2.72 Elements of Mechanical Design

Homework #7
Cams: Design and Manufacturing

Due Date: Thursday 13 April, 2:30PM

Deliverable: Individual written report (about five pages)

Time allotment: You should expect to spend 5 hours on this homework.

Assignment:

1) A cam is shaped as an ellipse 5cm wide along its major axis and 3cm wide along its minor axis. The cam is mounted so that it rotates around one of its foci. The cam drives a 1cm diameter translating roller follower. Find and sketch the equivalent four-bar linkage for two positions of the cam and follower, say, rotated 10 deg and 30 deg from the topmost position of the follower. Does the mechanism have the same link lengths in the two positions?

2) (adapted from Norton 8-7) Design a double-dwell cam to move a knife edge follower from 0 to 2.5 inches on 60 deg, dwell for 120 deg, fall 2.5 inches in 30 deg, and dwell for the remainder. The total cycle must take 4 seconds. Choose suitable functions for rise and fall to minimize accelerations. Plot $s, v, a, j$ diagrams.

3) See Problem 8-2 in Norton. The describes a proposed design for a cam driven pump that simulates human aortic pressure so that hospital monitoring equipment can be tested daily. A colleague in your company has asked for your advice about the design. He is particularly concerned about whether the “dicrotic notch” can be adequately simulated. Write a letter to your colleague on the design issues he is likely to face and the advice you would offer to overcome any challenges you foresee.

4) A cam profile is given in file “hw7_cam.txt” (radius of the cam in meters is given for each degree). Estimate and sketch the material removal rate as a function of time if a 450mm diameter grinding wheel is used to grind the cam while rotating the part 3 times at a uniform speed over the course of one minute. State any assumptions needed to develop your estimate.