

2.72 Elements of Mechanical Design

Homework #4 Mechanisms: Analysis, Synthesis, Forces

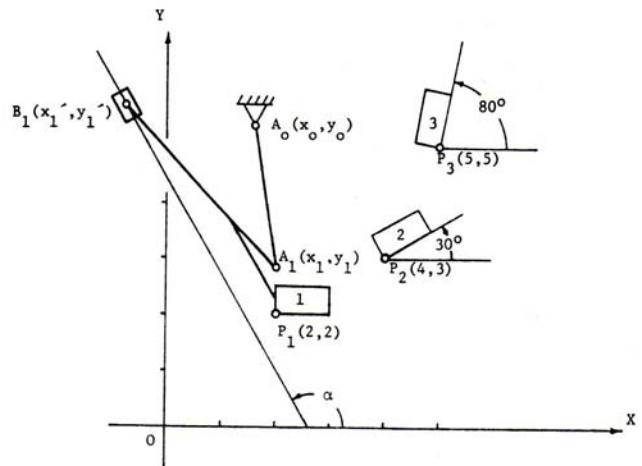
Due Date: Thursday 9 March, 2:30PM

Deliverable: Individual written report (about five pages)

Time allotment: You should expect to spend 5 hours on this homework outside of the scheduled 1.5 hours spent in the lab and 1.5 hours of scheduled project time.

Assignment:

1) Synthesize a slider-crank mechanism for the specified three position guidance task (depicted to the right). A slider crank angle α of 120° is specified and a distance between points A_1 and B_1 of 4.0 units is preferred. Show your work including the equations you used in the synthesis problem, the unknowns for which you are solving, and explain any challenges you faced and how you overcame them. (adapted from CAD of Mechanisms 4.21).



Source: Figure 4-21 in Suh, C. H. *Computer Aided Design of Mechanisms Part A*. Self-published book, 1989. Courtesy of Dr. C. H. Suh. Used with permission.

2) Analyze the automobile window glass mechanism shown (to the right). Given input handle rotation angle $\theta_j=0$ to -90° in increments of 10° . Find:

A) The output point locations P_j .

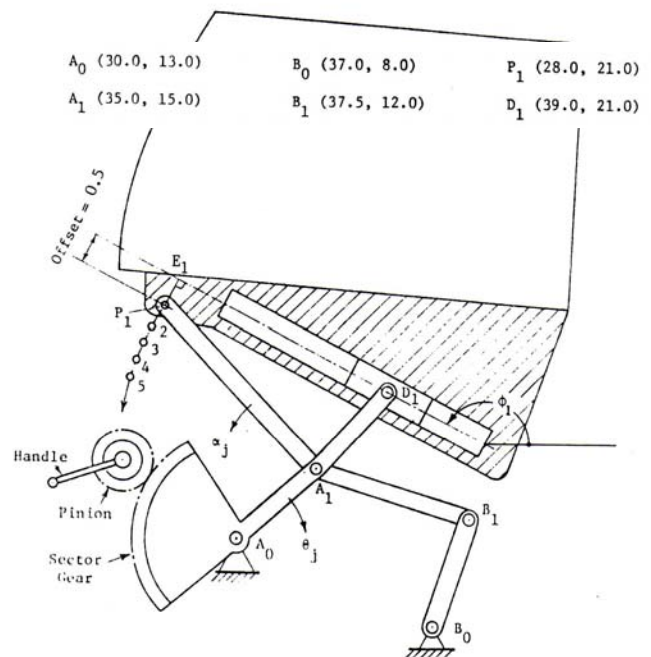
B) The required torque applied to the handle to keep the window glass from falling assuming no friction in the joints.

(adapted from CAD of Mechanisms 4.31).

3) Use a BASIC Stamp microcontroller (and other items as needed) to make the following devices. Provide instructions (include code and wiring diagrams as necessary) to enable a person to reproduce your device.

A) A button that causes an LED to blink three times each time it is pressed.

B) A potentiometer whose position controls the output of a hobby servo.



Source: Figure 4-31 in Suh, C. H. *Computer Aided Design of Mechanisms Part A*. Self-published book, 1989. Courtesy of Dr. C. H. Suh. Used with permission.

4) Choose a mechanism from *Ingenious Mechanisms for Designers and Inventors* and make a working model of the mechanism (either real or virtual). The books are available in Lab, and should remain in the lab as a reference; there is a copy machine that you can use if you want to take a copy of the drawing with you. If you construct a physical model, bring it with you to class and turn it in with your homework. If you use software (e.g., MathCad or Working Model), turn in a file by emailing it to the TA.