Impact of the EEDI on the Finnish-Swedish Winter Navigation System

Background and motivation

Maritime traffic on the Baltic Sea plays an important role for the economies of Sweden and Finland. The winter traffic accounts for around one-quarter of the annual traffic despite the fact that in winter the ice concentration on the northern Baltic Sea can be close to 100% and the maximum ice thickness can reach up to 120 cm. In order to handle the related challenges, a joint Finnish-Swedish Winter Navigation System (FSWNS) has been established. The FSWNS is based on a balance between icebreaker availability, real-time ice conditions, and the number and ice-going performance of merchant vessels in the area. A well-balanced system ensures good logistics and safe operation with minor delays and waiting time at a reasonable cost to shipping companies and society. Figure 1 shows a scenario of winter navigation coordinated by the FSWNS.

Figure 1. A scenario of winter navigation in the Baltic coordinated by the FSWNS

The Energy Efficiency Design Index (EEDI) regulations were enforced since 2017 and will be tightened incrementally every five years. The EEDI requirements, together with a trend of optimizing new ice-classed merchant vessels to operations in open water effectively reduce their installed propulsion power considerably. At the same time, the prevailing ice conditions are becoming increasingly dynamic due to climate change. Together, these factors may have a significant negative impact on the operating performance of the FSWNS. To help decision-makers to identify and evaluate measures to counteract any such negative effects, research needs to be carried out to predict the operating performance of the FSWNS in terms of key performance indicators (KPIs) such as transport capacity, number of instances of icebreaker assistance, and icebreaker waiting times.

Objectives

The main objective of this thesis project is to assess how the operating performance of the FSWNS reacts to the changes following current trends in ship design and operation together

with the enforcement of the EEDI regulations. Specifically, impacts on the waiting time for ice-breaker (IB) assistance as well as on the overall efficiency of the FSWNS must be evaluated.

Methods and tools

The project is a joint research between Chalmers and Aalto University in Finland, comprising maritime navigation, marine engineering, and data science. Data collection, processing, and analysis are the core of this thesis work. Participants will have access to high-resolution sea ice data as well as automatic identification system (AIS) data to identify potential trends in the development of winter navigation KPIs, such as the number of instances of IB assistance and IB waiting times.

Prerequisites

- Background in Naval Architecture, Computer Engineering, Mechanical Engineering, Logistics, or similar.
- Knowledge in the data acquisition and analysis

The MSc thesis project should incorporate the following tasks:

- Literature studies to define the of state-of-the-art knowledge of the research subject.
- Data collection and analysis of maritime traffic data, data on icebreaker assistance, and ice data.
- Application of an in-house code to simulate the waiting time for icebreaker assistance.
- If time allows, field study of merchant ships as well as icebreakers.
- Writing of a thesis report and presentation of the work at a public seminar.

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