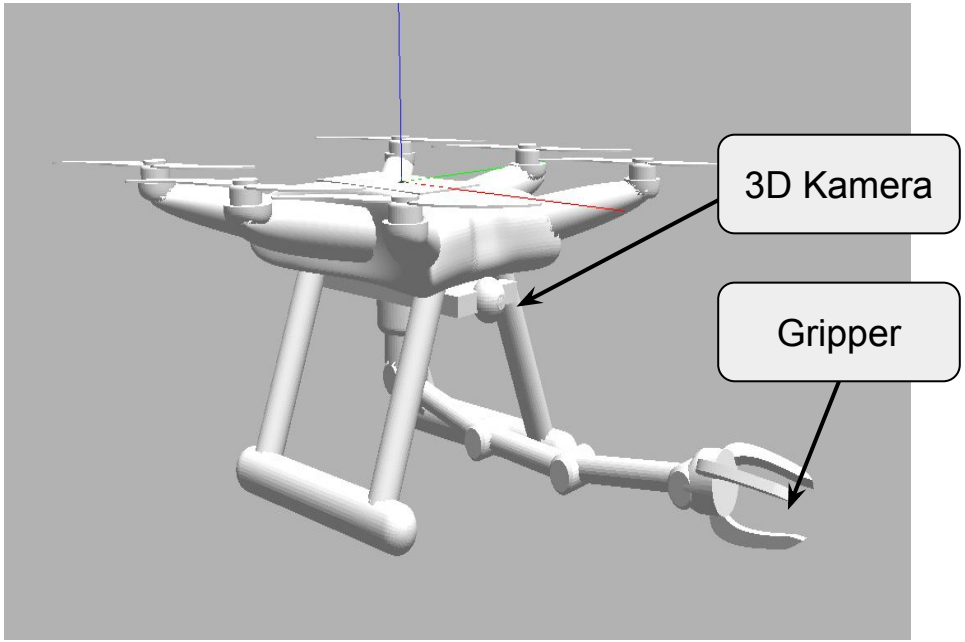
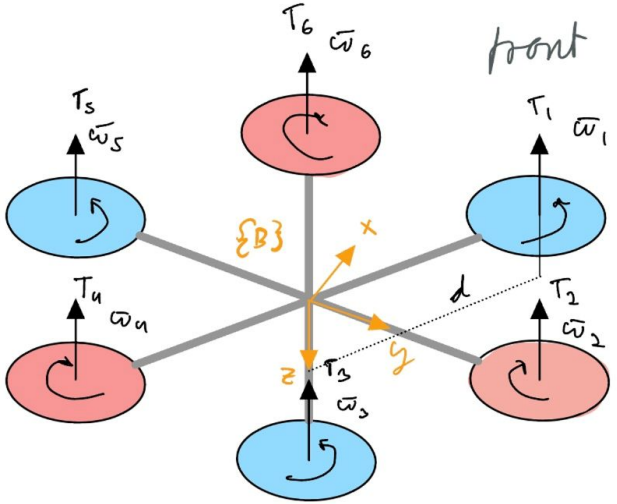
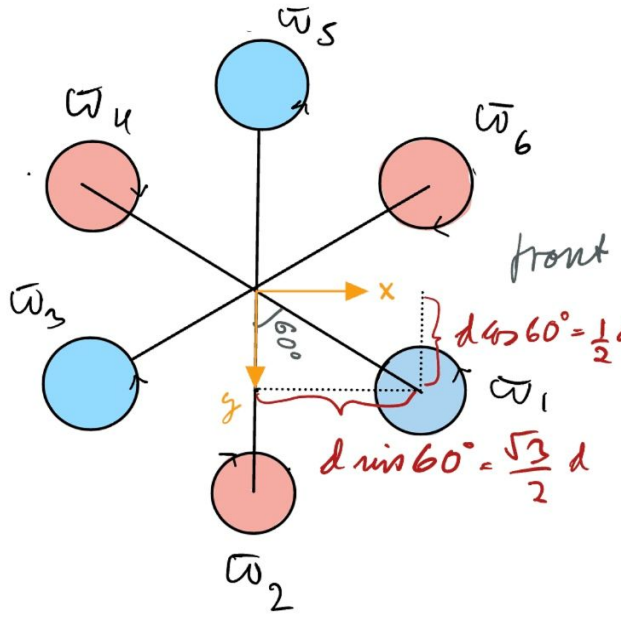
ELE306 Gruppe 6: Magnus Anthun, Eskil Digernes, Stian Flåten, Joakim Johansen, Asbjørn Tjensvold

# Robot design challenge 6: **Hexacopter for picking fruits from trees**



# Kinematisk og matematisk modell




$$T = b\varpi_i^2, \qquad i = 1, 2, 3, 4, 5, 6$$

$$\tau_x = db(\varpi_2^2 - \varpi_5^2 + \tfrac{1}{2}(\varpi_1^2 + \varpi_3^2 - \varpi_4^2 - \varpi_6^2))$$

$$\tau_y = db\tfrac{\sqrt{3}}{2}(\varpi_1^2 + \varpi_6^2 - \varpi_3^2 - \varpi_4^2)$$

$$\tau_z = k(\varpi_1^2 + \varpi_3^2 + \varpi_5^2 - \varpi_2^2 - \varpi_4^2 - \varpi_6^2)$$

*T: kraft*

*b: oppdrift konstant*

*$\varpi$: rotorhastighet*

*i: antall rotorer*

*d: lengde fra senter til rotor*

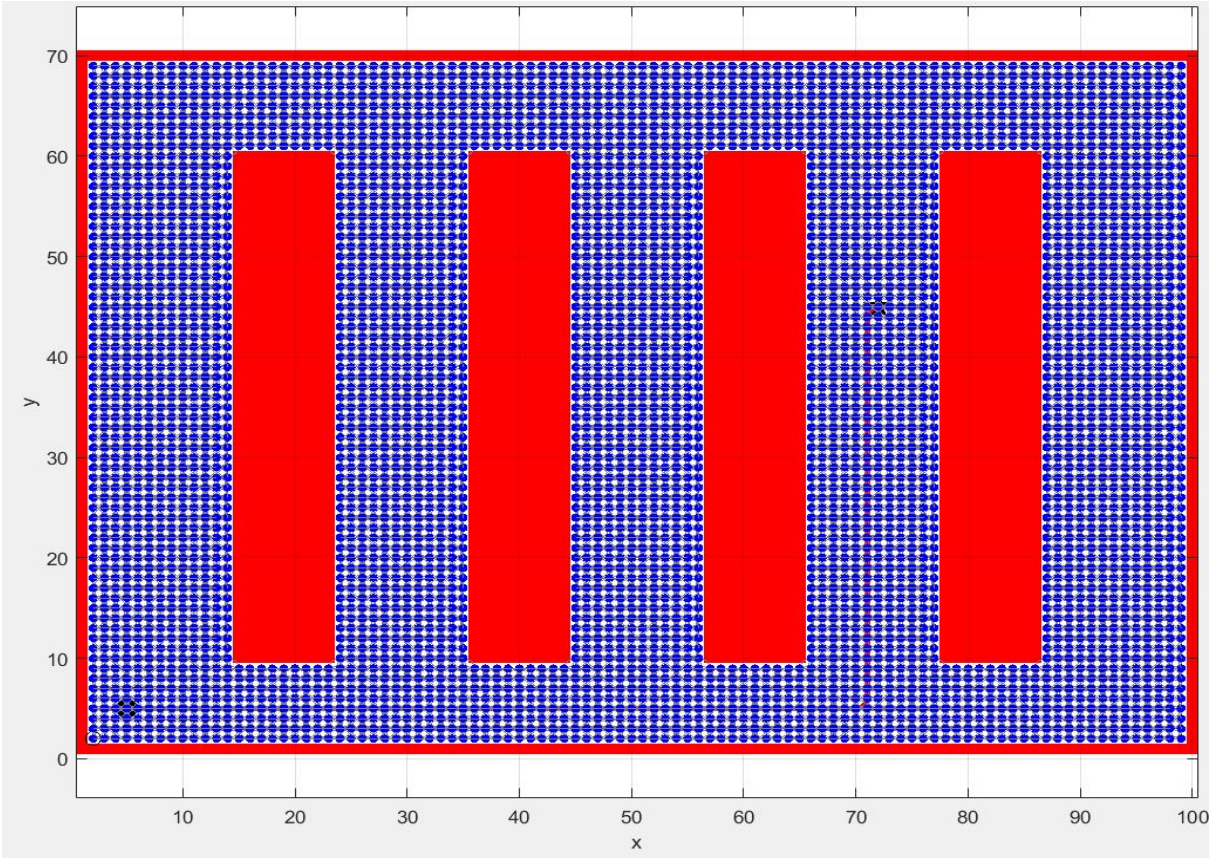
*$\tau$: dreiemoment*

*k: lufttetthet*

$$\begin{pmatrix} T \\ \tau_x \\ \tau_y \\ \tau_z \end{pmatrix} = \begin{pmatrix} -b & -b & -b & -b & -b & -b \\ \frac{1}{2}db & db & \frac{1}{2}db & -\frac{1}{2}db & -db & -\frac{1}{2}db \\ \frac{\sqrt{3}}{2}db & 0 & -\frac{\sqrt{3}}{2}db & -\frac{\sqrt{3}}{2}db & 0 & \frac{\sqrt{3}}{2}db \\ k & -k & k & -k & k & -k \end{pmatrix} \begin{pmatrix} \varpi_1^2 \\ \varpi_2^2 \\ \varpi_3^2 \\ \varpi_4^2 \\ \varpi_5^2 \\ \varpi_6^2 \end{pmatrix} = A \begin{pmatrix} \varpi_1^2 \\ \varpi_2^2 \\ \varpi_3^2 \\ \varpi_4^2 \\ \varpi_5^2 \\ \varpi_6^2 \end{pmatrix}$$

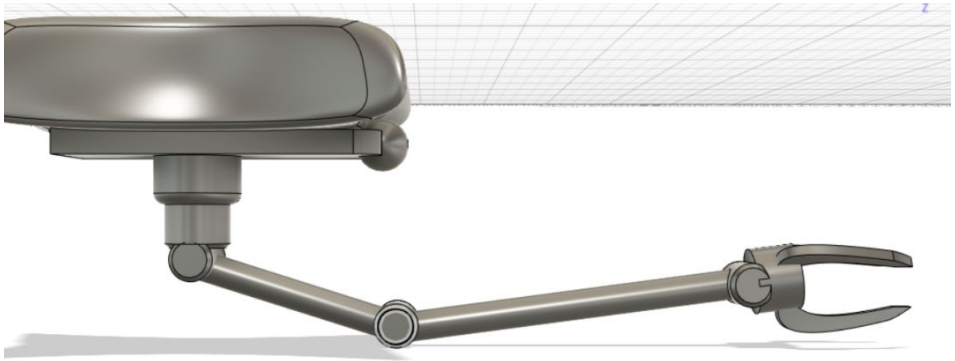
# Navigering

- Svingradius på 10 cm
- Frukthage størrelse 70 $m^2$
- Navigere mellom trær
- For ikke-holonomiske kjøretøy



# Forward kinematics og DH-parameter

- RRRR arm
- 4 akser
- 4DOF

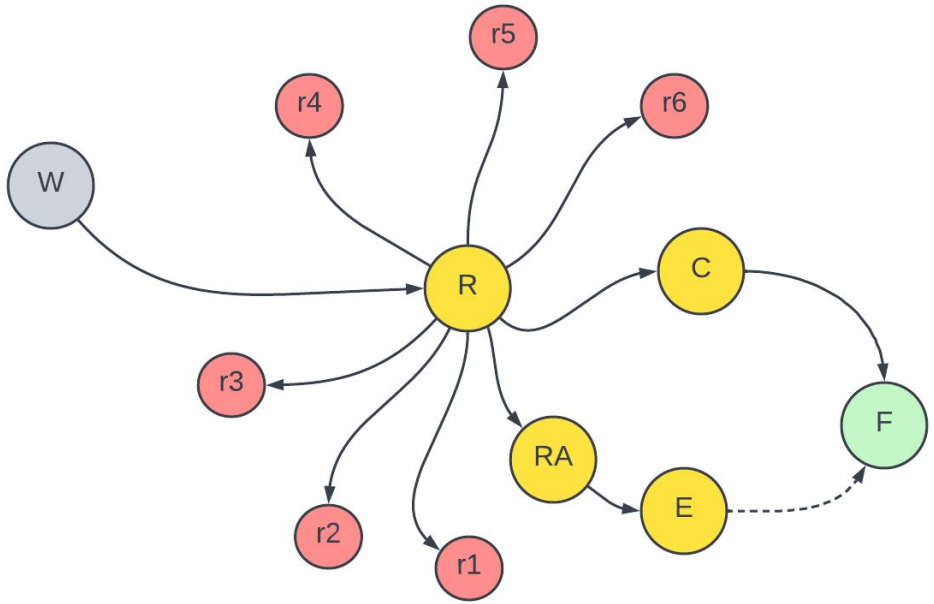


noname:: 4 axis, RRRR, stdDH, slowRNE

| j | theta | d | a | alpha | offset |
|---|---|---|---|---|---|
| 1 | q1 | -200 | 0 | 1.5708 | 0 |
| 2 | q2 | 0 | 250 | 0 | 0 |
| 3 | q3 | 0 | 450 | 0 | 0 |
| 4 | q4 | 0 | 100 | 0 | 0 |

# Transformation Mapping

- W → Verden (GPS)
- R → Robotbase
- C → 3D kamera
- RA → Robotarm
- E → End effector
- F → Frukt
- r(n) → Rotorer



# Veien videre

- Fullføre kontroller og navigasjon
- Gazebo/matlab simulering