SOAL TAKE HOME TEST
MEKANIKA KEKUATAN BAHAN

Jurusan/Program : Teknik Mesin – EKSTENSI D3
Hari/Tgl. Diberikan : Selasa, 30 Desember 2008
Hari/Tgl. Dikumpulkan : Kamis, 1 Januari 2009
Jam Pengumpulan Akhir : 10.00 WIB
Tempat Pengumpulan : Lab. Proses Produksi – CNC

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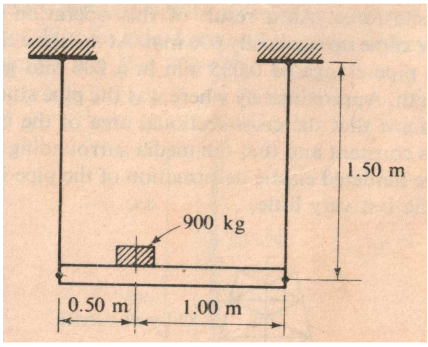
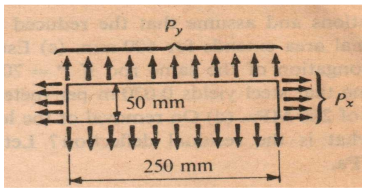
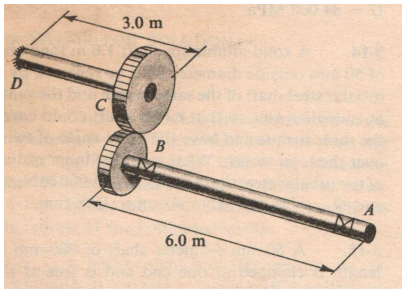
1. Two wires are connected to a rigid bar as shown in the figure, and a mass of 900 kg is applied. The cross sectional area of the left wire is 60 mm^2, and its E = 200,000 MN/m^2; the corresponding quantities for the right wire are 120 mm^2, and E = 70,000 MN/m^2. Calculate the vertical displacement of the weight.



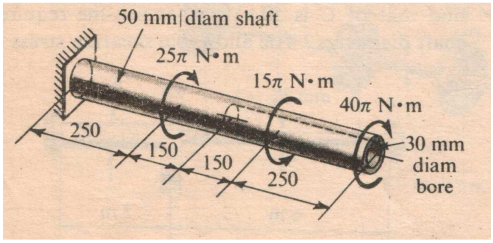
2. A piece of 50 mm by 250 mm by 10 mm steel plate is subjected to uniformly distributed stresses along its edges (see figure). (a). If P_x = 100 kN and P_y = 200 kN, what change in thickness occurs due to the application of these forces ?, (b). To cause the same change in thickness as in (a) by P_x alone, what must be its magnitude ? Let E = 200,000 MN/m^2 and $\nu = 0.25$.



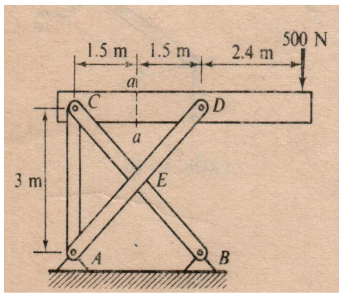
3. Two gears are attached to two 50 mm diameter steel shafts as shown in the figure. The gear at B has a 200 mm pitch diameter; the gear at C a 400 mm pitch diameter. Through what angle will the end A turn if at A a torque of 560 N.m is applied and the end D of the second shaft is prevented from rotating ? (G = 84.000 MN/m^2).



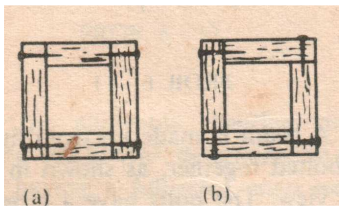
4. (a). Determine the maximum shearing stress in the shaft subjected to the torques shown in the figure, (b). Find the angle of twist in degrees between the two ends. Let G = 84,000 MN/m^2.



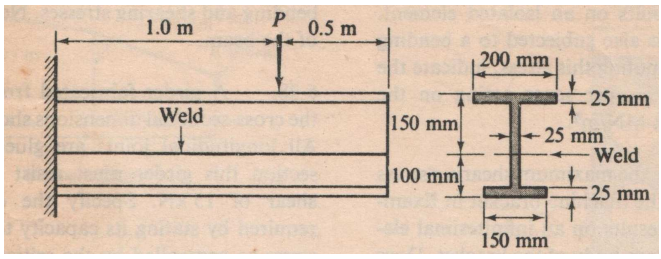
5. Determine the axial force, the shear, and the bending moment at section a-a. There is no connection between members AD and BC at point E.



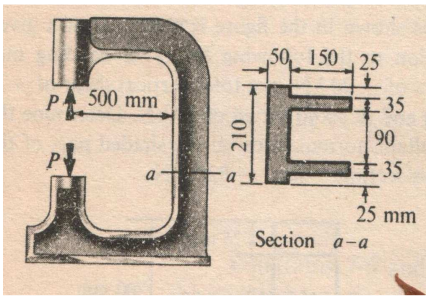
6. A 250 mm square box beam is to be made from four wood pieces 50 mm thick. Two possible design are considered as shown in the figure. Moreover, the design shown in (a) can be turned 90° in the application. (a). Select the design requiring the minimum amount of nailing for transmitting shear, (b). If the shear to be transmitted by this member is 3020 N, what must the nail spacing be for the best design ? The nailing is to be done with nails that are good for 240 N each in shear.



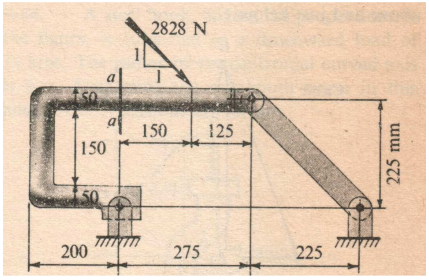
7. A steel cantilever beam is made of two structural tees welded together as shown in the figure. Determine the allowable load P that the beam can carry. Neglect the weight of the beam. The allowable stresses are : σ = 150 MN/m^2 in tension and compression, τ = 100 MN/m^2 in shear on the rolled material, and q = 2 MN/m on the welded joint.



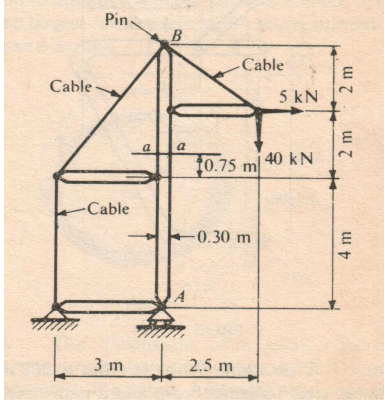
8. A cast iron frame for a punch press has the proportion shown in the figure. What force P may be applied to this frame controlled by the stresses in the section such as a-a, if the allowable stresses are 28 MPa tension and 80 MPa in compression.



9. Calculate the maximum compressive stress acting on section a-a caused by the applied load for the structure shown in the figure. The cross section at section a-a is that of a solid circular bar of 50 mm diameter.

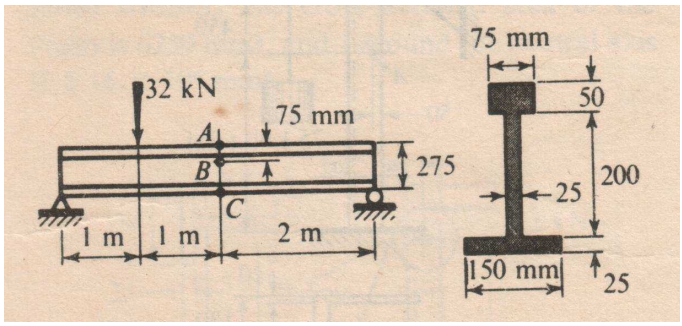


10. Compute the maximum compressive stress acting normal to the section a-a for the structure shown in the figure. The post AB has a 300 mm by 300 mm cross section. Neglect the weight of the structure.

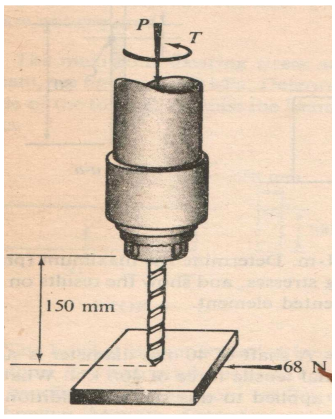


11. If the unit strains are ε_x = - 0.00012, ε_y = + 0.00112, and γ_{xy} = - 0.00020, what are the principal strains and in which directions do they occur ? To answer, use Mohr's circle of strain.

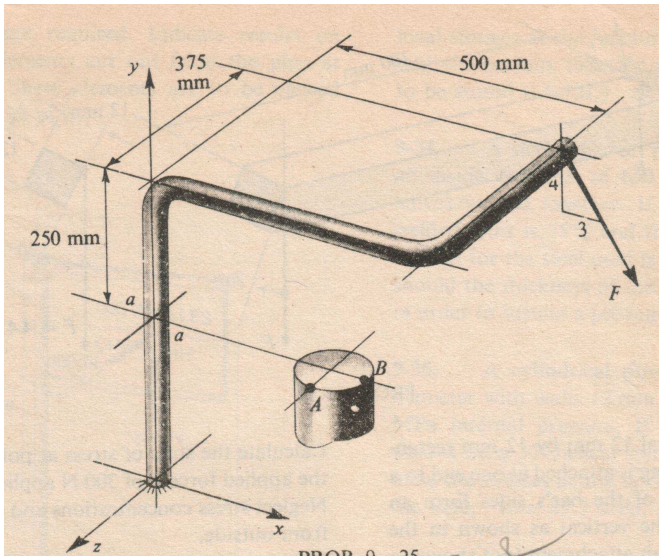
12. A cast iron beam is loaded as shown in the figure. Determine the principal stresses at the three points A, B, and C caused by the applied force.



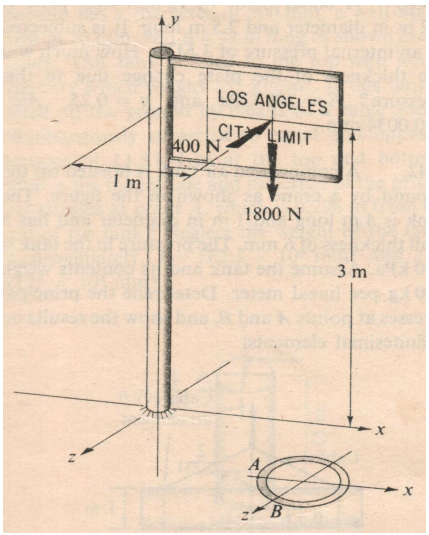
13. A 12 mm diameter drill bit (A = 113 mm^2, I = 1020 mm^4, I_p = 2040 mm^4) is inserted into a chuck as shown in the figure. During the drilling operation an axial force P = 6.78 kN and a torque T = 27.2 N.m act on the bit. If a horizontal force of 68 N is accidentally applied to the plate being drilled, what is the magnitude of the largest principal stress which develops at the top of the drill bit ? Determine the critically stressed point on the drill by inspection.



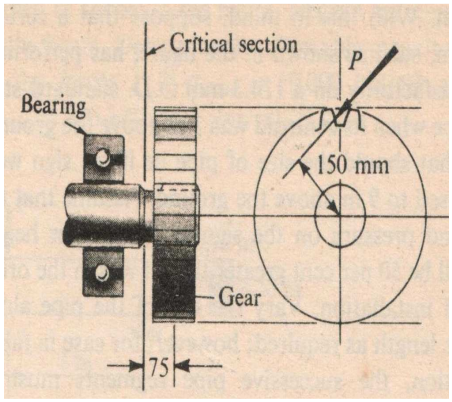
14. A 50 mm diameter rod is subjected at its free end to an inclined force F = 225π N as in the figure. (The force F in plan view acts in the direction of the x-axis). Determine the magnitude and directions of the stresses due to F on the elements A and B at section a-a. Show the results on elements clearly related to the points on the rod. Principal stresses are not required.



15. An 1800 N sign is supported by a 73 mm O.D. standard weight steel pipe as in the figure. The maximum horizontal wind force acting on this sign is estimated to be 400 N. Determine the state of stress caused by this loading at points A and B at the built-in end. Principal stresses are not required. Indicate results on sketches of elements cut out fom the pipe at these points. These elements are to be viewed from outside the pipe.



16. A low speed shaft is acted upon by an ecentrically applied load P caused by a force developed between the gears. Determine the allowable magnitude of the force P on the basis of the maximum shearing stress theory if τ_{allow} = 45 MPa. The small diameter of the overhung shaft is 75 mm. Consider the critical section to be where the shaft changes diameter, and the M = 0.075P N.m and T = 0.15P N.m. Note that since the diameter size changes abruptly, the following stress concentration factors must be considered : K_1 = 1.6 in bending, and K_2 = 1.2 in torsion.



17. A straight round shaft is subjected to a torque of 6000 lb-in. Determine the required diameter, using steel with a tensile yield point of 60 ksi and a safety factor of 2 based on static yielding : (a). According to the maximum-normal-stress theory; (b). According to the maximum-shear-stress theory; (d). According to the maximum-distortion-energy theory.

18. A 100 in. diameter cylinder made of material having σ_{yp} = 60 ksi is subjected to an internal pressure of 300 psi. Using a safety factor of 3 applied to initial yielding, estimate the wall thickness required, based on : (a). Maximum-normal-stress theory; (b). Maximum-shear-stress theory; (d). Maximum-distortion-energy theory. Assume that the thin-wall analysis is adequate, and then discuss briefly the validity of this assumption and of the three failure theories used.