ME 370

Homework 2: Planar Mechanisms – Part 2

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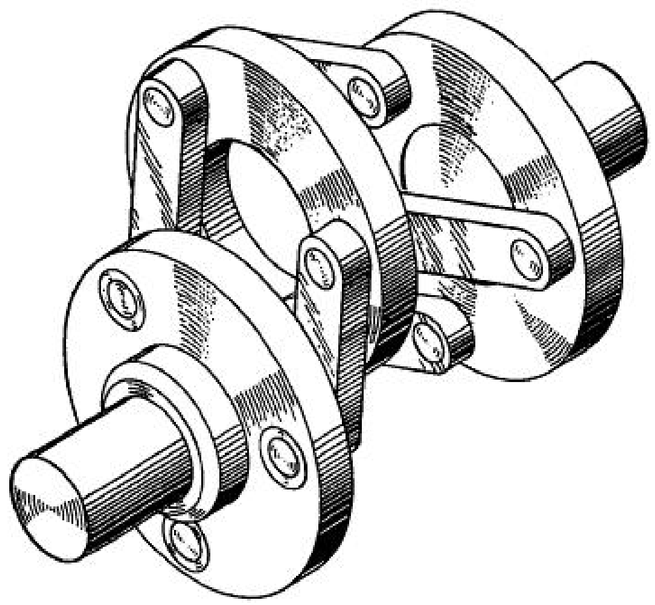
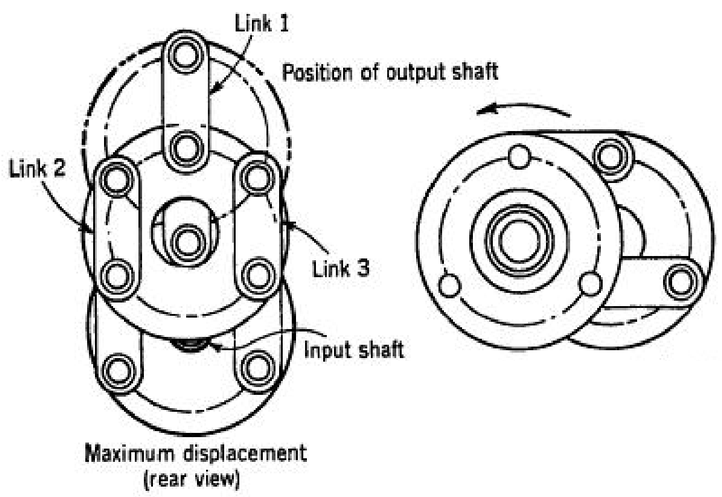
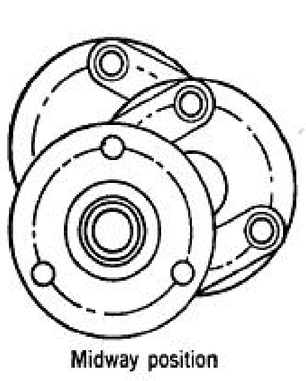
Deadlines and submission information listed on Canvas

Total Points: 25 Points

Problem 1 [10 pts]: Schmidt Coupler







The mechanism on the left, called a Schmidt coupler, is used to transmit rotational motion between 2 parallel shafts with small offset. Watch the following videos:

https://www.youtube.com/watch?v=PKXc7EzgJh4
https://www.youtube.com/watch?v=-ymq2IkL4aI

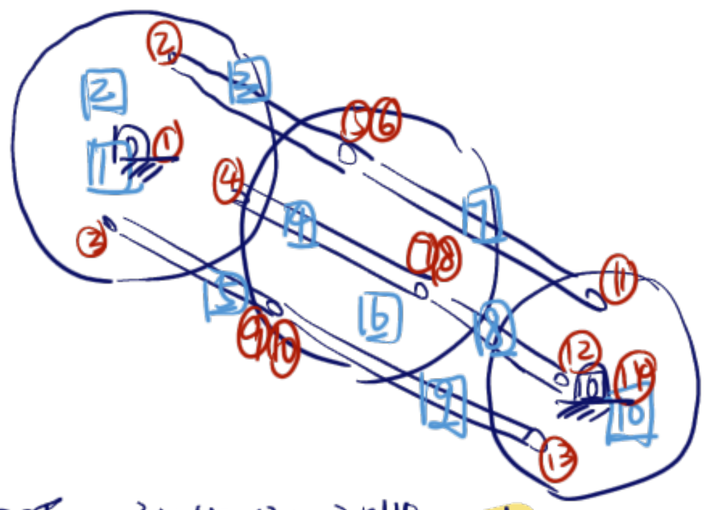
In this problem, assume that the input and output shafts cannot translate, and can only rotate (as seen in the second video)

a) From the videos, how many degrees of freedom do we expect in this mechanism? Explain. (1 pts)

(1a) DOF = 1

Because when right rotate, all of the left move to a center angle, and don't have other freedom.

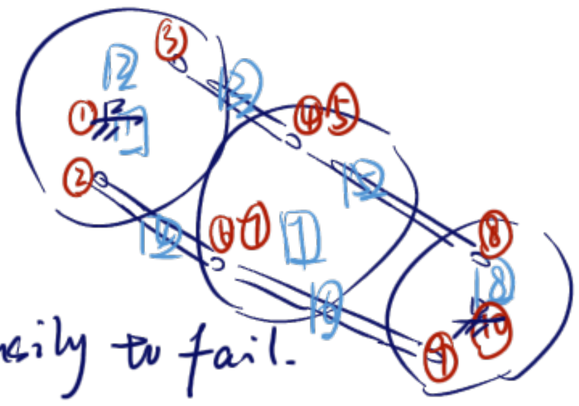
(1b)



(1c) DOF = $3\times(10-1)-2\times14=-1$

(1d) not same, because their are two links are extra, and over constrained, only two links between two input circle is enough They are additional links

(1e)



DOF = $3\times(18-1)-2\times16=1$

(1f) Because they can make the mechanism more easily to steable and not easily to fail. rotation

b) Sketch an equivalent kinematic diagram, with links, joints and ground clearly identified. Assume both the input and output shaft are fixed in position with respect to ground but allowed to freely rotate.
(3 pt)

c) Calculate the degrees of freedom making no special assumptions. (2 pt)

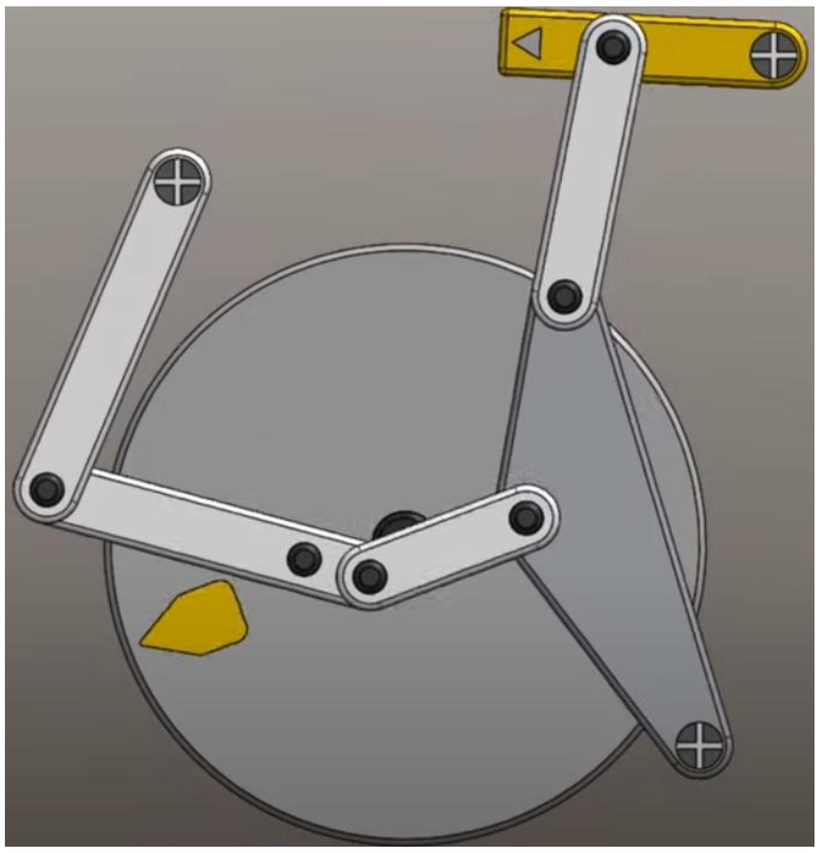
d) Does the computed DOF match the DOF observed? Explain the difference. (1 pts)

e) How do we correctly compute the number of degrees of freedom in this mechanism? Do it! Identify the kind of degrees of freedom. e.g. translation vs rotation (2 pts)

f) If the additional links do not contribute to the degrees of freedom, why are they still included in the mechanism? (1 pt)

Problem 2 [10 pts]: Mechanism Analysis

Watch a video of the mechanism below



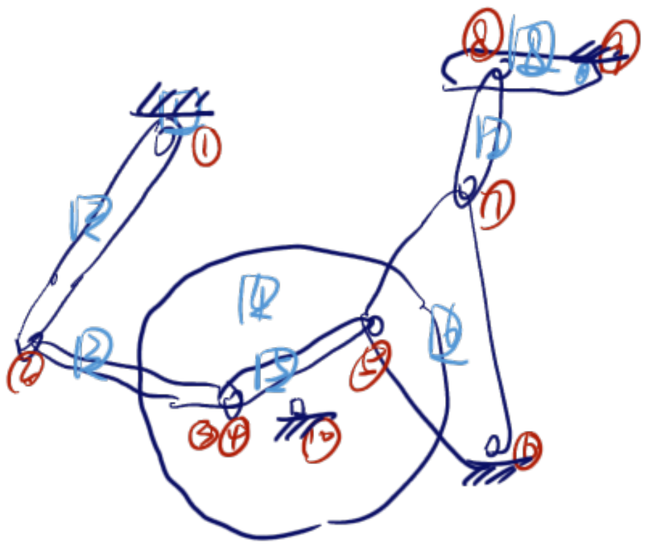
https://www.youtube.com/watch?v=ahFrHYJrorE&t =106s

a) From intuition and experience, how many degrees of freedom do we expect from the mechanism? Explain. (4 pts)

b) Draw a kinematic diagram and analyze the links and joints and DOF of this mechanism. (6 pts)

(a) There is only 1, because when one of the parts move, all the other parts move follow ly.

(b)



DOF = $3 \times (8-1) - 2 \times 10$

$= 1$

Problem 3 [5 pts]: Linkage Treasure Hunt

Once you know what to look for, you realize that linkages are everywhere, and we interact with them every day. A basic skill of mechanical design is dissecting the structure and functionality of real world mechanisms. Practice this skill: Find and analyze **a planar linkage** that you use or see everyday. Pick a mechanism that we did not discuss in class. These linkages should not include gears or cams. For
example, on my way to work today, I passed by a person using a hatchback trunk on their car, a collapsible bike rack, and an emergency fire escape.

(1) Picture

(2) Describing :

The purpose is to cut through hard materials, such as hardened steel bolts, chains .

The way is works is firstly long handles act as a simple lever Secondly between the main handle pivot and the jaw. When user give a force on the handle, the input force will be channeled through a set of short rubust links, so there are two times force becomes larger. then jaw closed and cut.

(3)(4) open.

closed

Agreed And predict can be seen that when link 6 move, all left part move jaw closed as follows. no other freedom.

(5) link 6
full joint 7

DOF = 3x(6-1)-2x7=1 rotational freedom

Select one of the following options:

a) My answer was created by a Gen AI algorithm, and I have not modified it
b) My answer was created by a Gen AI algorithm, and I have made some minor changes.
c) My answer was created by a Gen AI algorithm, and I have made major changes.
d) My answer was created solely by myself.
e) If I used Gen AI, I used ___ (name of program).