Model-Based Development of an Underwater Vehicle

Adam Aili & Erik Ekelund

June 10

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- Model-based design development
- Control system

Purpose of model-based design developmentPurpose of a control system

- Assemble the ROV.
- Develop a framework for changing controller in the ROV.
- Estimate a model of the ROV.
- Create a plant model of the ROV in Matlab/Simulink.
- Develop a robust model-based controller and evaluate its performance with simulations and tests.

Bluerov I/O sensorfusion

what is a model and be used for damping - linear quadratic Coriolis restoring forces added mass and added moment of inertia simplifications and why they are needed

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What is parameter estimation and why is it needed pem and problems kalman smoother pem results kalman estimation kalman results discussion

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- Automatic control - What is it?

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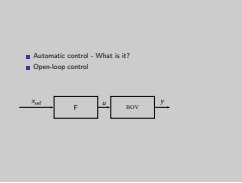
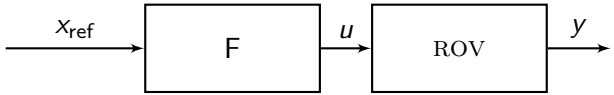
To control a system towards a desired state using inputTo control the system without measuring the current state. Needs to be modelled in order to attain good performance.To base the control action on measurements from outputs of the system.To compensate for a systems non-linearities using a model of the system.



- Automatic control - What is it?
- Open-loop control



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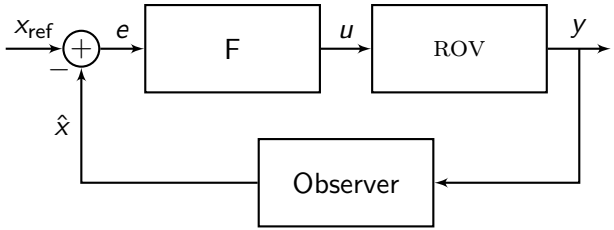

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- Exact linearisation

Consider the non-linear system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} x_2 \\ -ax_1 - bx_2|x_2| + u \end{bmatrix}$$

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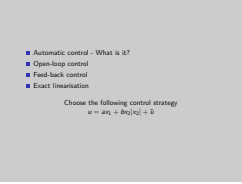

- Automatic control - What is it?
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Choose the following control strategy

$$u = ax_1 + bx_2|x_2| + \bar{u}$$

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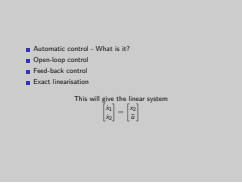
This will give the linear system

$$\begin{bmatrix} \dot{x}_1 \\ \dot{x}_2 \end{bmatrix} = \begin{bmatrix} x_2 \\ \bar{u} \end{bmatrix}$$



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Attitude controller using exact linearisation.

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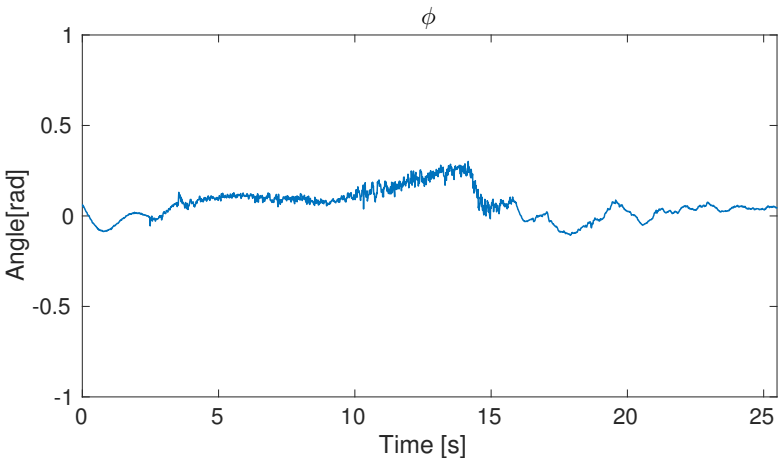
An attitude controller has been developed using the exact linearisation technique described earlier.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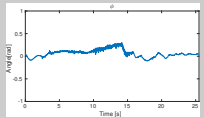

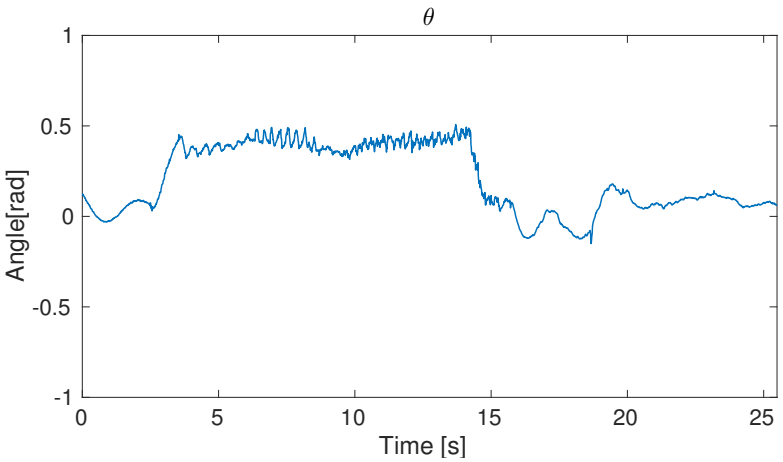
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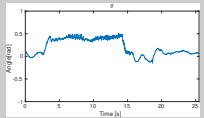

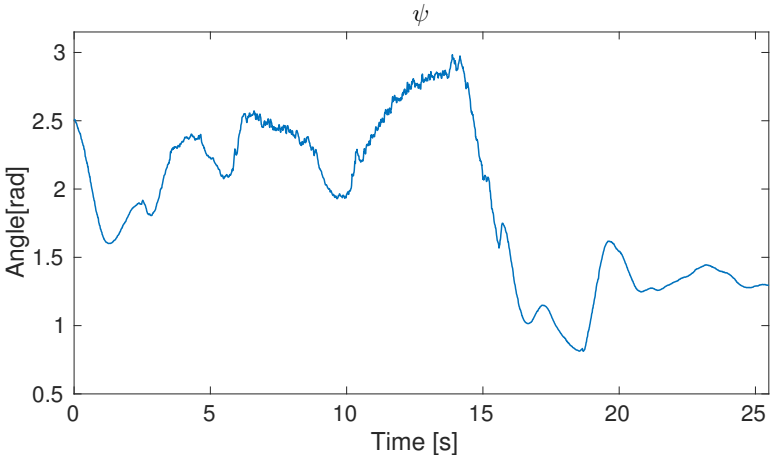
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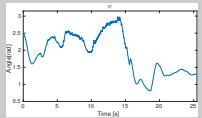

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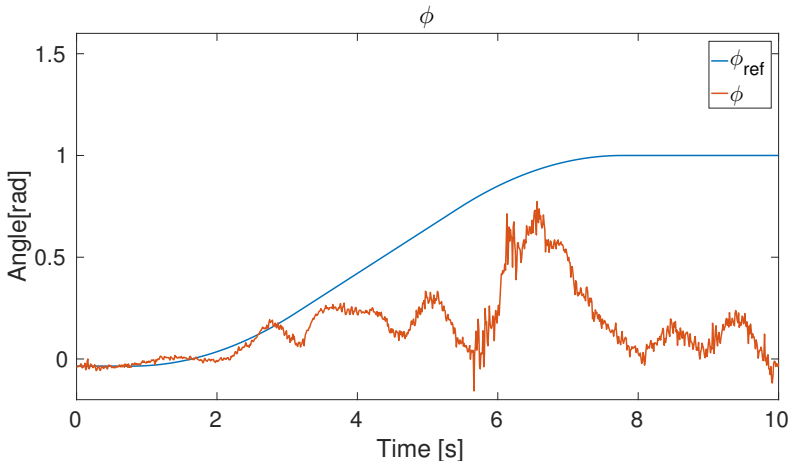
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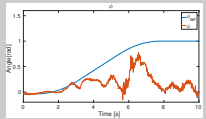

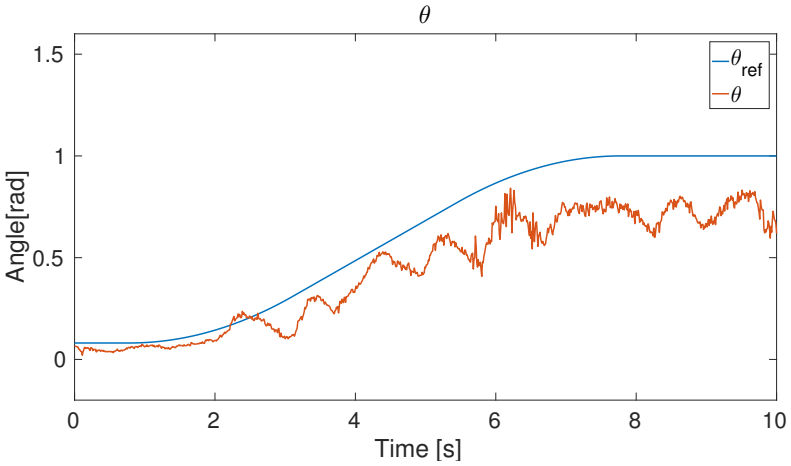
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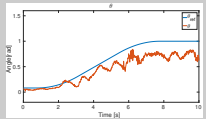

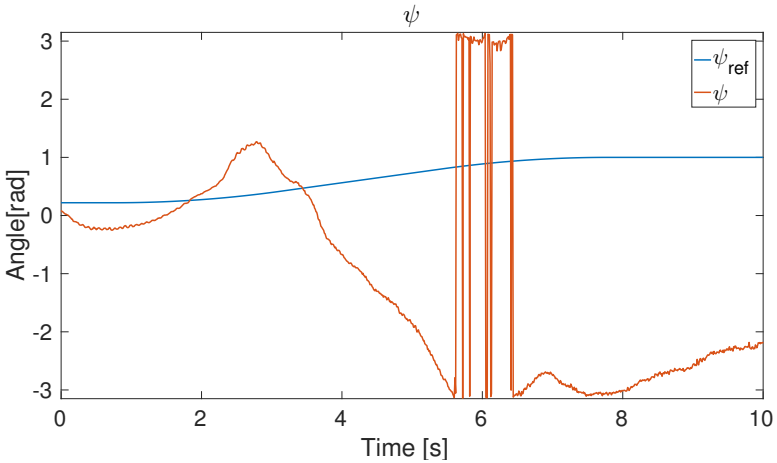
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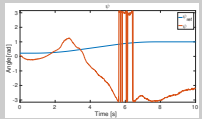

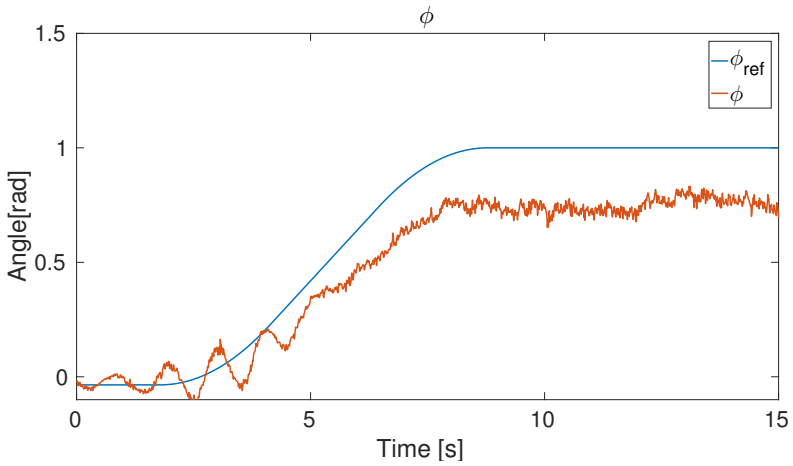
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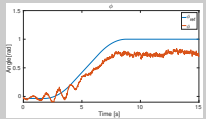

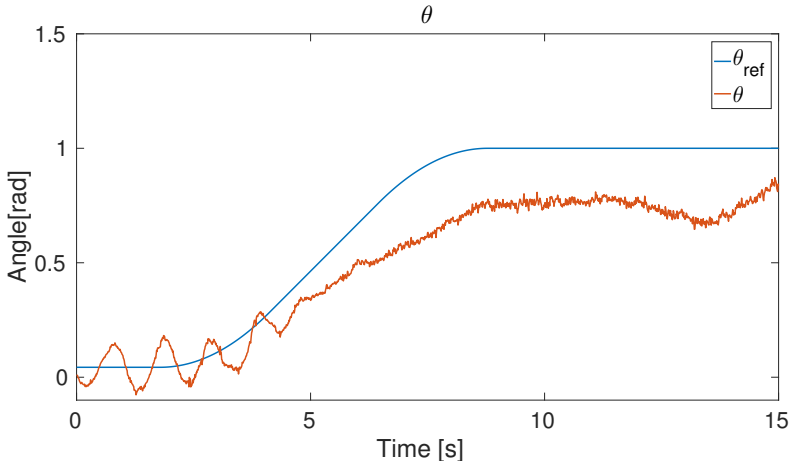
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