Homework 4: Graphical Linkage Synthesis Part 2

Graded

Student

Shihong Yuan

Total Points

28 / 30 pts

Question 1

P3 **18** / 20 pts

1.1 **(no title)** **4** / 5 pts

– **0 pts** Correct

✔ – **1 pt** Small error

– **3 pts** Incorrect/Missing steps

– **2 pts** Incorrect/Missing S angle

– **1 pt** Click here to replace this description.

– **0.2 pts** Missing S angle

You mixed up alpha and beta during your calculation for the S angle.

1.2 **(no title)** 4 / 5 pts

– 0 pts Correct

✔ – 1 pt Incorrect/Incomplete angle labeling

– 0.5 pts Incorrect sign

– 0.5 pts Minor drawing error

– 5 pts Incomplete

– 2 pts Missing Angle Labels

– 0.2 pts Define angles in drawing

Label the alpha angle or beta angle on the crank.

1.3 **(no title)** **4** / 4 pts

✔ **– 0 pts** Correct

– 2 pts Incorrect Sketch

– 2 pts Dimensions not Labeled

– 0.5 pts Link mechanism not fully defined

– 4 pts Missing

– 2 pts Incorrect mechanism

1.4 **(no title)** **2** / 2 pts

✔ **– 0 pts** Correct

– 1 pt Missing

– 0.2 pts incorrect lengths

– 0.1 pts Missing a length

– 2 pts Missing Link Lengths (1.3 and 1.4)

1.5 **(no title)** **2** / 2 pts

✔ **– 0 pts** Correct

– 0.5 pts Incorrect

– 2 pts No answer

– 0.2 pts Small mistake

1.6 **(no title)** **2** / 2 pts

✔ **– 0 pts** Correct

– 1 pt Incorrect/Missing Class

– 1 pt Incorrect/Missing Inversion Type

– 0.5 pts Missing crank rocker inversion type in answer

– 2 pts missing

Question 2

P4 **10** / 10 pts

2.1 **(no title)** **6** / 6 pts

✔ **– 0 pts** Correct

– 5 pts No answer

– 1 pt Small error leading to incorrect placement

– 2 pts Large error leading to incorrect placement

– 2 pts Connecting links not drawn/incorrect

– 3 pts No work shown to get final answer

– 3 pts Multiple errors

– 3 pts Missing O1 or O2

– 4 pts Incorrect

2.2 (no title) **4** / 4 pts

✔ **– 0 pts** Correct

– 2 pts Incorrect

Question 3

Penalties **0** / 0 pts

✔ **– 0 pts** Correct

– 3 pts Pages Not Assigned

– 3 pts Less than 1 day late

– 6 pts Less than 2 days late

– 9 pts Less than 3 days late

– 15 pts More than 5 days late

Questions assigned to the following page: 1.1 and 1.2

ME 370 Fall 2025

Homework 4: Advanced Graphical Linkage Synthesis

NAME: shihong yuan UIN: 665247031

Total Points: 25 points

Synthesis is about precisely defining the length of elements to accurately generate the correct motion. Print the assignment out at full size on a normal piece of paper, and use the graphical synthesis tools developed in class to find real lengths. For all of these problems, you will be graded not just on applying the right steps, but also on precision and accuracy.

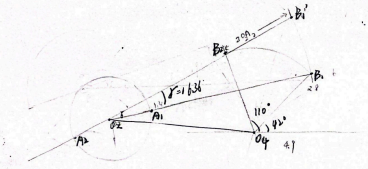
Problem 1 (20 pts): Design a quick return 4 bar linkage whose input is driven by a constant speed motor and whose output oscillates between 42 degrees and 110 degrees with the clockwise motion time being 1.2 times slower than the counter-clockwise motion. The ground pivot points (O_2 and O_4) should not be further than 8 inches apart.

1.1 (5 pt) Calculate the angles needed to achieve this time ratio

$\alpha + \beta = 360^\circ \Rightarrow \beta = 163.63^\circ \Rightarrow \gamma = 163.63^\circ$

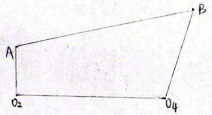
$\frac{\alpha}{\beta} = 1.2$ $\alpha = 196.36^\circ$

1.2 (5 pts) Show the sketch of the graphical construction used to synthesize the quick return mechanism, with important angles indicated.



Questions assigned to the following page: 1.4, 1.5, 1.6, and 1.3

1.3 (4 pts) Draw the final four bar linkage to scale



1.4 (2 pts) List the lengths of all the links

O_2A : crank 1.4 cm
AB : coupler : 6 cm
BO_4 : coupler : 2.8 cm
O_4O_2 : ground link : 4.9 cm

$S+L = 1.4 + 4.9 < 2.8 + 6 = P+Q$

1.5 (2 pts) What is the angle of the GND link measured counter clockwise with respect to the horizontal

It is 0 (180°) for now.
But for the previous page it is 175°

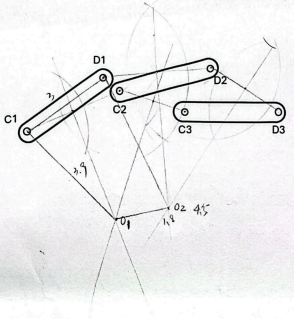
1.6 (2 pts) Identify the class and inversion type of your mechanism

∵ $S+L < P+Q$
∴ Grashof mechanism
first inversion
∵ $S = L_2$
∴ crank - rocker

Questions assigned to the following page: 2.1 and 2.2

Problem 2 (10 pts): Three position synthesis

2.1 (6 pt) Using Graphical Linkage Synthesis, design a four-bar mechanism to give the three positions of the coupler motion shown below.



2.2 (4 pts) Does the mechanism have a toggle position at either of the prescribed positions? If so, how would you overcome this?

No, it doesn't.

Because this is a double crank

$\because$ $S = 1.8$ cm $L = 4.5$ cm $P = 3.1$ cm $Q = 3$ cm

$1.8 + 4.5 < 3.1 + 3$ $\therefore$ No toggle position

Select one of the following options:

My answer was created by a Gen AI algorithm, and I have not modified it

My answer was created by a Gen AI algorithm, and I have made some minor changes.

My answer was created by a Gen AI algorithm, and I have made major changes.

(✓) My answer was created solely by myself.

If I used Gen AI, I used ___ (name of program).