Summary | Dynamics

Introduction

Mechanism

An assembly of machine components (kinematic links) designed to obtain a desired motion from an available motion while transmitting appropriate forces and moments.

Simple mechanisms

- Lever
- Pulley
- Gear trains
- Belt and chain drive
- Four bar linkage

Other mechanisms

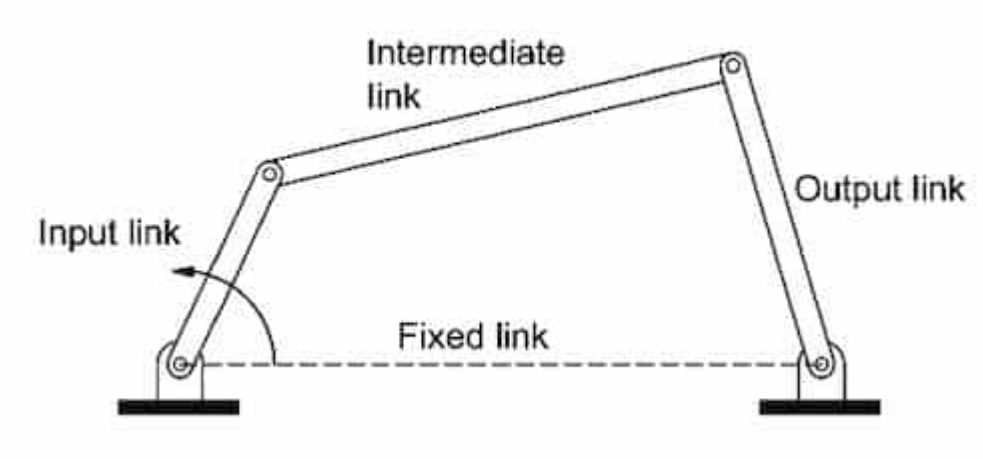
- Lock stitch mechanism (used in sewing machine)
- Geneva mechanism
  Constant rotational motion to intermittent rotational motion. mostly used in watches.
- Scotch yoke mechanism
  Constant rotational motion to linear motion (vice versa.). Mainly used as valve actuators in high pressure gas pipelines.

Four bar linkage

Four bar-shaped members connected to each other in one plane.

Usually:

- 1 fixed link + 3 moving links
- 4 pin joints
- 2 moving pivots + 2 fixed pivots



- **input link** - usually denoted in the left.
- **output link** - usually denoted in the right.
- **coupler** - intermediate link
- **frame** - fixed link

Grashof’s law

A four bar mechanism has at least one revolving link **if** $l_0 + l_3 \leq l_1 + l_2$.

Here: l_0, l_1, l_2, l_3 are the length of four bars from shortest to longest.

Modes of motions

Mechanism	Action
Crank rocker	Shortest link is the input link
Double crank	Shortest link is the fixed link
Double rocker	Shortest link is the coupler link

crank means a link that makes a full revolution. **rocker** means a link that doesn’t make a full revolution.

Crank rocker mechanism

Shortest link rotates a full revolution. Output link oscillates.

Double crank mechanism

Shortest link is fixed. Both input and output links rotates a full revolution.

Double rocker mechanism

Shortest link make full resolution. Input and output links makes a full revolution.

Special cases

$l_0 + l_3 = l_1 + l_2$.

Mechanism	Orientation
Parallelogram linkage or anti-parallelogram linkage	Equal links are opposite to each other
Deltoid linkage	Equal links are adjacent to each other

Parallelogram linkage

Double crank mechanism. Opposite links are equal and parallel. Angular velocity of input crank & output crank is same. Orientation of the coupler doesn’t change during the motion.

Anti-parallelogram linkage

Double crank mechanism. Angular velocity of input crank is different to output crank.

Deltoid linkage

- Longest link is fixed: crank rocker mechanism
- Shortest link is fixed: double crank mechanism

Non-Grashof’s condition

A four bar mechanism with the property **if** $l_0 + l_3 > l_1 + l_2$.

Here: l_0, l_1, l_2, l_3 are the length of four bars from shortest to longest.

Three links are in oscillation.