SOAL TAKE HOME TEST
MEKANIKA KEKUATAN BAHAN

Jurusan/Program : Teknik Mesin – REGULER
Hari/Tgl. Diberikan : Rabu, 14 Januari 2009
Hari/Tgl. Dikumpulkan : Kamis, 15 Januari 2009
Jam Pengumpulan Akhir : 11.30 WIB
Tempat Pengumpulan : Lab. Proses Produksi – CNC (Bp. Sutiyoso)

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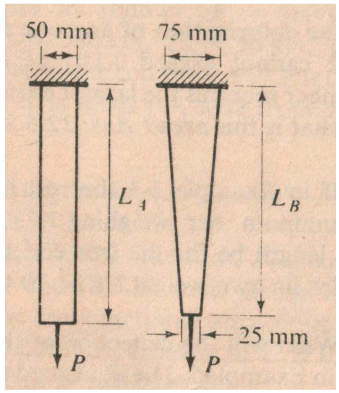
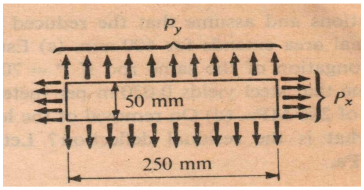
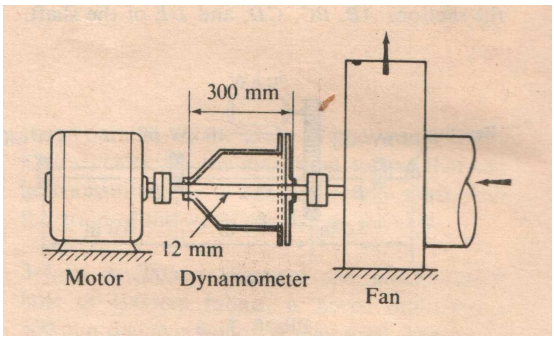
1. Two bars are to be cut from a 25 mm thick metal plate so that both bars have a constant thickness of 25 mm. Bar A is to have a constant width of 50 mm throughout its entire length. Bar B is to be 75 mm wide at the top and 25 mm wide at the bottom. Each bar is to be subjected to the same load P. Determine the ratio L_A/L_B so that both bars will stretch the same amount. Neglect the weight of the bar.



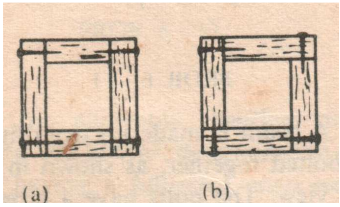
2. A piece of 50 mm by 250 mm by 10 mm steel plate is subjected to uniformly distributed stresses along its edges (see figure). (a). If P_x = 100 kN and P_y = 200 kN, what change in thickness occurs due to the application of these forces ?, (b). To cause the same change in thickness as in (a) by P_x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



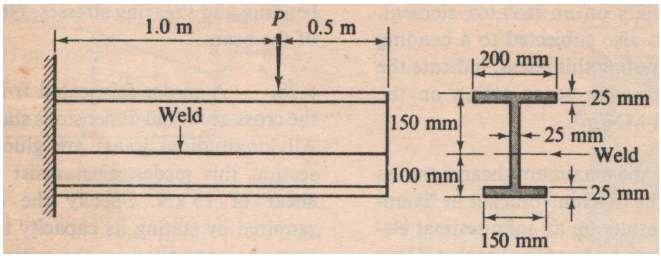
3. A dynamometer is employed to calibrate the required power input to operate an exhaust fan at 20 Hz. The dynamometer consists of a 12 mm diameter solid shaft and two disks attached to the shaft 300 mm apart as shown in the figure. One disk is fastened through a tube at the input end; the other is near the output end. The relative displacement of these two disks as viewed in stroboscopic light was found to be 6^o. Compute the power input in kW required to operate the fan at the given speed. Let G = 84000 MN/m^2.



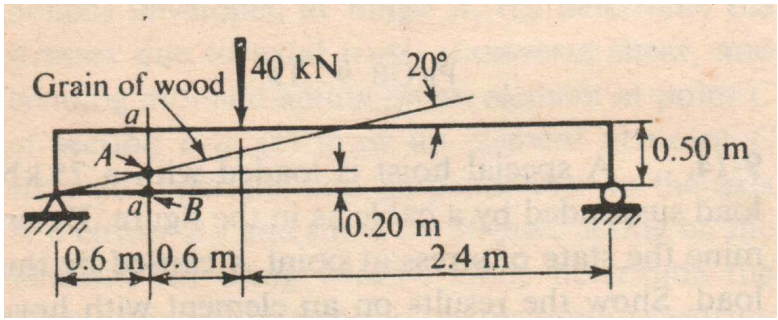
4. A 250 mm square box beam is to be made from four wood pieces 50 mm thick. Two possible design are considered as shown in the figure. Moreover, the design shown in (a) can be turned 90^o in the application. (a). Select the design requiring the minimum amount of nailing for transmitting shear, (b). 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.



5. 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.

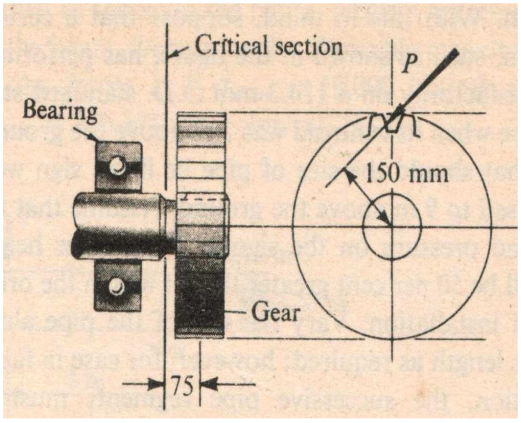


6. A 100 mm by 500 mm rectangular wooden beam supports a 40 kN load as in the figure. At section a-a the grain of the wood makes an angle of 20^o with the axis of the beam. Find the shearing stress along the grain of the wood at points A and B caused by the applied concentrated force.

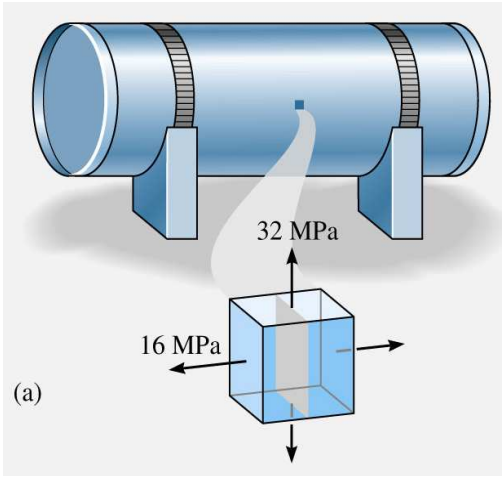


7. A low speed shaft is acted upon by an ecentrically applied load P caused by a force developed between the gears. Determine the allowable magnitude of the force P on the basis of the maximum shearing stress theory if τ_{allow} = 45 MPa. The small diameter of the overhung shaft is 75 mm. Consider the 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.



8. The point on the surface of the cylindrical pressure vessel, as in figure, is subjected to the state of plane stress. Determine the absolute maximum shear stress at this point.



9. 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.

10. A 100 in. diameter cylinder made of material having $\sigma_{yp} = 60$ 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.