機械

國立成功大學八十二學年度　　考試(机構学与机械設計 試題) 共 1 頁 第 1 頁

I. 機構學 (共50%)

1.(10%)

An engineer is asked to design a mechanical press with toggle effect which is driven by a motor. Initially a kinematic sketch shown in Fig. 1 is proposed.

a. What's wrong with the design? Describe your reasons.

b. How to modify the sketch?

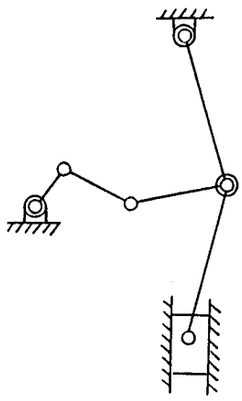

Fig.1

2.(15%)

We have a mechanism sealed in a housing (Fig. 2). The details of the mechanism itself are not knowm to us, but we have been able to experiment by moving, and making motion measurements on, three links which project from the housing. We have found that if we turn the shaft of link 2 counterclockwise at a constant angular velocity of 20 rad/sec, then, at the position illustrated, the shaft of link 4 and point C of link 3 have the states of motion indicated. If we were to turn the shaft of 2 clockwise at 10 rad/sec and also give it a clockwise angular acceleration of 150 rad/sec^2, what would be the resulting states of motion for link 4 and for point C, in the same mechanism position?

ω_2 = 20 rad/sec

α_2 = 0

ω_4 = 40 rad/sec

α_4 = 2000 rad/sec^2

V_c = 30 ft/sec

A_c = 600 ft/sec^2

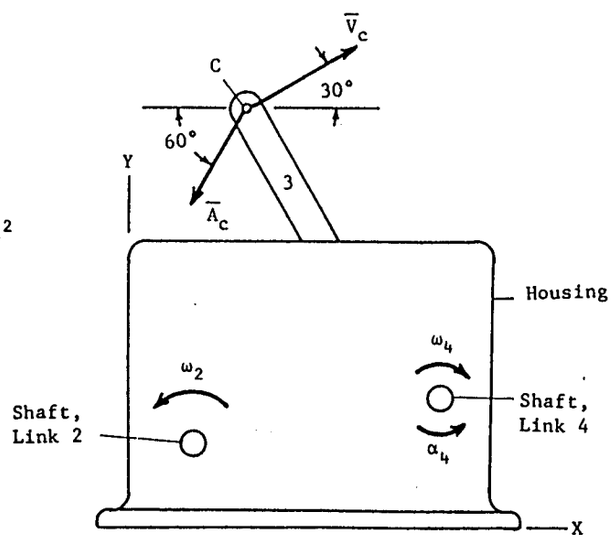

Fig.2

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II. 機械設計試題 (50%)

(註：本科考試中不得參閱任何資料。)

5. Define the following terminologies:
   (a) Stress concentration factors (k_t). (5%)
   (b) Endurance limit and modified Goodman line. (5%)
   (c) Maximum distortion energy theory and von Mises stress. (5%)

6. (a) What is the major stress in the (i) torsion springs and (ii) helical spring ? (5%)
   (b) A straight roller bearing is subjected to a radial load of 12kN. The life is to be 4000h at a speed of 750rev/min. What load rating should be used to enter the bearing catalog? (5%)
   (c) What primary factors must be considered when determining appropriate numerical values of the shaft diameters? (5%)

7. A class 8.8, M10x1.5 bolt with rolled threads (Su=830MPa, Sy=660MPa, Se(Sn)=373MPa, Sp=600MPa, A_t=58mm^2, k_f=3) is used in a joint having a soft gasket such that the clamped member stiffness is only half the bolt stiffness. The bolt initial tension corresponds to 0.9SpA_t. During operation, there is an external separating force that fluctuates between 0 and P. This application involves negligible bending of the bolts.
   (a) Estimate the maximum value of P that would not cause eventual fatigue failure. (12%)
   (b) Estimate the maximum value of P that would not cause joint seperation. (8%)

3.(15%)

For the crank-shaper mechanism shown in Fig. 3, link 2 rotates at a constant angular velocity. Determine ω_4 and α_4.

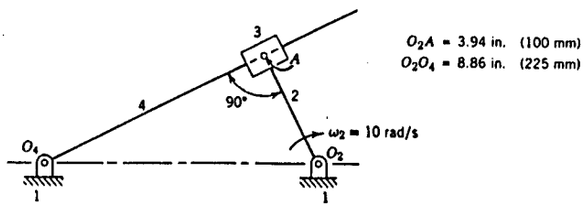

Fig.3

4.(10%)

In the planetary gear train shown in Fig. 4, the angular velocity of shaft A is 360 rad/sec in the direction shown and that of shaft B is 2000 rad/sec in the opposite derection. Determine the angular velocity of shaft C.

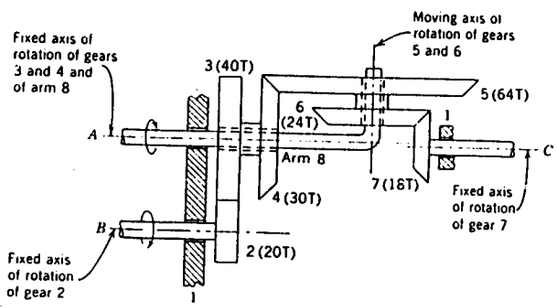

Fig. 4