ME 352A Homework 1
August 8, 2017

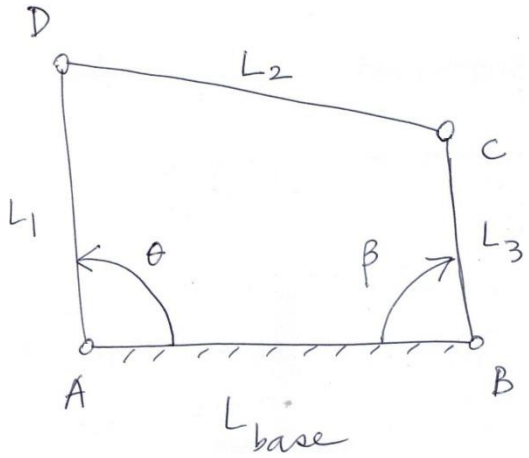
(Not for submission)

1. Read Kutzbach and Grübler's criteria from the textbook (Ghosh and Mallik). Each link in a plane has 3 degrees of freedom. One link in the linkage is fixed to ground, so you consider $n-1$ links. Each hinge removes 2 degrees of freedom (dofs). Each sliding joint removes 2 dofs. Etc. Do read the discussion accompanying Figure 1.37 to understand some ways in which these criteria can fail.

   Then, with this elementary theory, enumerate the links and count the final dofs in the linkages/mechanisms (assume one link will be held fixed, as discussed in class) given in Figures 1.38 (b), 1.39 (a), (b), 1.40 (a), 1.41 (d), (e).

2. Make sure you understand how the Matlab code given works. Discuss the code with your friends. Write similar code to animate motion where there is a triangle rigidly attached to one of the links. Write other code for the situation when link BC is used as a crank.

3. Recall the basic four bar linkage discussed in class, with L_{base}, L_1, L_2, and L_3; and vertices A, B, C and D as marked in class. Let the crank angle be Θ as in class. Let the angle between AB and BC, measured clockwise from AB, be β. It is given that L_{base} = 0.9 m, and L_1 = 0.8 m. If the minimum and maximum values of β over one full rotation of the crank (L_1) are 8 degrees and 140 degrees respectively, find L_2 and L_3. Numerical solution will be required. Do it by hand using your calculator and the Newton-Raphson method. A picture is provided below, but is not really needed and may not be provided on, say, quizzes.



4. In the same problem, let all the data be the same except L_3 = 0.8 m and L_1 is not given. Find L_1 and L_2.

5. For a similar mechanism, given that L_{base}, L_1, L_2, and L_3 are 1 m, 0.7 m, 0.7 m and 0.6 m, respectively, what is the range of angular movement of the crank AD (L_1)?