Aalto University
School of Engineering

**Dissertation Release** **16.10.2020**

# How can we simulate ship performance in level ice reliably and efficiently?

| | |
|---|---|
| **Title of the dissertation** | Numerical simulation of ship performance in level ice: evaluation, framework and modelling<br>Laivan suorituskyvyn numeerinen simulointi tasaisessa jääkentässä: arviointi, kehys ja mallinnus |
| **Contents of the dissertation** | Shipping activities in polar and sub-polar regions rely on ice-strengthened ships with capability to navigate through ice-covered waters. An important index of a ship's icebreaking capacity is the thickness of level ice which the ship can break continuously. To estimate this, knowledge and methods are needed to calculate the attainable speed of a ship in level ice with various thickness. This thesis focuses on numerical methods to make such calculations.<br><br>To achieve the goal, this thesis starts with an evaluation of the state-of-art methods for the estimation of ship performance in ice and identify the most critical aspects to be further investigated. A framework is proposed following the evaluation to investigate the methodological issues regarding the establishment of a reliable and efficient numerical model. The thesis then proposes models in local ship-ice interaction scale and assembles the models into a global scale model, which simulates ship motion in level ice either in straight course or during maneuvering.<br><br>The results of this thesis can be used as the basis to develop future numerical models for ship performance in level ice. The resulting numerical model has good potential to be applied in practical ship design process, which enables credible estimation of ship performance at early design stage and promotes innovation on icebreaking hull forms. |
| **Field of the dissertation** | Marine technology |
| **Doctoral candidate** | Fang Li, M.Sc. (Tech)<br>Born in Shandong, China. 22.02.1992 |
| **Time of the defence** | 06.11.2020 at 12:00 PM |
| **Place of the defence** | Zoom link, https://aalto.zoom.us/j/66696860489 |
| **Opponent** | Professor Raed Lubbad, Norwegian University of Science and Technology, Norway |
| **Supervisor** | Professor Pentti Kujala, Aalto University School of Engineering, Department of Mechanical Engineering |
| **Electronic dissertation** | http://urn.fi/URN:ISBN:978-952-64-0069-3 |
| **School of Engineering electronic dissertations** | https://aaltodoc.aalto.fi/handle/123456789/49 |
| **Doctoral candidate's contact information** | Fang Li, Department of Mechanical Engineering, tel: +358 505240424, fang.li@aalto.fi |

The dissertation is publicly displayed online 10 days before the defence at
https://aaltodoc.aalto.fi/doc_public/eonly/riiputus/