Date: 8 -1- 2025

1. Define mechanism.
2. Define kinematic link, kinematic pair.

Date: 10 -1- 2025

3. Degree of freedom of planar mechanism.

GRUBLER'S RULE

Degrees of freedom/mobility of a mechanism:

It is the number of inputs (number of independent coordinates) required to describe the configuration or position of all the links of the mechanism, with respect to the fixed link at any given instant.

Grubler's equation:

Number of degrees of freedom of a mechanism is given by

$F = 3(n-1)-2l-h$.

Where,

F = Degrees of freedom

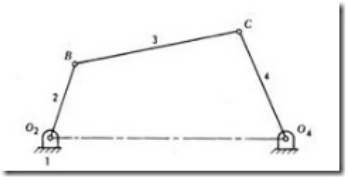
n = Number of links = $n_2 + n_3 + \ldots\ldots + n_j$, where, n_2 = number of binary links, n_3 = number of ternary links…etc.

l = Number of lower pairs, which is obtained by counting the number of joints. If more than two links are joined together at any point, then, one additional lower pair is to be considered for every additional link.

h = Number of higher pairs

Examples of determination of degrees of freedom of planar mechanisms:

(i)



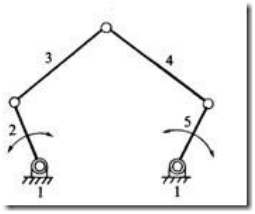
$F = 3(n-1)-2l-h$

Here, $n_2 = 4$, $n = 4$, $l = 4$ and $h = 0$.

$F = 3(4-1)-2(4) = 1$

I.e., one input to any one link will result in definite motion of all the links.

(ii)



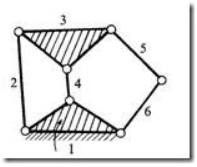
$F = 3(n-1)-2l-h$

Here, $n_2 = 5$, $n = 5$, $l = 5$ and $h = 0$.

$F = 3(5-1)-2(5) = 2$

I.e., two inputs to any two links are required to yield definite motions in all the links.

(iii)



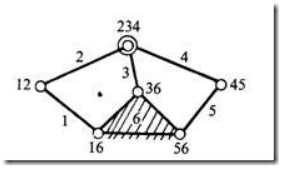
F = 3(n-1)-2l-h

Here, $n_2 = 4$, $n_3 = 2$, n = 6, l = 7 and h = 0.

F = 3(6-1)-2(7) = 1

I.e., one input to any one link will result in definite motion of all the links.

(iv)

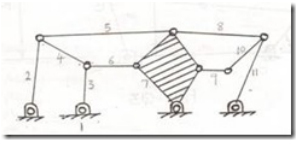


F = 3(n-1)-2l-h

Here, $n_2 = 5$, $n_3 = 1$, n = 6, l = 7 (at the intersection of 2, 3 and 4, two lower pairs are to be considered) and h = 0.

F = 3(6-1)-2(7) = 1

(v)

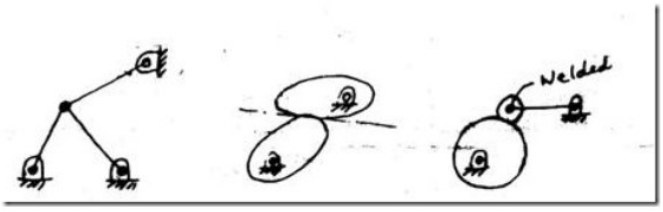


F = 3(n-1)-2l-h

Here, n = 11, l = 15 (two lower pairs at the intersection of 3, 4, 6; 2, 4, 5; 5, 7, 8; 8, 10, 11) and h = 0.

F = 3(11-1)-2(15) = 0

(vi) Determine the mobility of the following mechanisms.



(a)

F = 3(n-1)-2l-h

Here, n = 4, l = 5 and h = 0.

F = 3(4-1)-2(5) = -1

I.e., it is a structure

(b)

F = 3(n-1)-2l-h

Here, n = 3, l = 2 and h = 1.

F = 3(3-1)-2(2)-1 = 1

(c)

F = 3(n-1)-2l-h

Here, n = 3, l = 2 and h = 1.

F = 3(3-1)-2(2)-1 = 1

Date: 13 – 01 - 2025

4. Inversion of mechanism: inversion of 4- bar mechanism, inversion of slider cranks mechanism, inversion of double slider mechanism.

5. Grashof's Law