

## Design Mechanisms

Any existing design can be improved (Inspiration behind designing)

- Parallel Jaw Pliers  
<https://www.youtube.com/watch?v=8uxwHwmi55s> (Use)  
<https://www.youtube.com/watch?v=TbdkXOo0z94> (Mechanism)

Some Basic tools you'll be using

- nut-bolt, screws, washers, hammer, wrench, pliers

## **MECHANICAL COMPONENTS**

### **Gears**

Gears are toothed cylindrical or conical wheels used for power transmission with or without speed reduction

Types of gears:

- Spur - transmitting power between parallel shafts
- Helical - can be used for non parallel shafts
- rack and pinion - convert rotation to linear motion
- Bevel - transmitting power between perpendicular intersecting shafts
- Hypoid - similar to bevel but there is shafts can be offset
- Worm and worm wheel - large speed reduction possible

### **Bearings**

They support the shaft at the same time allow rotation with very low friction.

- Rotary Bearings
- Linear Bearings

## **ACTUATORS**

An **actuator** is a component of a machine that is responsible for moving and controlling a mechanism or system, or in simple terms a mover.

Types of actuators:

- Electric
  - DC motors
  - Servo motor
  - Stepper motor
  - Linear actuator
- Hydraulic
- Pneumatic
- Mechanical

Rack and pinion is a type of mechanical actuator that converts one form of motion to another

## MACHINES

- Drill, grinder, lathe, saw
- CNC

## SOME COMMON DESIGN MECHANISMS

### CAM mechanism

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[CAM](#)

### Linkage Mechanism

Linkage: A system of links connected at joints with rotary or linear bearings

- Link: A rigid body that possess at least 2 nodes, which are the attachment points to other links
- Joint (kinematic pairs): Connection between two or more links at their nodes, which allows motion to occur between the links

Degree of Freedom: The number of input motions required in order to provide the desired output. For most cases, the DoF is equal to the number of actuators in a device.

### 4-Bar Linkage Mechanisms

4-Bar Linkage mechanisms are the most used form of linkage mechanisms.

The 4 types of links used in this mechanism are:

Fixed link, crank, coupler, rocking arm

<https://www.youtube.com/watch?v=KBFFwgCCP0U>

However this is the most basic form and several modifications have already been done on this.

- 4 bar parallelogram
- Crank slider mechanism

<https://www.cs.cmu.edu/~rapidproto/mechanisms/chpt5.html>

### HOECKENS mechanism

Hoeckens mechanism is a type of 4 bar linkage mechanism that converts a rotational motion into an approximate straight line motion.

[https://www.youtube.com/watch?v=\\_KWfkewD0Rg](https://www.youtube.com/watch?v=_KWfkewD0Rg)

A walking machine using Hoeckens mechanism

<https://www.youtube.com/watch?v=2fwz9vatJR0>

(EXTRA : Combining hoeckens with jansen <https://www.youtube.com/watch?v=ebb8FotCfE0>)

**Reciprocating Motions** : It is a term used for repetitive up-down or back-forth linear motion. Most of the following mechanisms will involve the use of this motion

### **SLIDER CRANK Mechanism**

Crank are the opposite of CAMs that is they are used to convert translational motion to rotational motion.

<https://www.youtube.com/watch?v=ZO8QEG4x0wY>

Crankshaft mechanism is mainly used in car designs.

### **SCOTCH YOKE mechanism**

The **Scotch Yoke** (also known as slotted link **mechanism**) is a reciprocating motion **mechanism**, converting the linear motion of a slider into rotational motion, or vice versa. The piston or other reciprocating part is directly coupled to a sliding **yoke** with a slot that engages a pin on the rotating part.([wiki](#))

<https://www.youtube.com/watch?v=hsaoTo1vuY4>

You can also modify the scotch yoke mechanism to create different motions. One such possibility involves removing the constraints keeping the shaft linear and adding a hinge on one side. This will replicate a waving motion.

Lead Screw