending moment and indicate the point on ABCD at which this maximum occurs, by means of the distance of this point from point A.

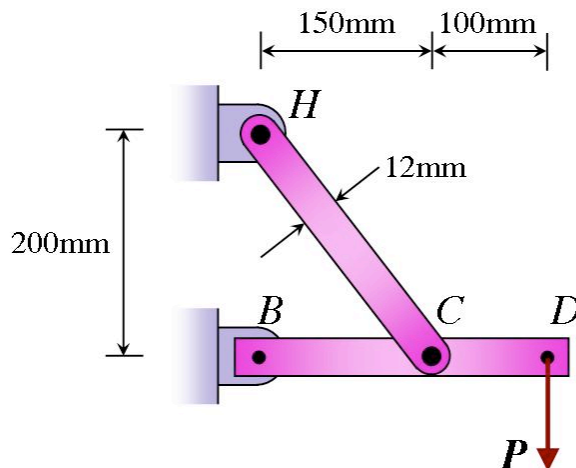


Question 2 (10 marks)

Link HC is made of a steel with a ultimate normal stress of 400 MPa, and has a 6 x 12 mm uniform rectangular cross section. It is connected to a support at H and to member BCD at C by pins with a diameter of 9 mm, while member BCD is connected to its support at B by a pin with a diameter of 7.5 mm; All of the pins are made of a steel with an ultimate shearing stress of 175 MPa, and are in single shear.

- Knowing that a factor of safety of 3.0 is desired, determine the largest load P that may be applied at D as shown.
- What would the answer be if the load P were acting upward?

Note that link HC is not reinforced around the pinholes.



Question 3 (10 marks)

A rectangular plate lying on the xy plane has sides 2ℓ in the x direction and ℓ in the y direction, thickness h in direction z , and is made of a material with Young's modulus E , Poisson's ratio ν , and shear modulus G . The plate is first subjected to the state of stress in Figure A. Then, a shear stress is also imposed, as shown in figure B, where $\tau = \frac{1}{4}\sigma$.

Under the state of stress in Figure A, determine:

- the elongations in the x and y directions;
- the change in thickness in the z direction;
- the change in angle α .

Under the state of stress in Figure B, determine:

- the elongations in the x and y directions;
- the change in thickness in the z direction;
- the change in angle α .

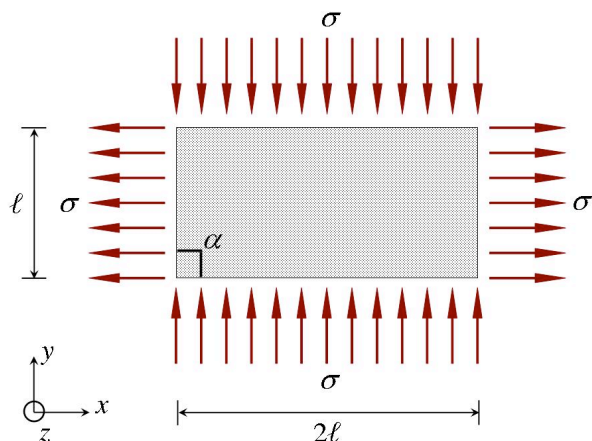


Figure A

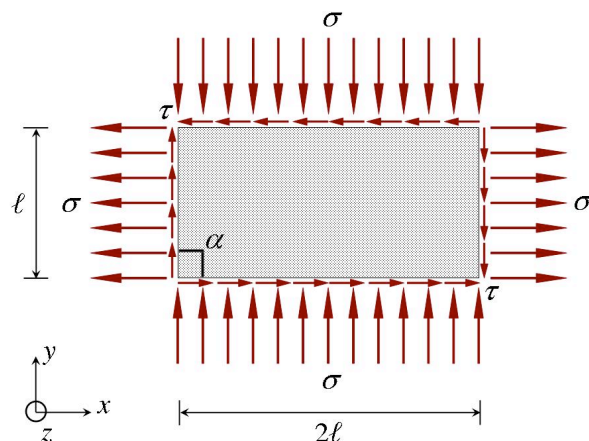


Figure B