Assignment 3, TTK4190

Shiv Jeet Rai
Arne Selle
Erik Liland

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1 Autopilot design

1.1 Heading autopilot

We model the heading of MS Fartøystyring with a Norrbin model

$$\begin{aligned} \dot{\Psi} &= r \\ T\dot{r} + n_3 r^3 + n_1 r &= K\delta \end{aligned} \tag{1}$$

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

$$u >> v$$

which leads to the conclusion that

$$U = u$$

. We then use a first order linear speed 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

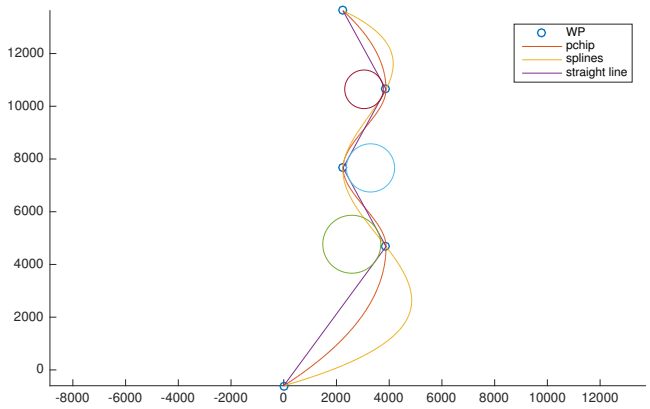

Figure 1: Different trajectories

2.2 Path following

Her skriver vi om Path following

2.3 Path Tracking

Her skriver vi om Path tracking