MARIN

BETTER SHIPS, BLUE OCEANS

MOSES

Control of a full port-to-port mission for a feeder vessel

Bas J. de Kruif, Ed F. G. van Daalen, H. Cozijn, G. Iavicoli

Introduction

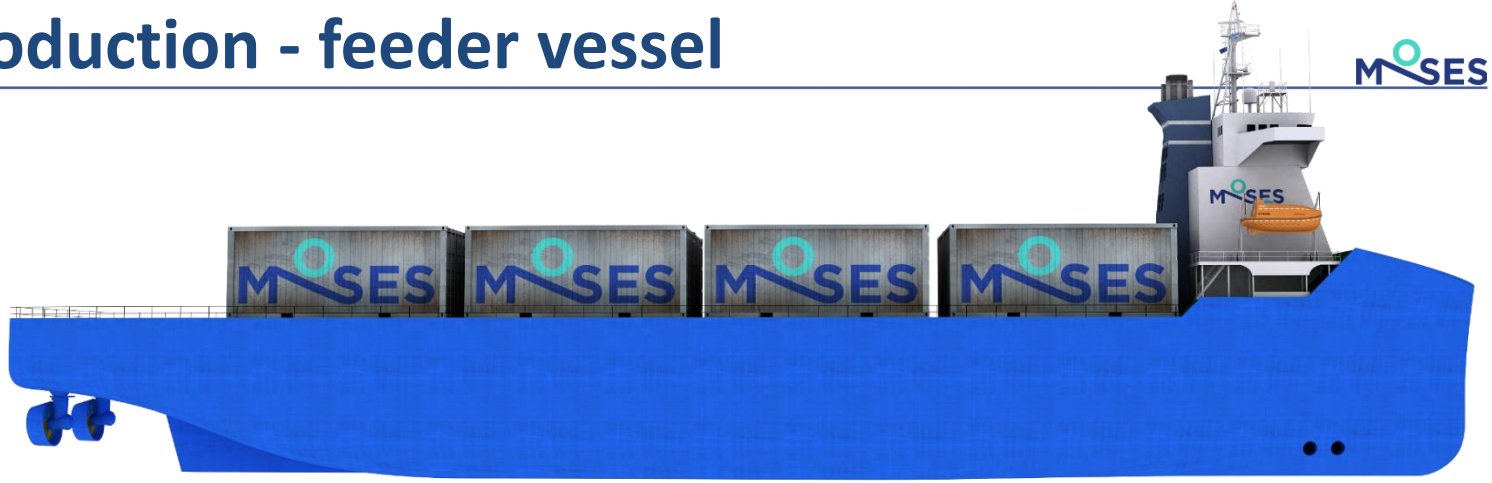
Aim:

- Design control scheme such that our feeder vessel can perform the whole port-to-port mission.

Approach:

- split operation
- guidance - navigation - control
- results

Introduction - feeder vessel



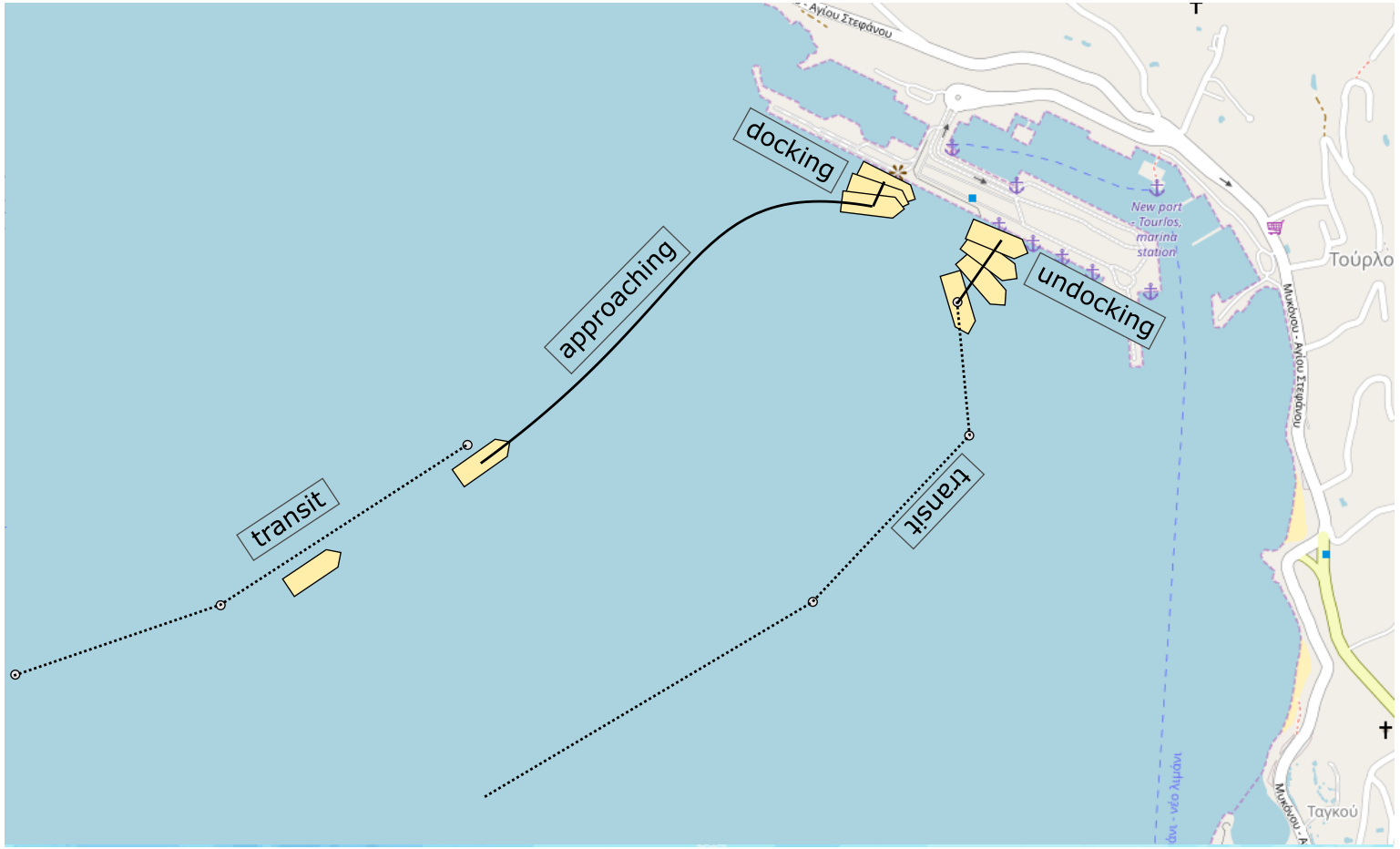
L_{pp}	71.0 m
B	13.0 m
t	4.5 m
∇	2.8 10^3 m^3
m	2.9 10^6 kg

- two azimuthing pods
- two bow thrusters
- course unstable ship

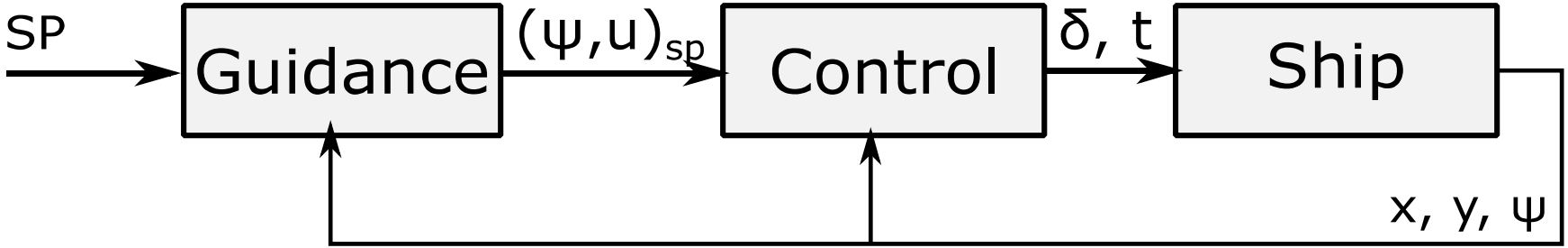
manoeuvring model from CFD calculations
→ available in time domain simulator

Split operation

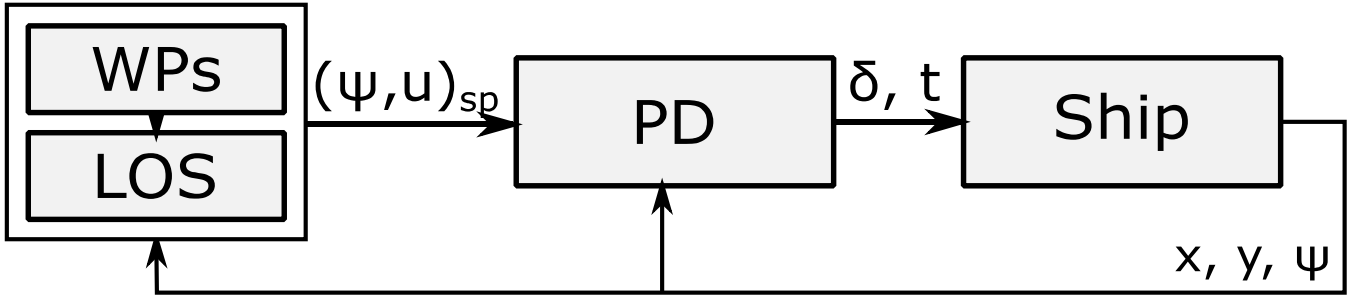
Split operation

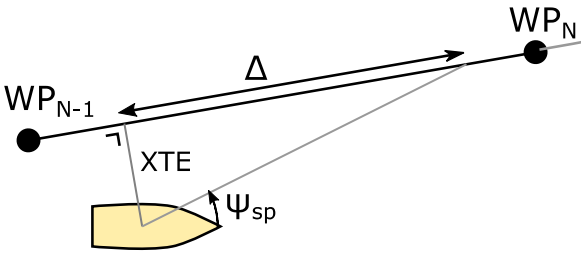


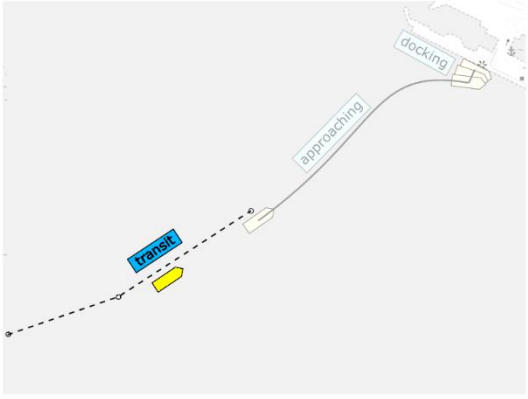
GNC - overview



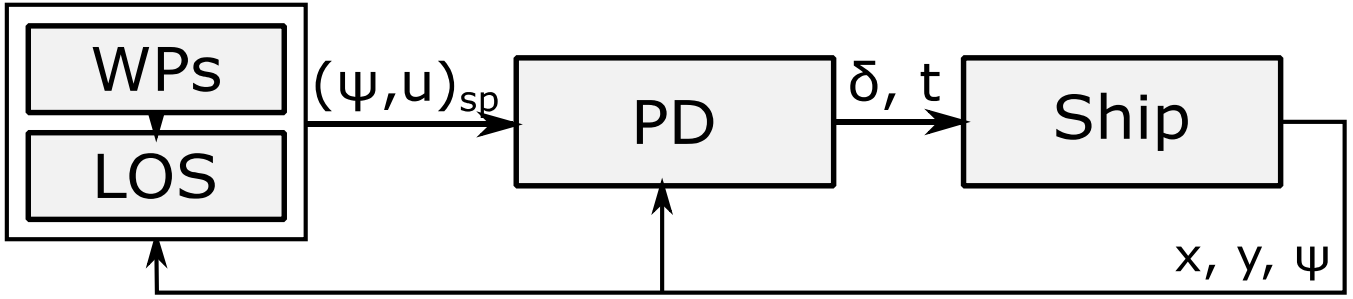
GNC - transit

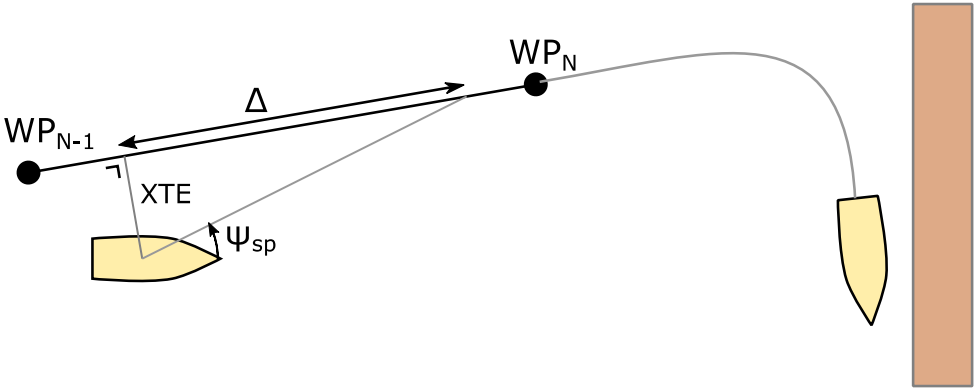

WPs
LOS
$(\psi,u)_{sp}$
PD
δ, t
Ship
x, y, ψ

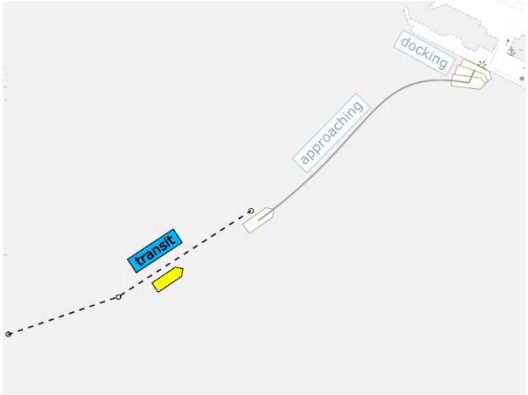

WP_N
Δ
WP_{N-1}
XTE
ψ_{sp}


docking
approaching
transit

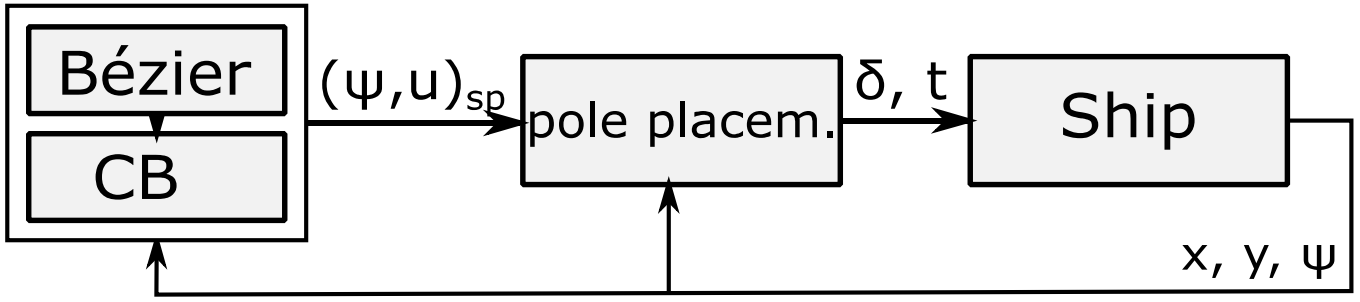
GNC - transit

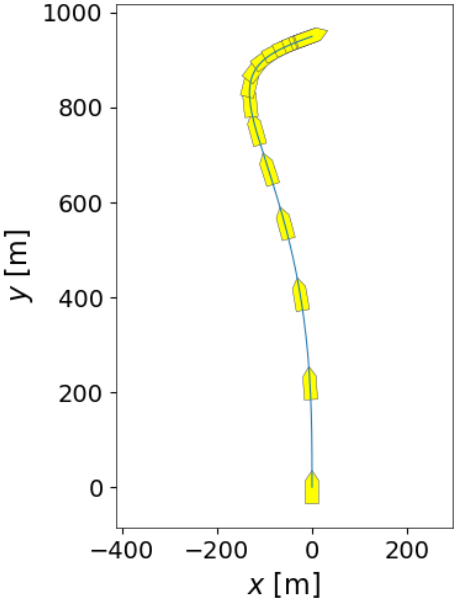

WPs
LOS
$(\psi,u)_{sp}$
PD
δ, t
Ship
x, y, ψ

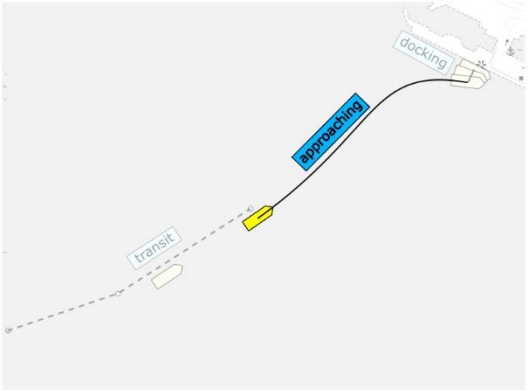

WP_N
Δ
WP_{N-1}
XTE
ψ_{sp}


docking
approaching
transit

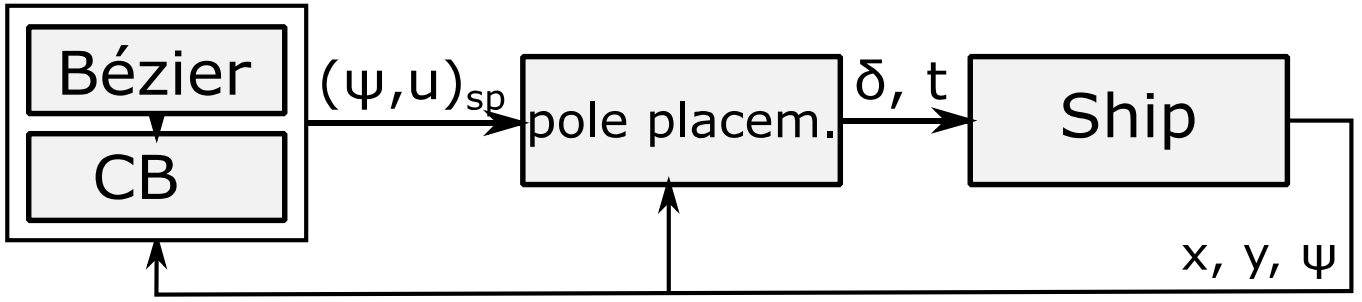
GNC - approaching

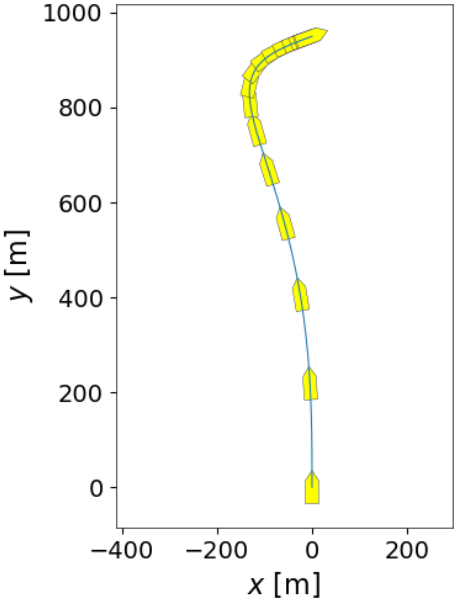


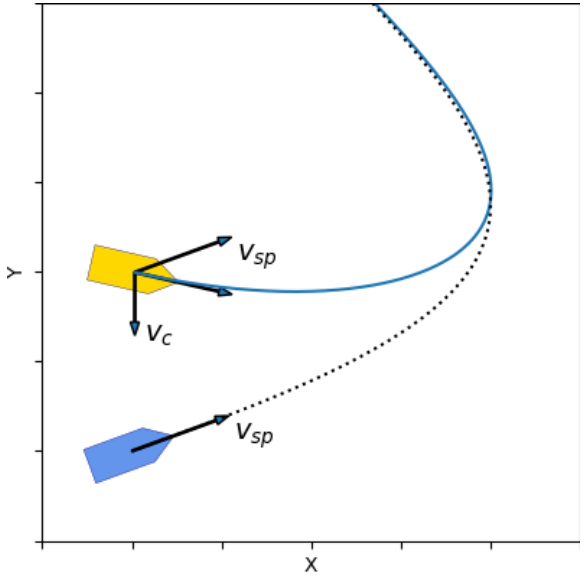


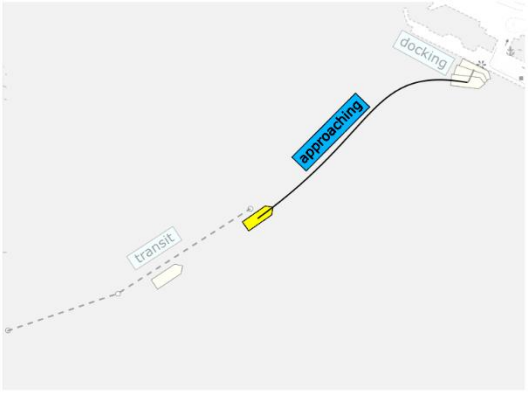


GNC - approaching

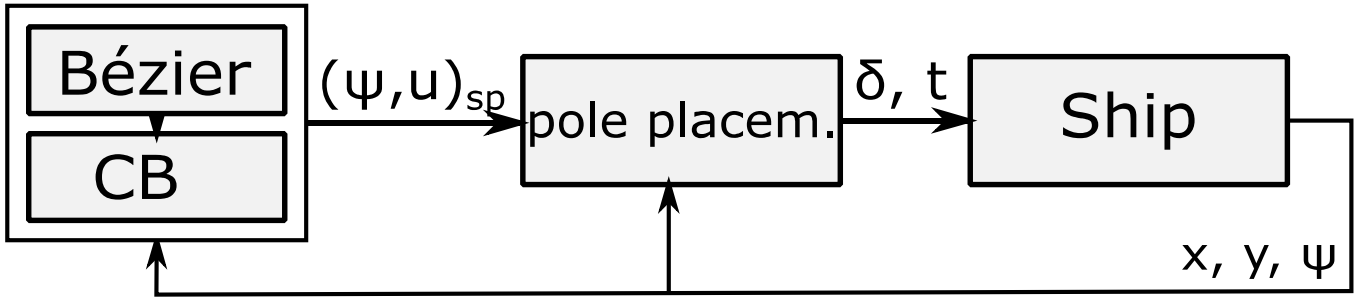


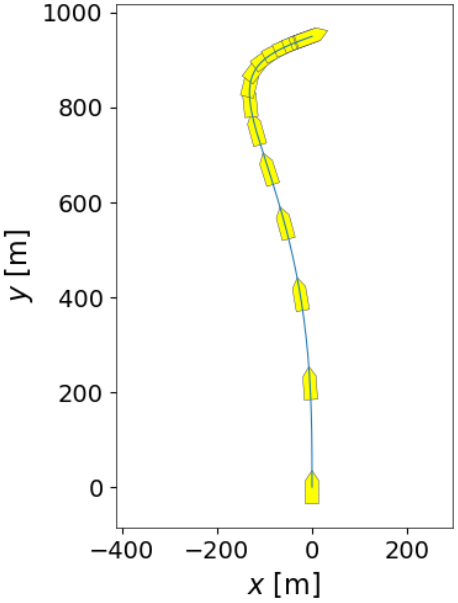


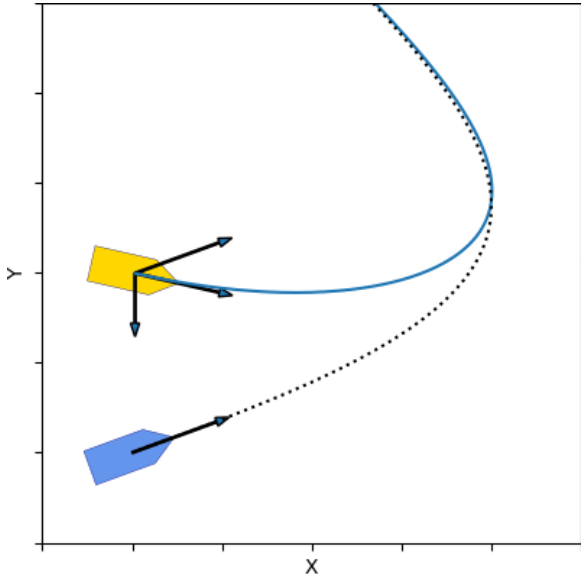


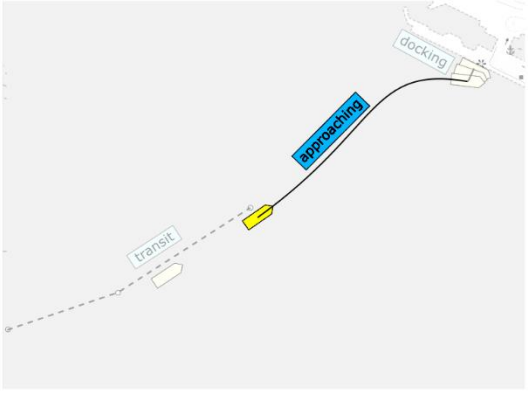


GNC - approaching

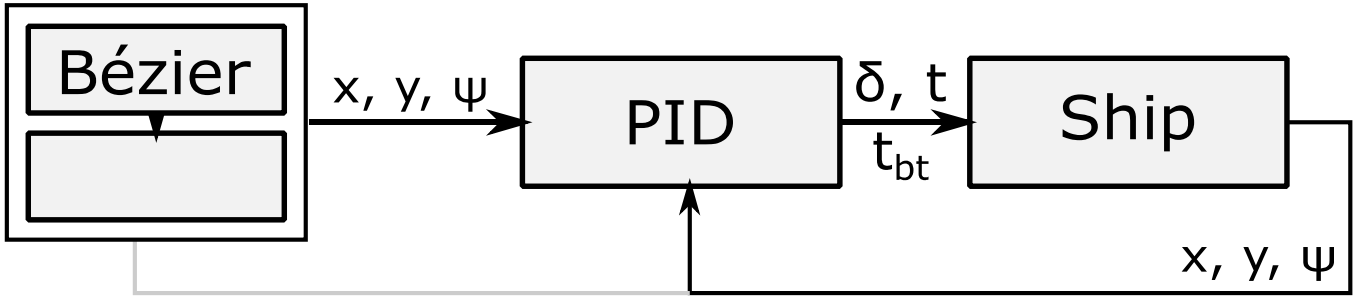


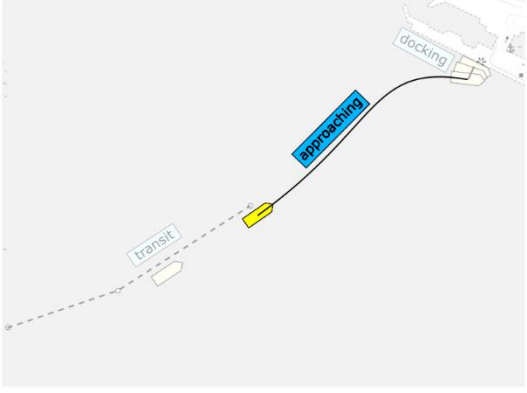




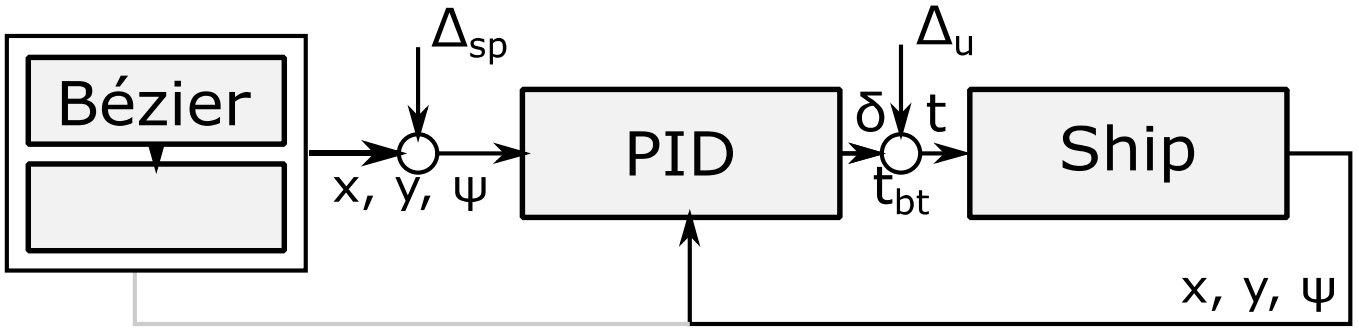


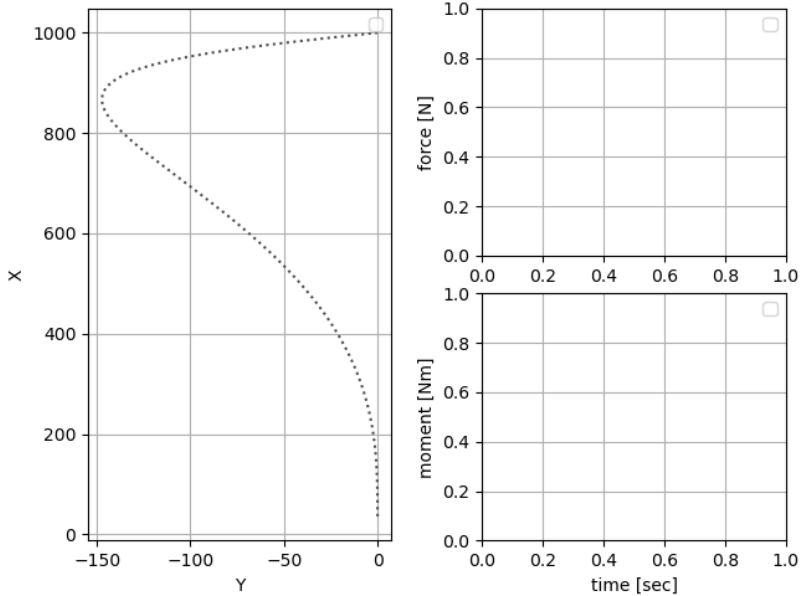
GNC - approaching II

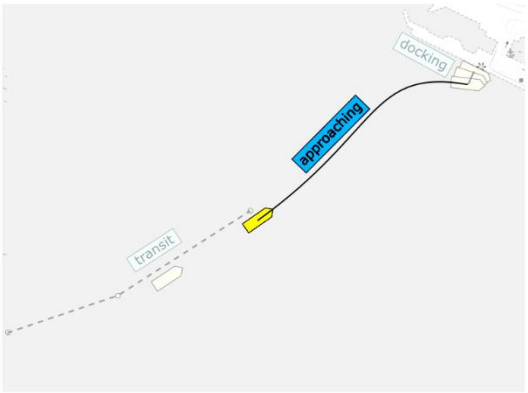




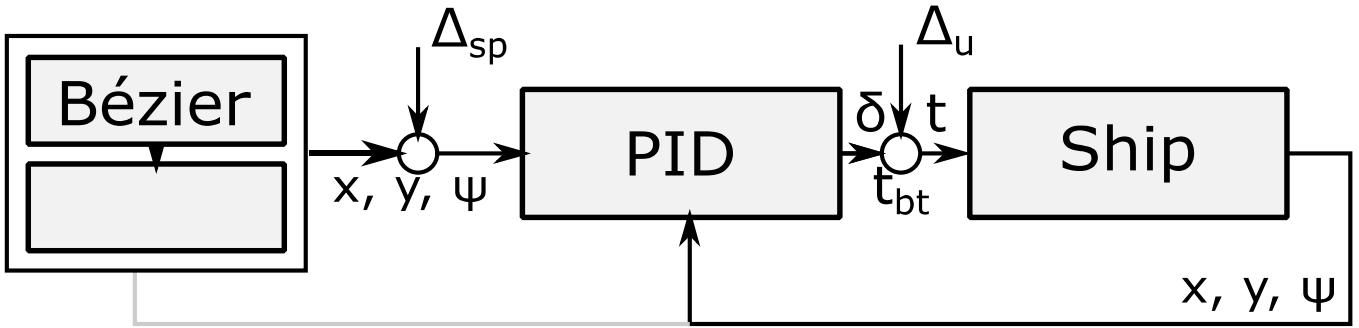
GNC - approaching II

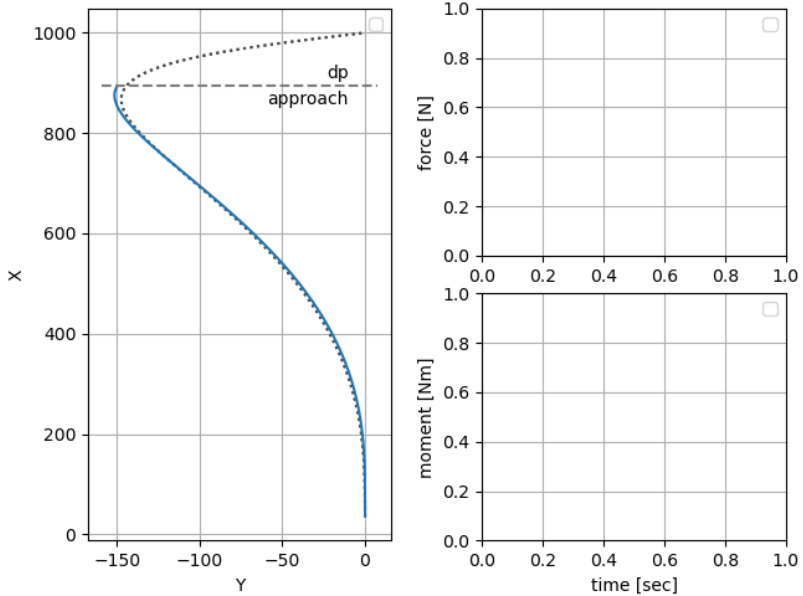


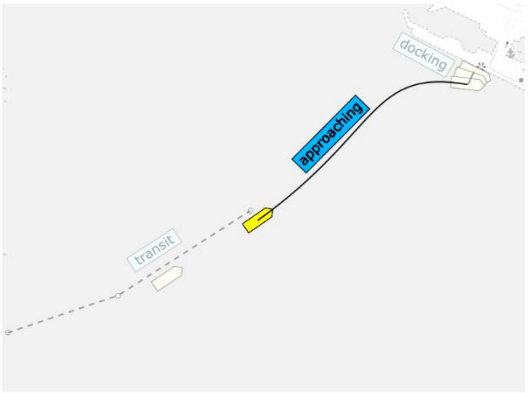




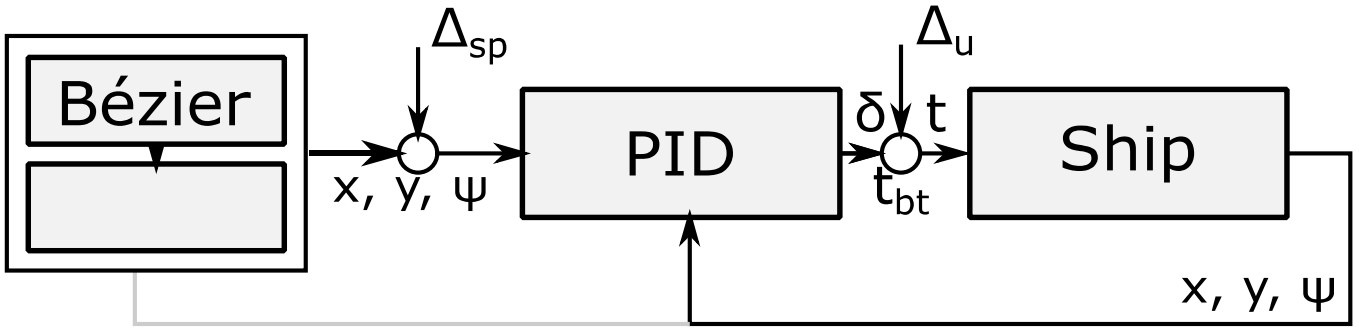
GNC - approaching II

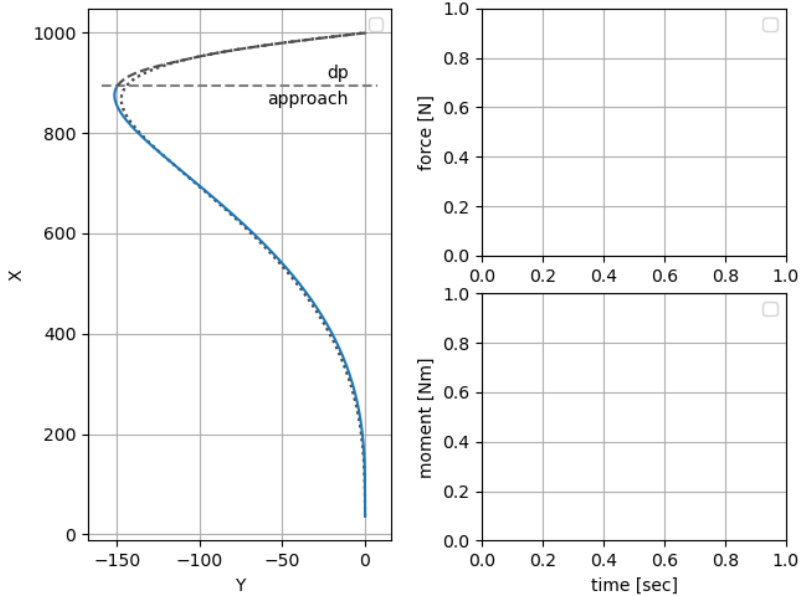


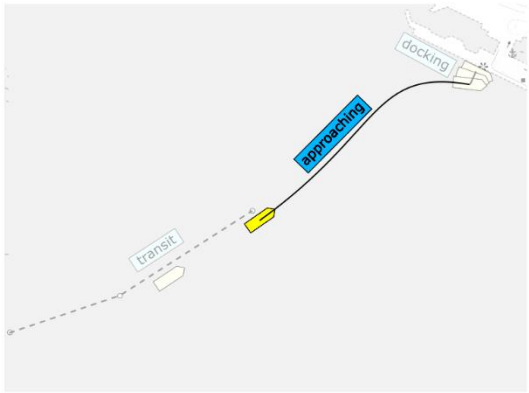




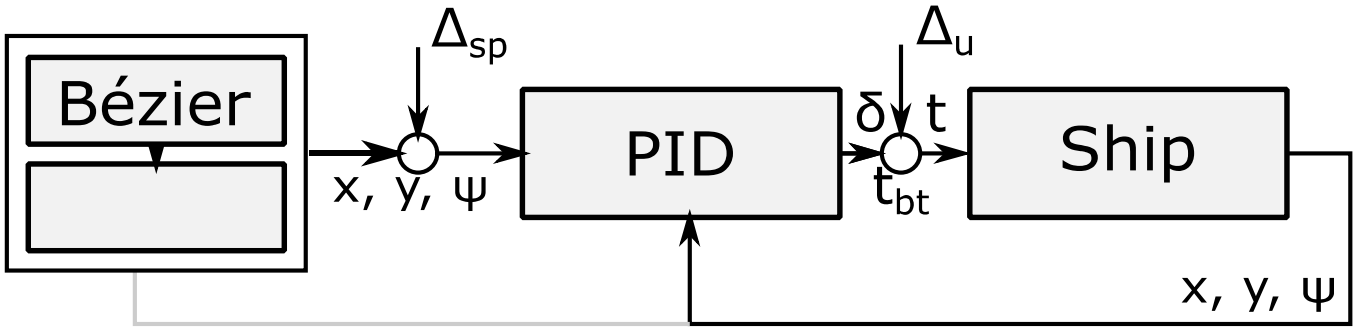
GNC - approaching II

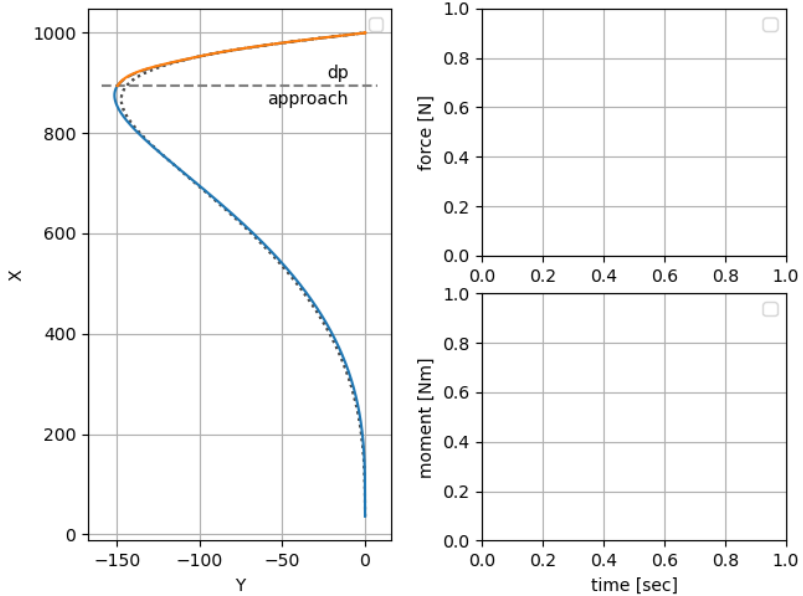


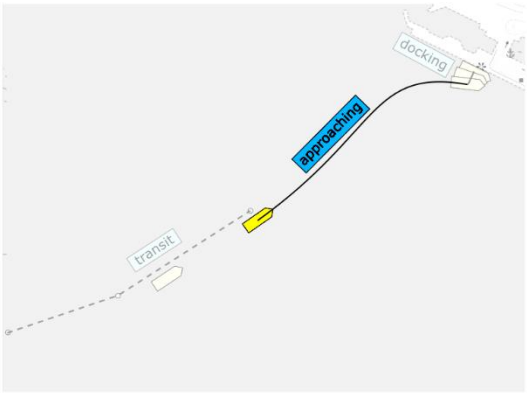




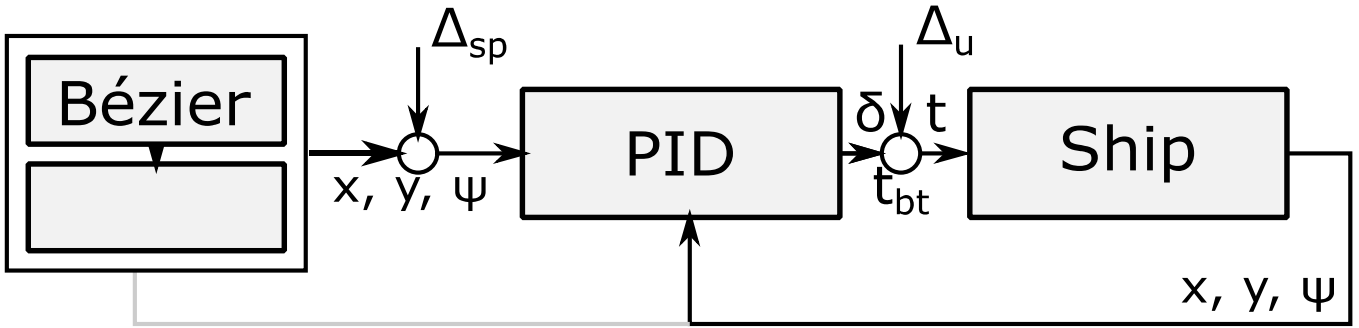
GNC - approaching II

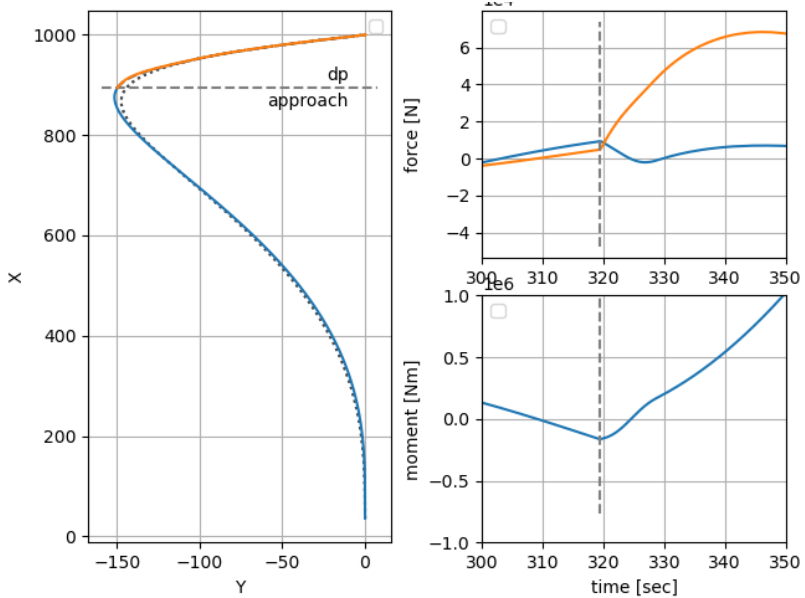


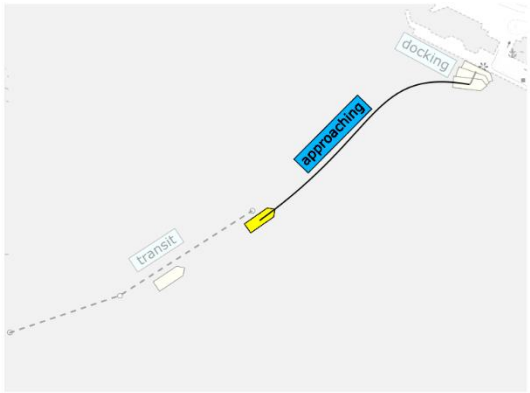




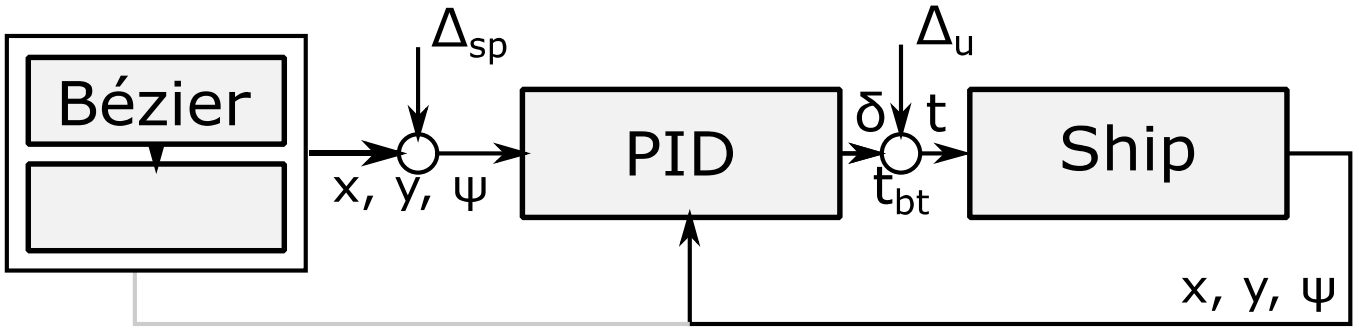
GNC - approaching II

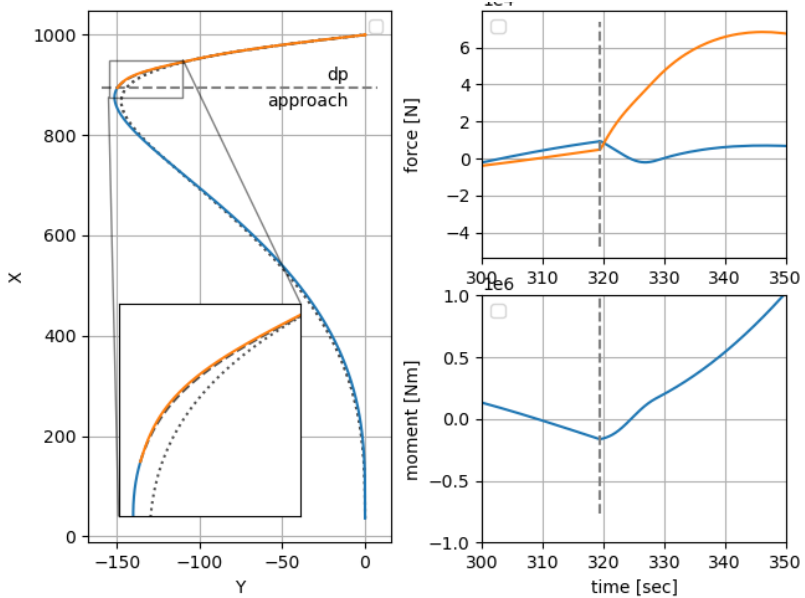


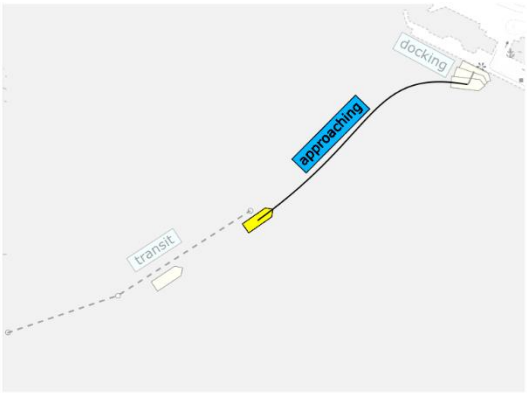




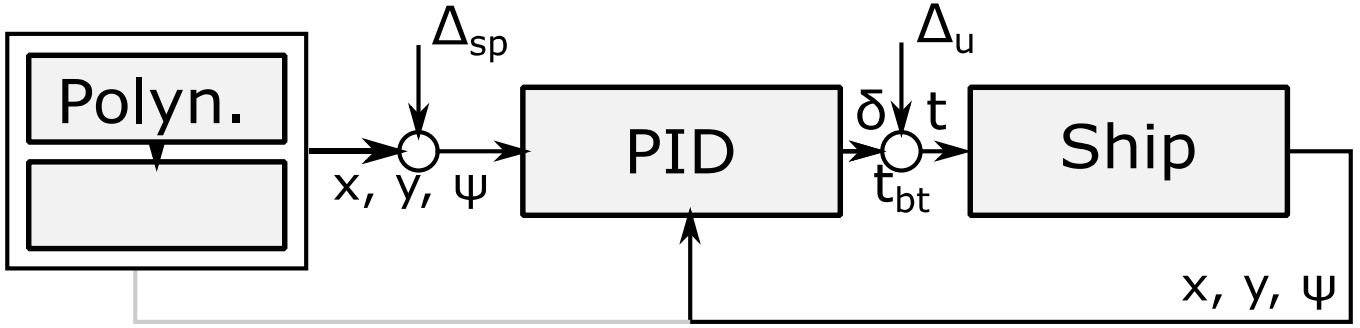
GNC - approaching II

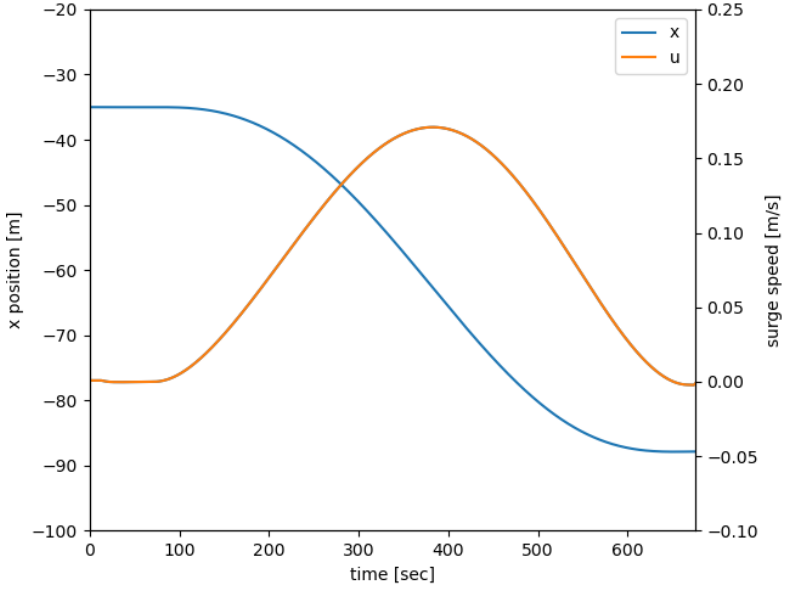


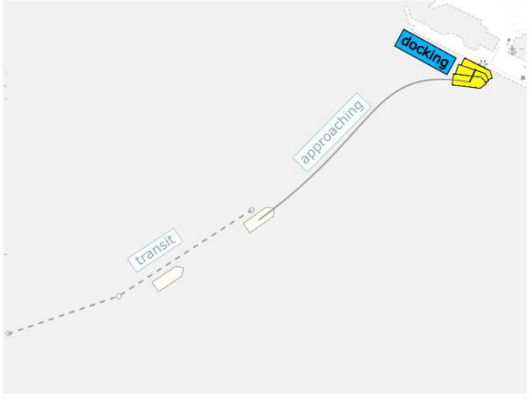




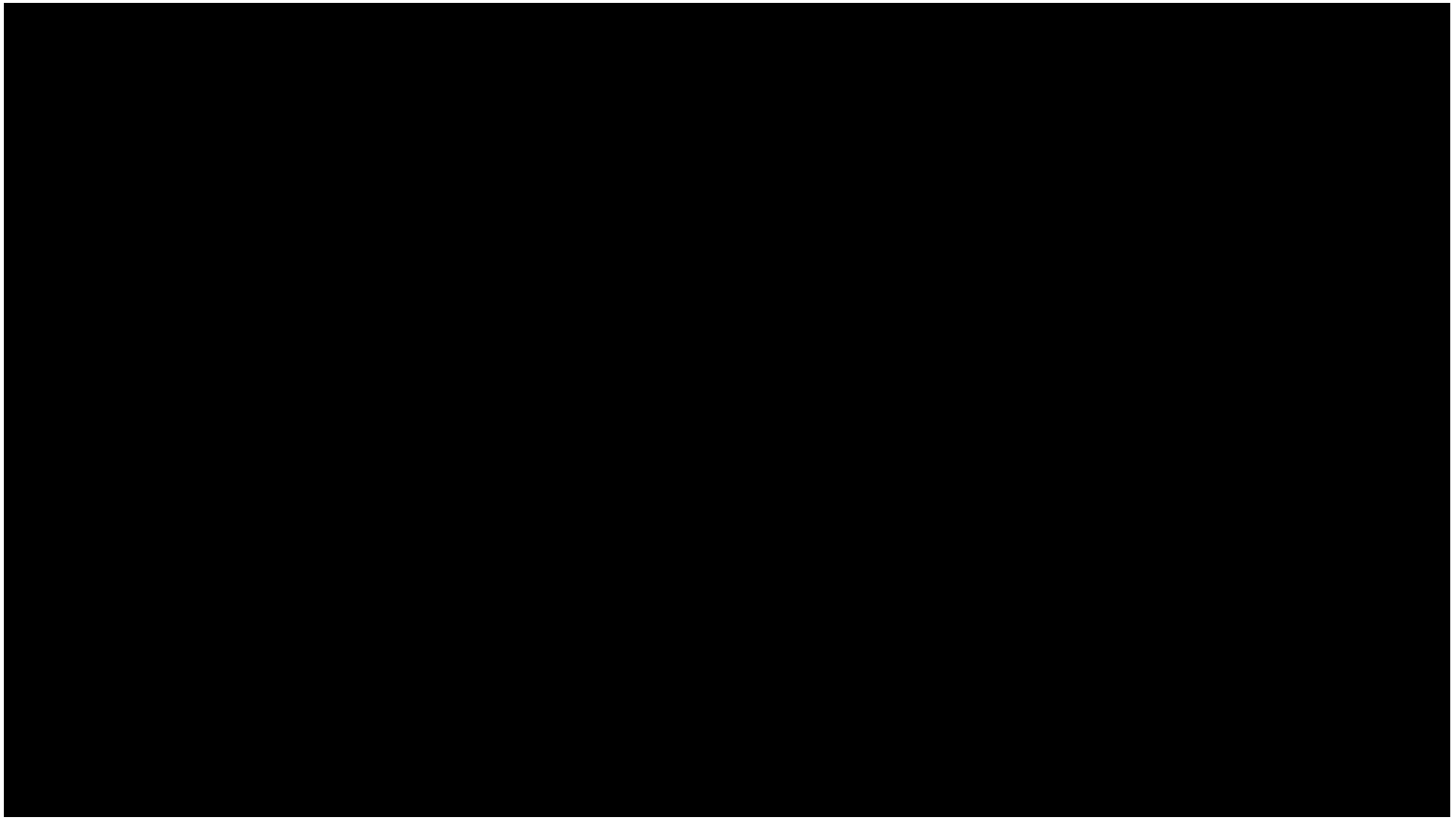
GNC - docking


Polyn.
Δsp
x, y, ψ
PID
Δu
δ t
tbt
Ship
x, y, ψ

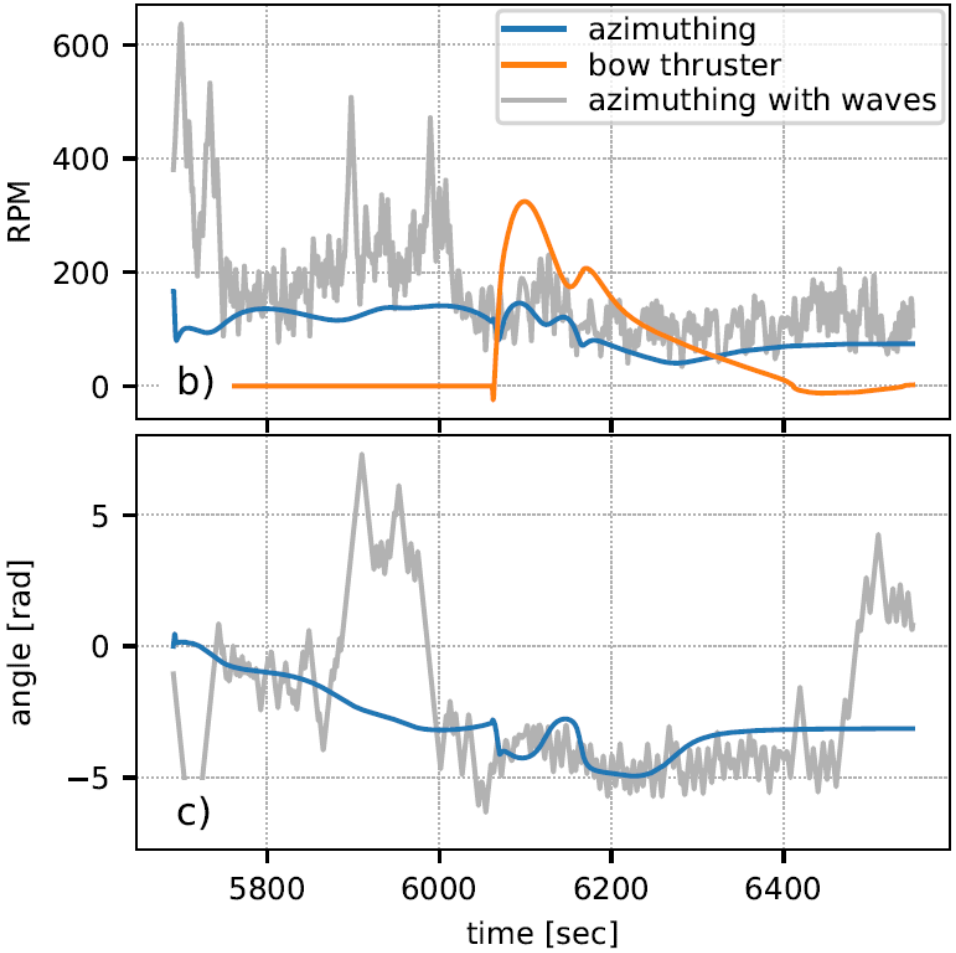

x
u
x position [m]
surge speed [m/s]
time [sec]
−20
−30
−40
−50
−60
−70
−80
−90
−100
0.25
0.20
0.15
0.10
0.05
0.00
−0.05
−0.10
0
100
200
300
400
500
600


docking
approaching
transit

Results



Results


azimuthing
bow thruster
azimuthing with waves
RPM
600
400
200
0
b)
angle [rad]
5
0
−5
c)
5800
6000
6200
6400
time [sec]

Results - preview

Summary

- minimise technical risk before experiments
- full port-to-port operation simulated
  - ship motions controlled in multiple phases
  - detailed numerical model used
  - transitions given much attention

contact: b.j.d.kruif@marin.nl

Acknowledgment: *MOSES project has received funding from the European Union's Horizon 2020 research & innovation programme under grant agreement No. 861678. Content reflects only the authors' view and the Agency is not responsible for any use that may be made of the information it contains.*