

## Investigation of roll damping models based on SSPA test database

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### Background and motivation

In the second generation of intact stability criteria, the IMO addressed the importance of ships having enough roll damping to avoid large roll motions and parametric rolling, as well as excessive acceleration. The design of modern ships especially volume carriers seems to be more vulnerable to these phenomena, which gained more attention since the late 90's due to some accidents such as the APL China casualty. A recent study by Wallenius Marine AB showed that a relatively small difference in the roll damping prediction can lead to the difference between severe roll angles and hardly noticeable motions. Therefore, it is crucial to develop method for a good prediction of roll damping for safe ship design. Since the scale effect of the damping is mainly associated with the skin friction on ship hulls and the friction only contributes very little to a full-scale ship's total roll damping, experimental model tests are a widely accepted method to estimate a ship's roll damping. In this project, you will get the access of SSPA roll decay test database composed of more than 250 ship models to investigate ships' roll damping in terms of various ship parameters, with the overall objective to propose some correction factors to improve the current methods for roll damping prediction.

### Objectives and goals

- Benchmark various methods to compute roll damping coefficients from model tests
- Compare various semi-empirical method to predict a ship's roll damping
- Develop regression-based factors to improve the semi-empirical method for roll damping prediction and demonstrate its application for parametric rolling with the SSPA test

### Methods and tools

- Ship strip theory for wave load analysis to get the hydrodynamic parameters
- Python and sci-kit machine learning packages
- Regression toolbox to get parameters from model tests

### The tasks in the project include

- Literature review of state-of-the-art roll damping and its impact on ship safety, such as large motions and parametric rolling
- Understanding the governing function of ship motions and roll decay dynamics
- Regress parameters for a second order oscillator model to approximate ships' roll damping based on experimental tests
- Develop regression methods to obtain correction factors to extend the current semi-empirical roll damping models for different initial angles, wave frequency and speeds for test
- Apply the roll damping prediction for parametric rolling and compare with the SSPA model test

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