1. (25%) Fig. 1 shows five different mechanisms. We are interested in obtaining the absolute acceleration of the point A on each mechanism. Assume the position and velocity states of the links in each mechanism are all known and the accelerations are to be solved, which mechanism will encounter the calculation of Coriolis acceleration? Explain the reason for each mechanism.
   Descriptions of the mechanisms are: (a) A bar-link 3 slides on a rotating input link 2. Point A is on bar-link 3. (b) A 3-bar linkage where link OD is the input link. Point A is a point on the output link CE and slides in the slot on link OD. (c) A cylindrical block 3 slides on the bar of link 2 which can rotate about the pin joint O. (d) A Scotch yoke mechanism where link 2 is the input. Point A is on <u>link 4</u>. (e) A four-bar linkage where link 2 is the input. Point A is at the middle of the coupler link 3.

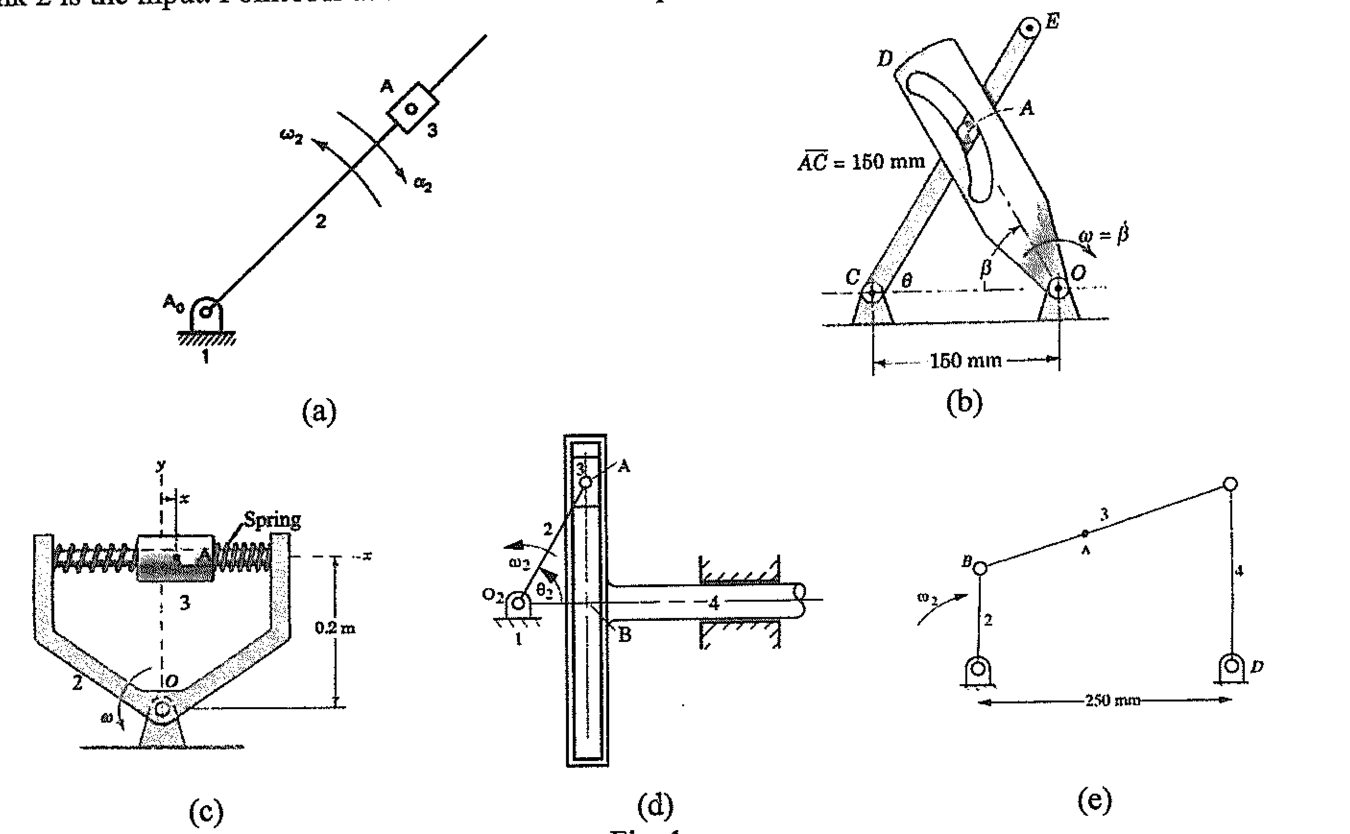

Fig. 1

2. (10%) Continue the question as in Problem 1. The known kinematic states of Fig. 1(a) are as follows: A_0A= 2 cm; angular velocity of link 2, ω_2= 3 rad/sec counter clockwise (ccw); angular acceleration of link 2, α_2= 3 rad/sec^2, clockwise (cw); sliding velocity of link 3 relative to link 2, $V_{A3/A2}$ = 1 cm/sec, pointing away from A_0; sliding acceleration of link 3 relative to link 2, $A_{A3/A2}$= 18 cm/sec^2, pointing away from A_0.
   (a)Find the Coriolis acceleration of point A. (4%) (b) Find the absolute acceleration of point A. (6%)

3. (20%) A uniform beam is suspended from two springs as shown in Fig. 2. The mass of the beam is m. At the instant when spring 2 breaks, determine
   (a) the angular acceleration of the beam, (10%)
   (b) the acceleration of point A, (10%)

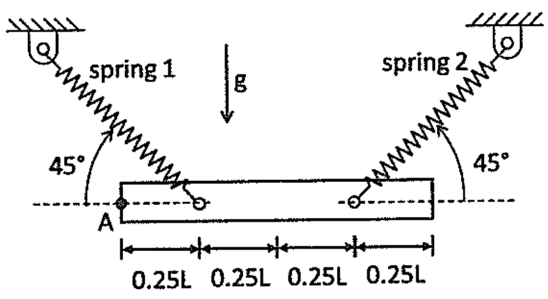

Fig. 2

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4. (15%) A mechanism is shown in Fig. 3. The mass of each uniform beam is 1 kg. The mass of the small wheel at C is negligible. The mechanism is originally held and then released at t_0. The velocity of the joint C is zero at time t_0. Determine the velocity of the joint B at time t_1 when the two beams lie horizontally.

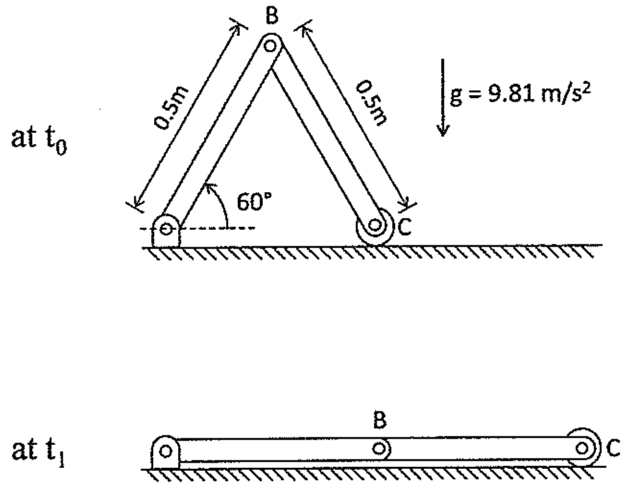

Fig. 3

5. (30%) As shown in Fig. 4, a link with length L, mass m, and center of mass at distal end. A spring with free length S_0 and stiffness K connect the link at distance b and ground at distance a. Determine
(a). elastic potential energy contributed by the spring in function of φ, (10%)
(b). gravitational potential energy by the mass in function of φ, (10%)
(c). reaction forces and reaction moment at point A. (10%)

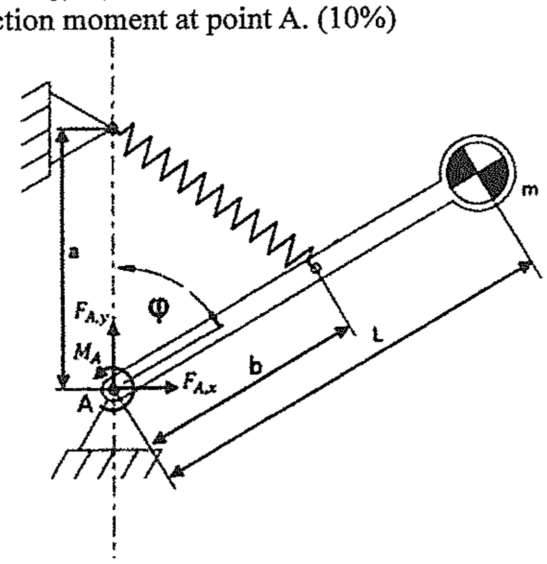

Fig. 4

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