

# Assignment 3, TTK4190

Shiv Jeet Rai  
Arne Selle  
Erik Liland

17. November 2015

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# 1 Autopilot design

## 1.1 Heading autopilot

We model the heading of MS Fartøystyring with a Norrbinn model:

$$\begin{aligned}\dot{\Psi} &= r \\ m\dot{r} + d_1 r + d_2 |r| r &= \tau\end{aligned}\tag{1}$$

## 1.2 Speed autopilot

To control the surge speed of MS Fartøystyring we suggest using a linearized model, where the surge speed is decoupled from the rest of the system. We are assuming

$$u \gg v$$

which leads to the conclusion that

$$U = u$$

. We then use a forward speed model from the 3DOF Momoto model

$$(m + X_{\dot{u}})\dot{u} - X_u u_r - X_{|u|u}|u_r|u_r = \tau\tag{2}$$

which leads to

$$\dot{u} = \frac{\tau + X_{|u|u}|u_r|u_r + X_u u_r}{m - X_{\dot{u}}} = \frac{X_{|u|u}|u_r|u_r + X_u u_r}{m - X_{\dot{u}}} + \tau_{nl}\tag{3}$$

where

$$\tau_{nl} = \frac{\tau}{m - X_{\dot{u}}} \Rightarrow \tau = \tau_{nl}(m - X_{\dot{u}})\tag{4}$$

## 2 Path following and Path tracking

### 2.1 Path Generation

Her skriver vi om Path generation

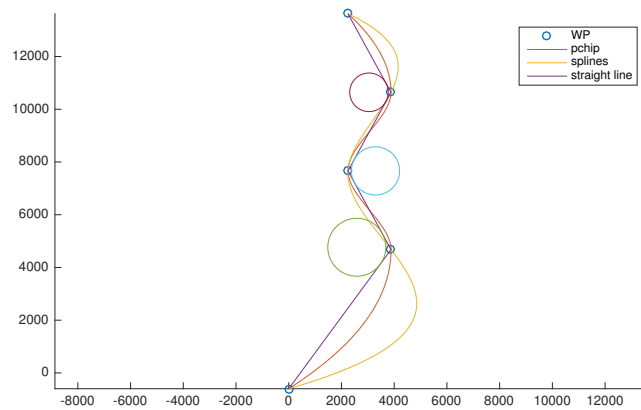


Figure 1: Different trajectories

### 2.2 Path following

Her skriver vi om Path following

### 2.3 Path Tracking

Her skriver vi om Path tracking