

# Kinematics & Dynamics of Machinery (ME 3320)

Recitation - 2

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## 1. Agenda:

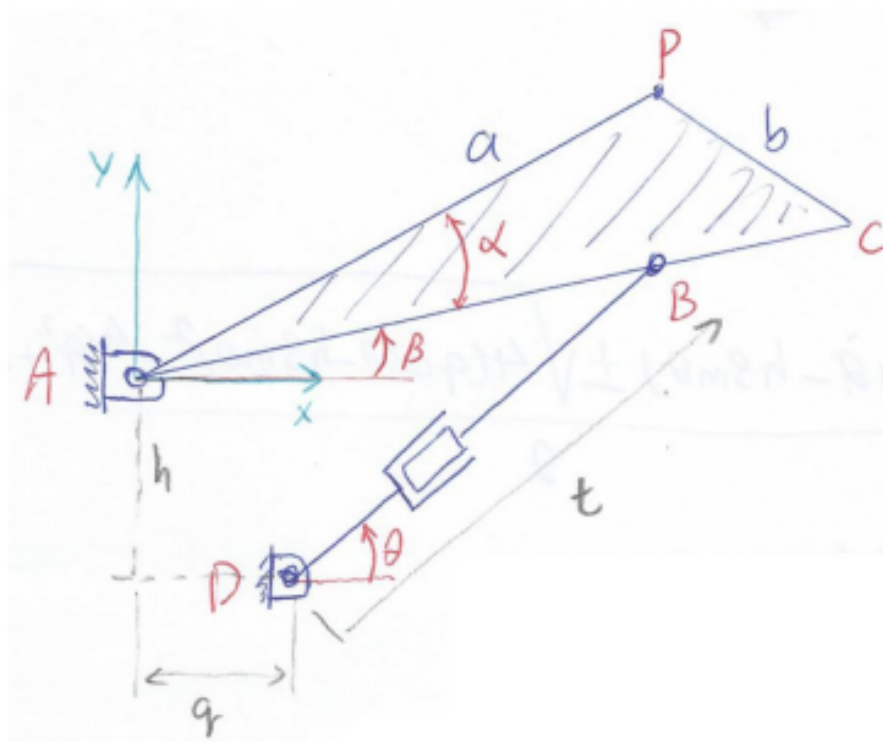
- Revision(Linkage, Mobility)
- Problems(Mobility)

## 2. Revision:

- What is the mobility of a 4-bar Linkage?
- If the mobility is equal to “2”, that means we need to control ..... variables for a given mechanism.
- What are the 6 steps that are essential in the derivation of the vector equation for the position analysis of a 4-bar linkage?
- What are the two ways of finding the dependent variables in a 4-bar linkage problem?
  1. ....
  2. ....
- What idea is the ‘distance constraint’ method based on?
- What idea is the ‘loop equations’ based on?

### 3. Problems:

- The linkage shown below is a kinematic sketch of a closing door mechanism with given dimensions. The acceptable value of the prismatic joint is:  $5 < t < 15$ .



**1) Calculate the Mobility of this linkage**

**2) What are the coordinates of points A, B & D?**

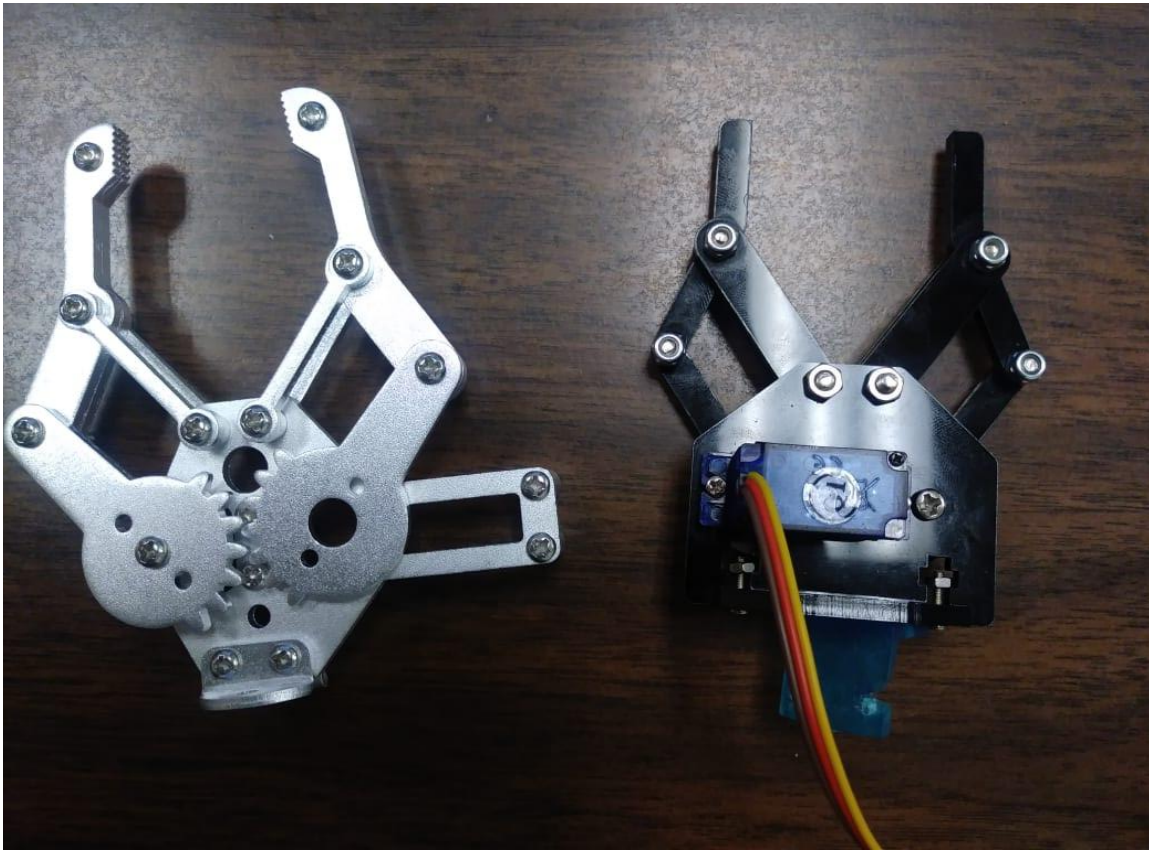
**3) For the defined reference frame and given  $\theta$ , perform the position analysis:**

**3. a) Using the distance constraint method, compute the dependent variable  $t(\theta)$  analytically as an explicit function of the input angle  $\theta$ . Consider the length of  $\overline{AB}$  as the fixed distance.**

**3. b) Formulate the loop equation and solve it to find the explicit equation for dependent variable  $\beta(\theta)$**

**(This problem will return in Recitation-3)**

- **Demo:**  
There are several applications of Linkage design around us. One common application is given below:



1. What is this part called?
2. What is its relevance in the Kinematics class?
3. Can you suggest any approaches to use this to balance between holding and squeezing?

(Demo: Run the system using a potentiometer)

**Bibliography:**

- **Dr. Deemyad's Notes**

## Miscellaneous:

- For avid googlers:
  - Watts Linkage
  - Pantograph
  - Ornithopter
  - Compliant Mechanism
- If you like 3D models:
  - Thangs.com
  - Thingiverse.com
- [Even Ironman uses 4-bar Linkage!](#)