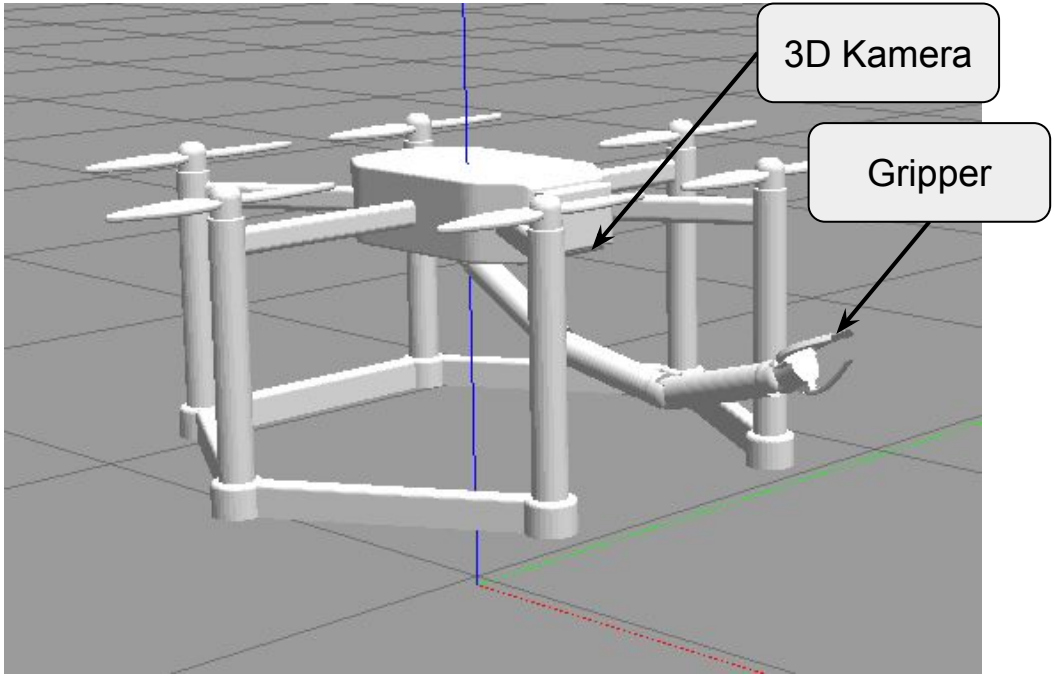
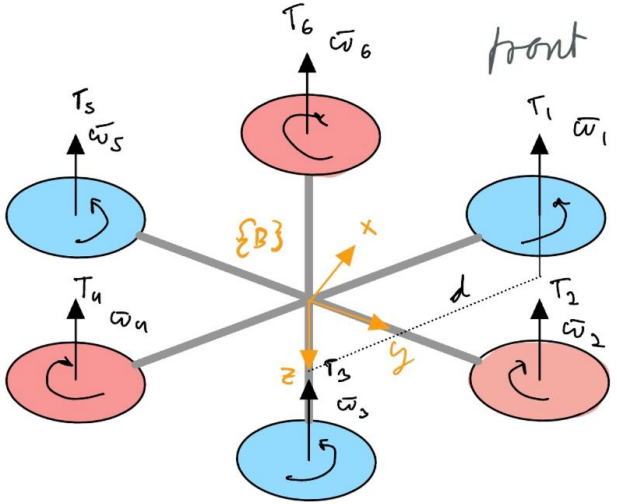
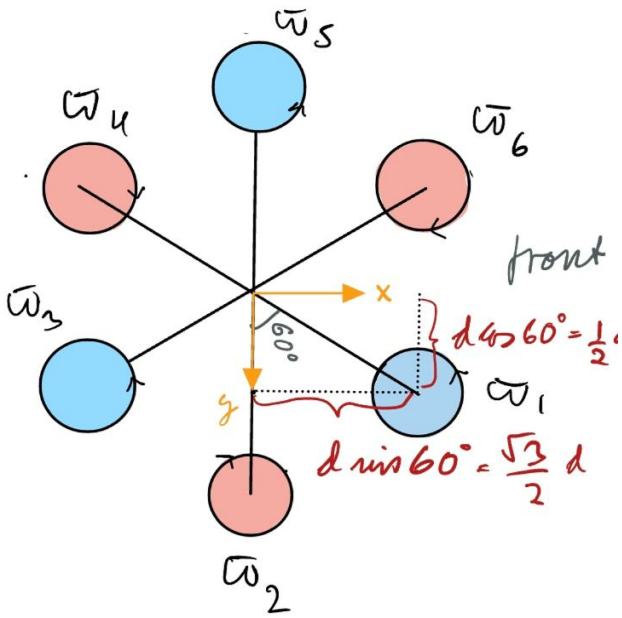
ELE306 Gruppe 6: Magnus Anthun, Eskil Digernes, Stian Flåten, Joakim Johansen, Asbjørn Tjensvold

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





Kinematics av basen



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

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

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

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

T: kraft

b: oppdrift konstant

ϖ: rotorhastighet

i: antall rotorer

d: lengde fra senter til rotor

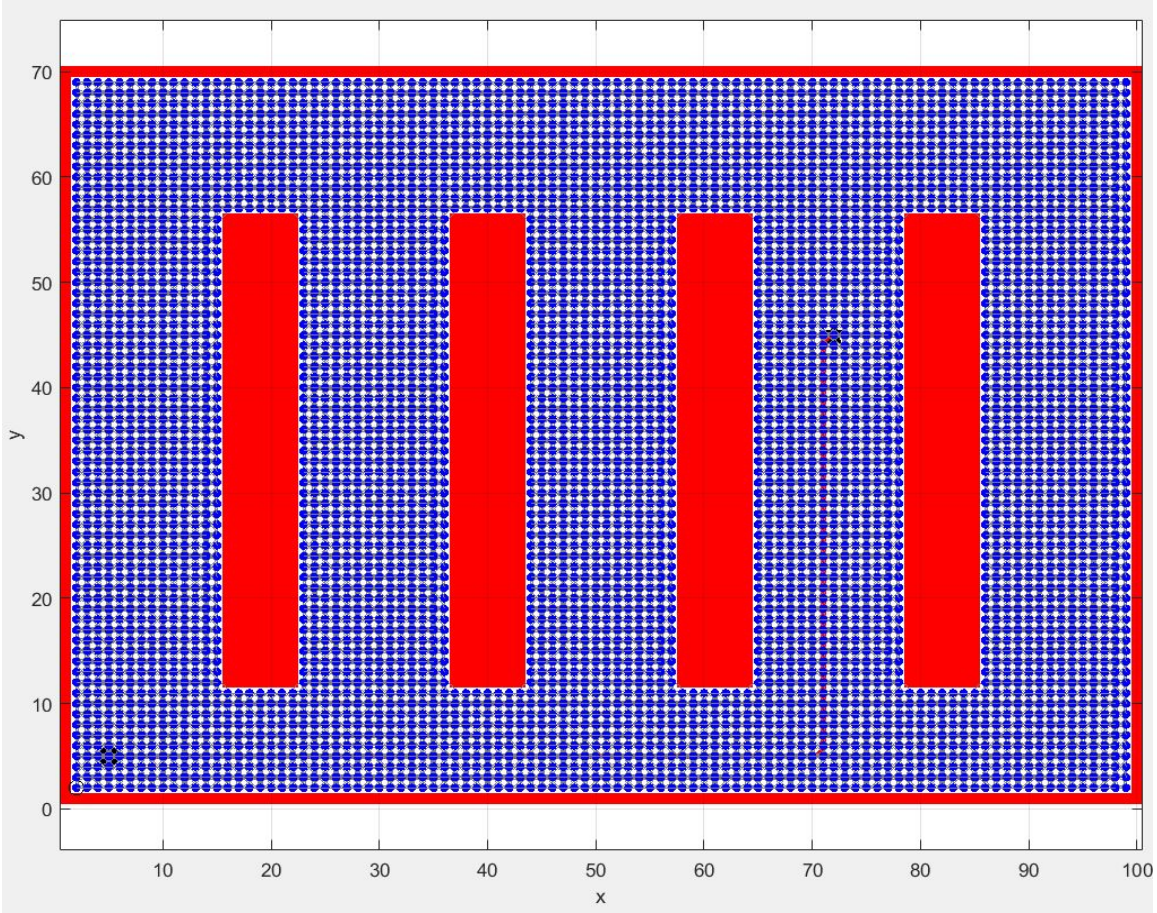
τ: dreiemoment

k: lufttetthet

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

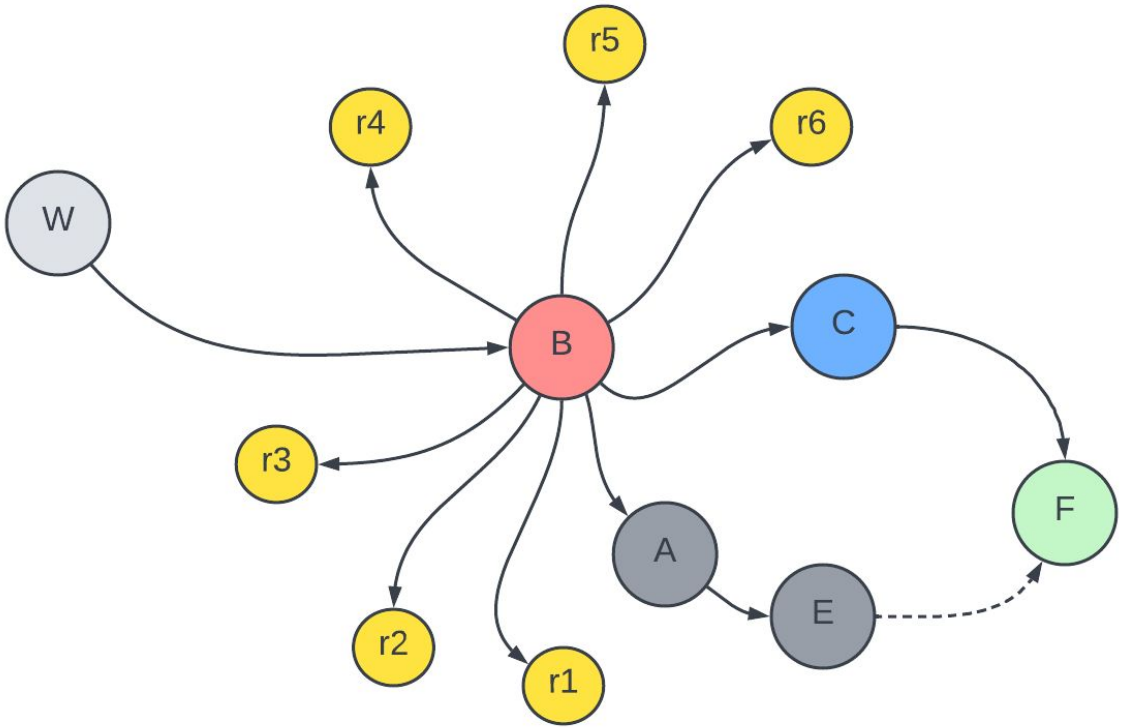
Navigering

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



Transformation Mapping

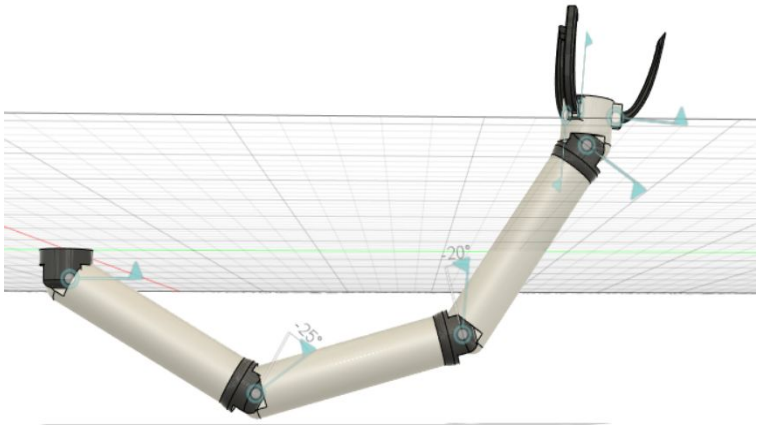
- W → Verden (GPS)
- B → Robotbase
- C → 3D kamera
- A → Robotarm
- E → End effector
- F → Frukt
- r(n) → Rotorer

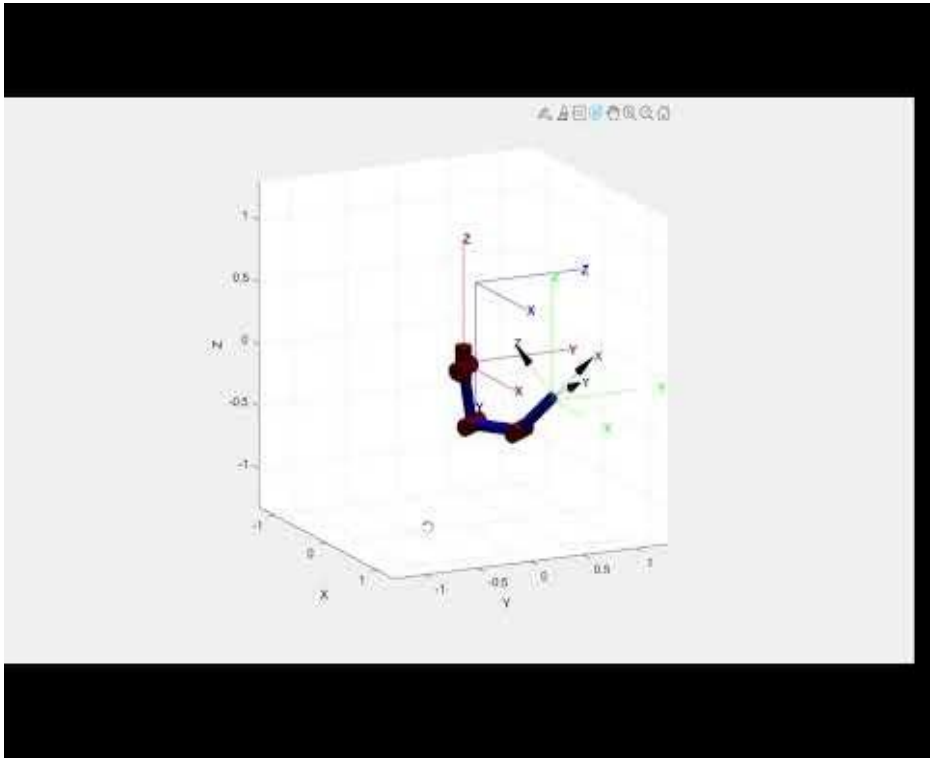


Kinematics & Inverse Kinematics

```
T05= T01*T12*T23*T34*T45
```

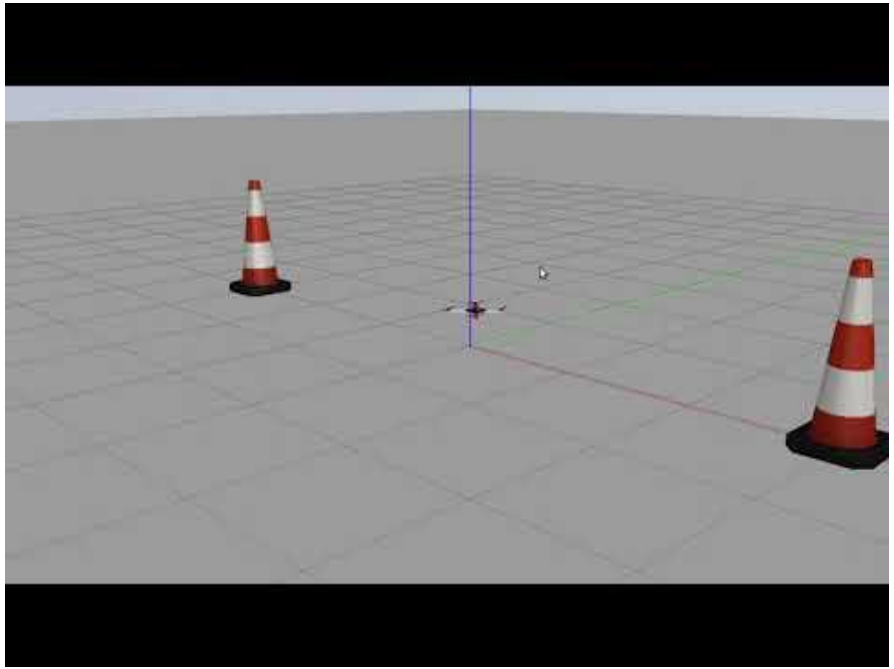
```
T05 = 4×4
      1.0000         0         0    1.4200
           0    1.0000         0         0
           0         0    1.0000   -0.0400
           0         0         0    1.0000
```



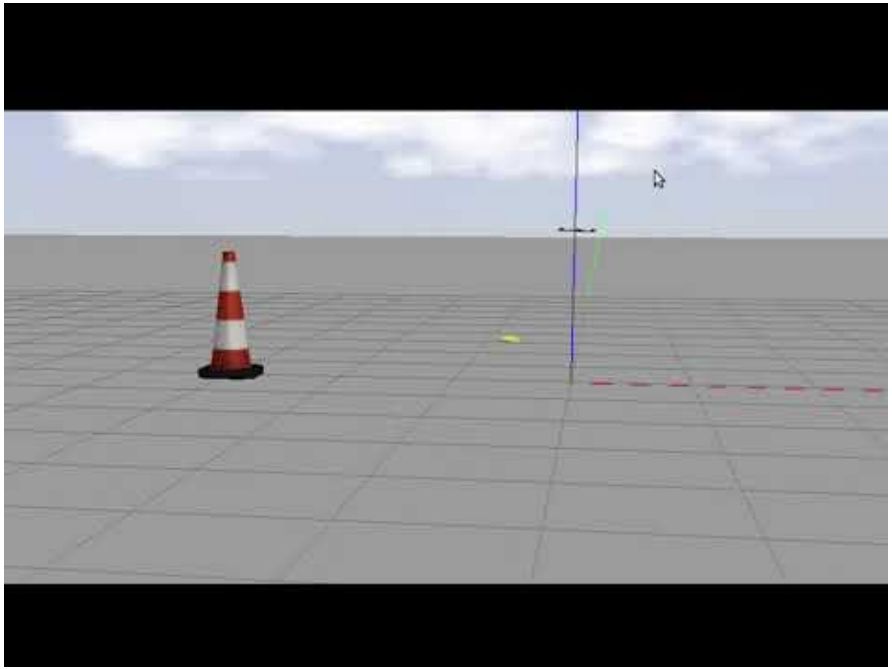


Gazebo

Med PID



Uten PID



Veien videre

- Fullføre kontroller og navigasjon
- Gazebo/matlab simulering
- Trajectory planning
- Differential kinematics