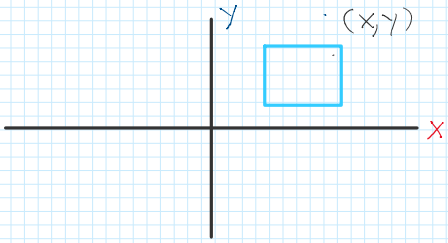
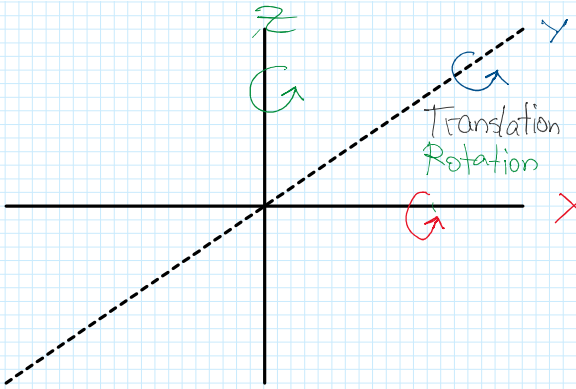
# Degrees of Freedom 3102

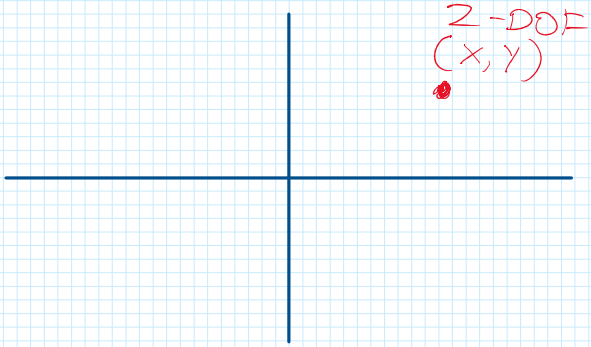
Sunday, 14 September 2025 2:19 pm



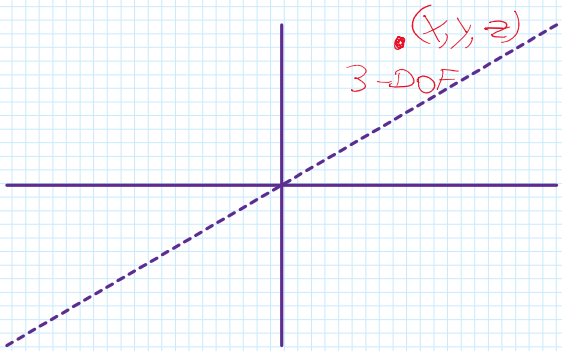

1 - DOF
+ 1 - DOF
2 - DOF



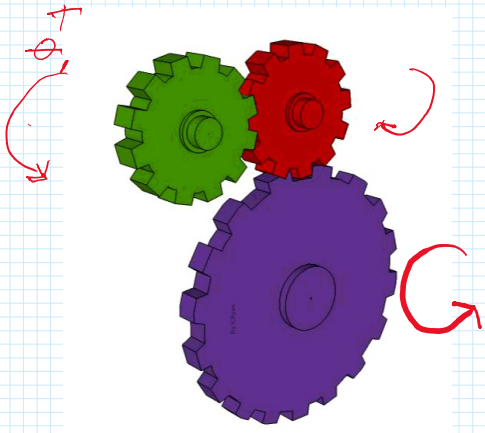

Translation 3 - DOF
Rotation 3 - DOF
X 6 - DOF

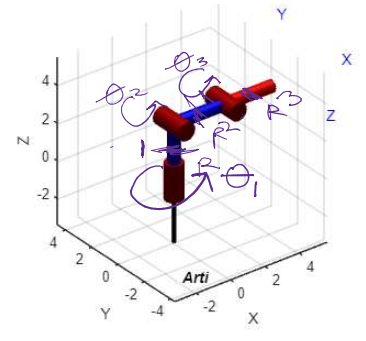


2 - DOF
(x, y)




3 - DOF



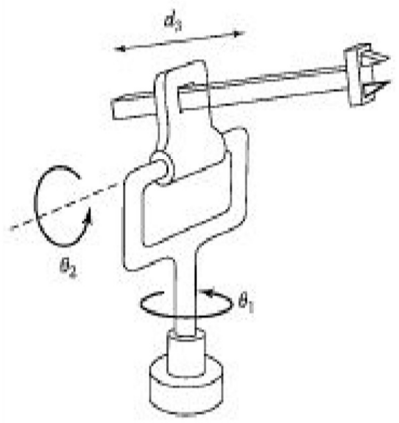




$m = 3$
n = 4
$C_{i1} = 1$
$C_{i2} = 1$
$C_{i3} = 1$

Formula: M = 6(n-1) - $\sum_{i=1}^{m}(6 - Ci)$
M = 6(4-1) - [(6-1) + (6-1) + (6-1)]
M = 6(3) - (5 + 5 + 5)
M = 18 - 15
M = 3-DOF

$\therefore$ *This is an under − actuated spatial manipulator with* $3 - dof$.

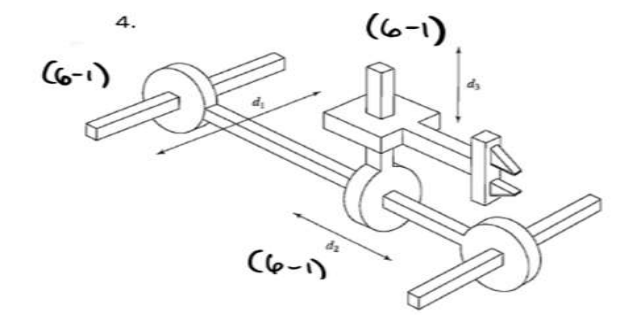
# Example 1: RRP Spherical Manipulator




$m = 3$
n = 4
$C_{i1} = 1$
$C_{i2} = 1$
$C_{i3} = 1$

Formula: M = 6(n-1) - $\sum_{i=1}^{m}(6 - Ci)$
M = 6(4-1) - [(6-1) + (6-1) + (6-1)]
M = 18 - (5 + 5 + 5)
M = 18 - 15
M = 3-DOF

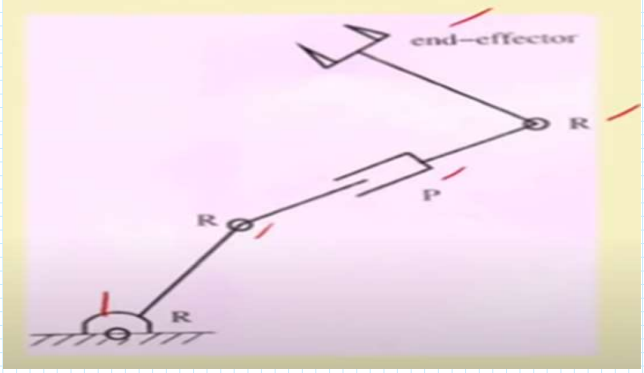
$\therefore$ *This is an under − actuated spatial manipulator with* $3 - dof$.




$m = 3$
n = 4
$C_{i1} = 1$
$C_{i2} = 1$
$C_{i3} = 1$

Formula: M = 6(n-1) - $\sum_{i=1}^{m}(6 - Ci)$
M = 6(4-1) - [(6-1) + (6-1) + (6-1)]
M = 18 - (5 + 5 + 5)
M = 18 - 15
M = 3-DOF

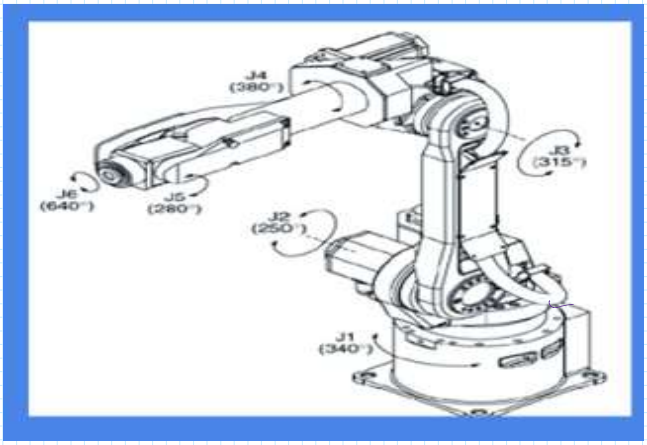
$\therefore$ *This is an under − actuated spatial manipulator with* $3 - dof$.




$m = 4$
n = 5
$C_{i1} = 1$
$C_{i2} = 1$
$C_{i3} = 1$
$C_{i4} = 1$

Formula: M = 3n - $\sum_{i=1}^{m}(3 - Ci)$
M = 3(5-1) - [(3-1) + (3-1) + (3-1) + (3-1)]
M = 12 - (2 + 2 + 2 + 2)
M = 12 - 8
M = 4

$\therefore$ *This is a reduntant planar manipulator with Mobility of* 4.




$m = 6$
n = 7
$C_{i1} = 1$
$C_{i2} = 1$
$C_{i3} = 1$
$C_{i4} = 1$
$C_{i5} = 1$
$C_{i6} = 1$

Formula: M = 6(n-1) - $\sum_{i=1}^{m}(6 - Ci)$
M = 6(7-1) - [(6-1) + (6-1) + (6-1) + (6-1) + (6-1) + (6-1)]
M = 36 - (5 + 5 + 5 + 5 + 5 + 5)
M = 36 - 30
M = 6-DOF

$\therefore$ *This is an Ideal Spatial manipulator with* $6 - dof$.

d
θ
θ
z
y
O
x
θ
θ
d
θ
θ
θ
θ
θ
d