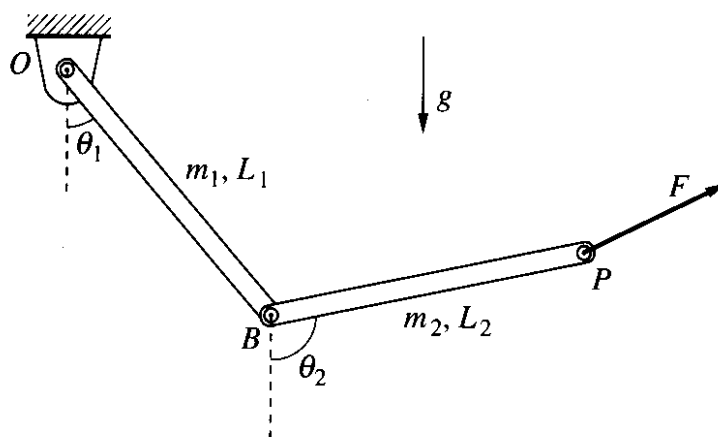


2.003/1.053 Dynamics and Controls I
Spring 2007
Problem Set 6

Issued on Monday, April 2nd
Due in lecture on Monday, April 9th

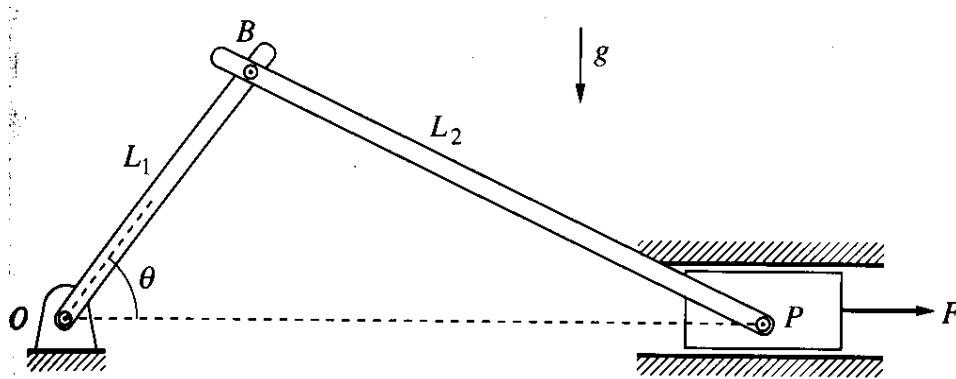
1 Two-link pendulum

Consider the two-link mechanism shown below, where a force \mathbf{f} is acting at point P . Find an expression for the virtual work for each link, considering the variations $\delta\theta_1$ and $\delta\theta_2$. Determine the generalized forces.



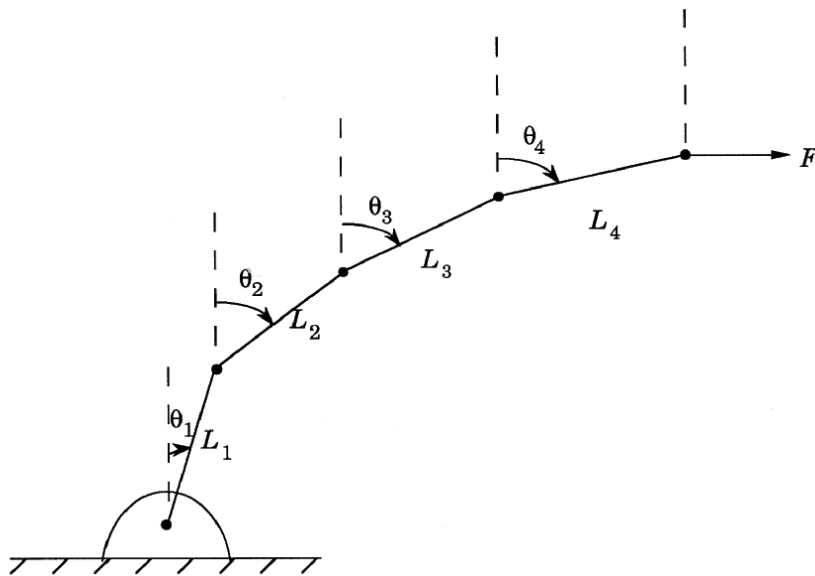
2 Slider-crank mechanism

Using θ as the generalized coordinate, calculate the virtual displacement of the slider at p in the slider-crank mechanism shown below, due to the virtual variation $\delta\theta$. Determine the generalized force.



3 Link-chain

The force F acts horizontally at the end of the four-member linkage shown below. The linkage is described by the generalized coordinates $q_1 = \theta_1$, $q_2 = \theta_2$, $q_3 = \theta_3$, $q_4 = \theta_4$. Find the generalized forces Q_1 and Q_2 conjugate to the generalized coordinates q_1 and q_2 and due to the force F . You may *not* assume that θ_1 , θ_2 , θ_3 , and θ_4 are small angles.



4 Rolling cylinders

In the position shown cylinder B is falling as it rolls over cylinder A , which is rolling over plane $y = 0$. Generalized coordinates are the horizontal distance x to cylinder A and the angle of elevation θ for the line connecting the centers. Determine the virtual displacement of the center of each cylinder and the virtual rotation of each cylinder resulting from the increments in the generalized coordinates.

