University of South-Eastern Norway

Faculty of Technology, Natural Sciences and Maritime Sciences

Master's Thesis

# Dynamic positioning, system identification, and control of marine vessels

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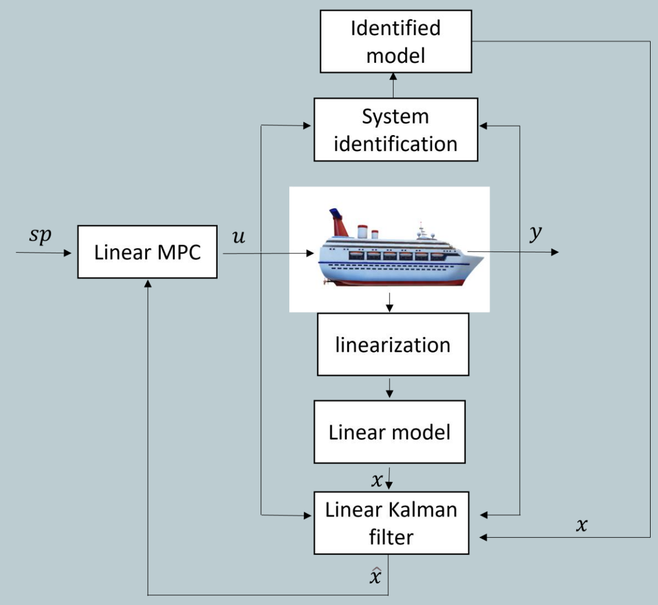



## Introduction

### Overview:

The dynamic positioning system DP is a computer-based system that aims to control vessel position by controlling its thruster and propulsion system.

### Objectives:

- Developing model predictive control based on Balchen mathematical model.
- Developing model-free model predictive control using system identification method.

## Methods

### Model Predictive Control MPC

Four versions of model predictive control are implemented and tested, standard MPC, reduced size MPC, simple MPC, and simple MPC with integral action.

### LQ optimal control with integral action

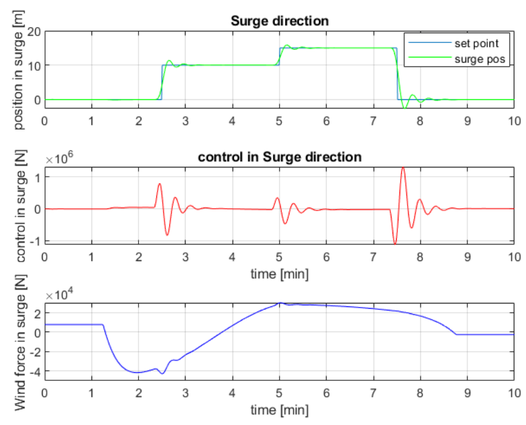
This control system uses the linear state-space model in deviation form.

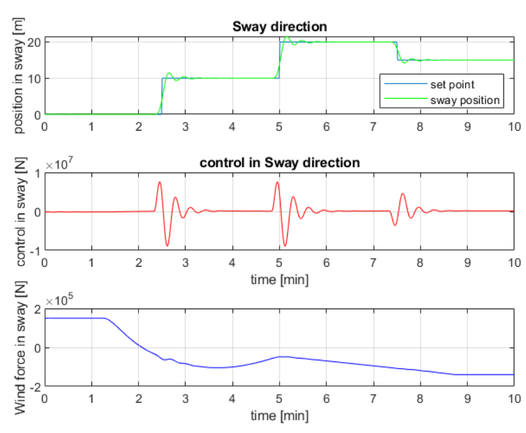
### System identification

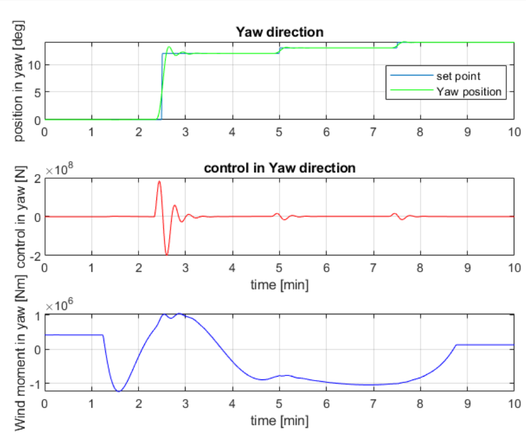
The deterministic and Stochastic system identification and Realization algorithm is proposed to get model-free MPC.

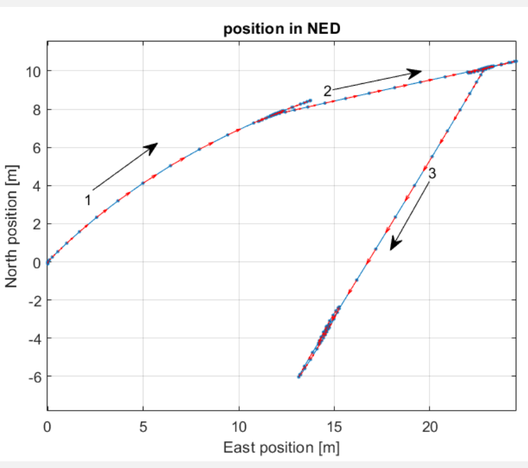
## Results

Model-free simple MPC with integral action is efficient in controlling the vessel position and tracking the desired set-point despite of different weather circumstances.




## Discussion

The simple MPC with integral action is the most effective control system in controlling vessel position compared with other tested MPC algorithms in this report. It is the superior one due to the short simulation time and because it is independent of known or unknown disturbances. It is more effective compared with optimal control with integral action since it deals with feed-forward and updates optimal values in each sampling time including the effect of disturbances on the vessel. In addition, it has a smoother change in the control signal.

## References

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