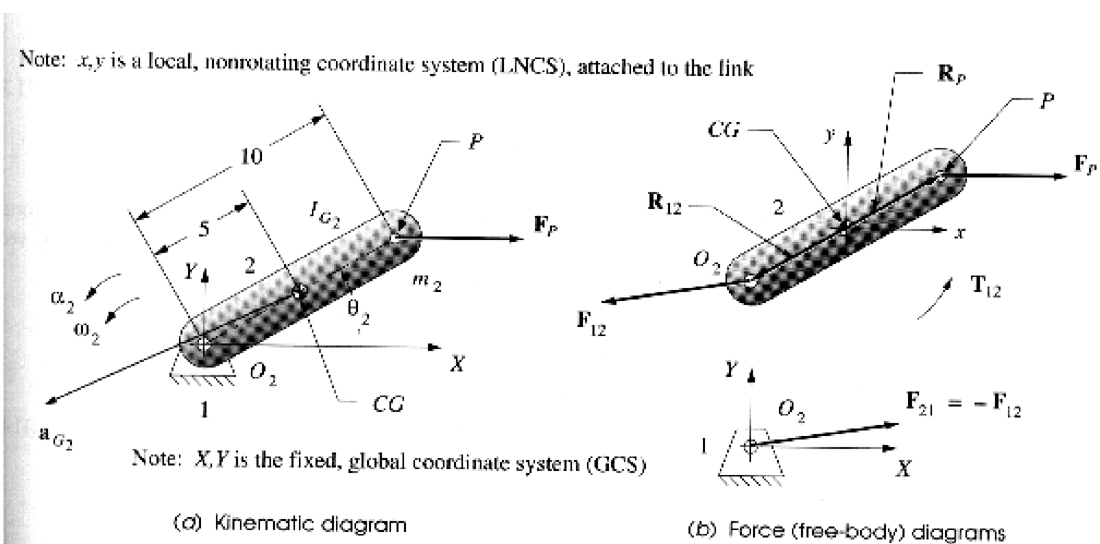
2. The simplest mechanism we have considered is a single link in pure rotation. If we need to design the supporting pin or the base for the rotating link, we need to know the load that will have to be supported. Assuming the rest of the mechanism has been analyzed and only the single link needs to be completed. The input force F_p is known to be a function of angle where

$$F_p = 50\sin(\theta)$$

where the angle is measured from the horizontal as shown in the figure.



IGURE 11-1

Problem 2 (cont.)

a) In order to obtain a conservative design find the smallest angle for which F_p is a maximum.

b) The angular acceleration and velocity are found from a constant angular acceleration of $\alpha = 0.5\, rad/s^2$ and $\omega = \alpha\,\theta$. This corresponds to the link having zero velocity and zero acceleration at $\theta = 0$ and having a constant acceleration. Find ω and α for the angle found in a)

c) Assume that the link is a thin homogeneous plate 12 inches long and 1 inch wide. The mass moment of inertia about the CG is:

$I_{zz} = \frac{1}{12} m\left(a^2 + b^2\right)$ where a and b are the length and width. Find the mass moment of inertia of the link.

d) In the vector:

$$\begin{bmatrix} m\ a_{G_x} - F_{P_x} \\ m\ a_{G_y} - F_{P_y} \\ I_G\alpha - \left(R_{P_x} F_{P_y} - R_{P_y} F_{P_x}\right) \end{bmatrix}$$

$a_{G_x} = -\alpha \cdot r$ and $a_{G_y} = -\omega^2 \cdot r$ where the radius is 6 inches. What are R_{P_x} and R_{P_y} and F_{P_x} and F_{P_y} equal to?

e) Using the data given, write out a matrix expression for the driving torque and the force components on the pin at O_{12} .as well as the torque required. Do not solve the matrix.

f) For the solution above, write out a symbolic expression that could be entered into MathCAD that would provide the solution to the magnitude and direction of the resultant force and the magnitude of the applied torque.