MAE 4120 - Machine Design II
Project Assignment #1

Objectives

- Analytically determine the position of each link in a linkage and any point on a link
- Write MATLAB code to determine the position of each link in a linkage and any point on a link
- Use the CAD software that comes with the text to determine the position of each link in a linkage and any point on a link
- Evaluate the use of CAD packages for linkage design
- Prepare an effective technical brief- a recommendation based on the comparison of two options

Purpose

You have been given the assignment to evaluate a software package for you company. You want to be able to evaluate position, velocity, and acceleration analyses which are important for the design of your linkages. (In this project, you will learn to use the software that accompanies the Norton text for doing velocity and acceleration analyses of a four-bar linkage. Appendix A in your text is a user's guide that gives detailed information on how to use the software.) Then you will write MATLAB code to serve the same purpose as the commercial code. You will then make a recommendation on purchasing the commercial code vs. writing your own.

Chebyshevsky Linkage

1) Run fourbar
2) From the main menu go to "Examples".
3) Create the Chebyshevsky linkage.
4) Select the defaults for calculating the linkage.
5) Animate the linkage.
6) Print the coupler curve (printing procedure is given later in this lab handout)
7) Plot the angular velocity of the coupler vs. time (this may be difficult)
8) Repeat the plot for the output (link 4)
9) Plot the velocity and acceleration for the coupler vs time (2 separate plots). What are the maximums (absolute value)?

More Linkages

12) Create a 4 bar linkage of your own with a coupler point set off the link axis. You cannot use the default linkages in the program! Select link lengths so that the linkage is Grashoff and repeat steps 5 through 9 for your linkage.

13) Change one link length so that your linkage is non-Grashoff. Repeat steps 5-7

14) Write Matlab code to determine the position, velocity and acceleration for each link in a 4-bar linkage and for any point on link 3. Your code should allow you to input the range on input angles and the increment of the input angle. Develop a way to show the results in a useful form for design.

Report

Submit a short formal report, sometimes called a technical brief. Include the recorded results. Be sure to be clear so that I know what parameters correspond to which results. Include plots. Describe how your linkages compare to the straight-line linkages. Compare your Grashoff and Non-Grashoff linkage. The report must be written from the perspective of evaluating the software for commercial use in design. Compare your matlab code with the commercial code and make a recommendation with justification for your choice.

Grading Rubric

Chebyshevsky Linkage (15 points)
Coupler curve
Velocity vs Time
Output vs Time
Coupler V and Accel. vs T & Max

Grashoff Linkage (15 points)
Coupler curve
Velocity vs Time
Output vs Time & Max
Coupler V and Accel. vs T & Max

Non – Grashoff Linkage (10 points)
Coupler curve
Velocity vs Time
Compare Grashoff and Non - Grashoff

Working MATLAB code (30 points)

Comparison of MATLAB to CAD results & explanation (10 points)

Technical writing/presentation (20)