DTU Management Engineering
Department of Management Engineering

Future Feeder Line Operations – Dynamic Route Planning and High Level Decision Support Tools

Erik Hellsten, PhD project

Feeder Line Network Design and Scheduling

Liner shipping is one of the major modes for transportation of cargo and it is seen that ever larger ships are used in order to reduce running costs and environmental impacts. However, the large vessels need to be supported by an efficient feeder line structure for the end transportation. The feeder lines must adapt to the arrivals and departures of the intercontinental ships and are such much more sensitive to disturbances than in regular liner shipping. This introduces a need for new, more dynamic models, with an increased focus on scheduling to create robust and efficient feeder line networks and schedules, as well as to help propose suitable measures to counteract delays and other unexpected circumstances.

It is further expected that tools from operations research would be useful in creating support tolls for strategic decisions in the feeder line business, such as whether to acquire additional vessels and sizes of vessels are optimal.

Research question?

- Which are the most important parameters in feeder line network design and scheduling?
- What mathematical models can be used to create efficient feeder line structures?
- Where lies the uncertainties and how can they be counteracted?
- How can operations research tools be applied to help support strategic decisions for feeder line businesses?

Conceptual model/theory

The problem definitions and solutions will mainly be based on classical mixed integer programming techniques as column generation and various metaheuristics. To handle the dynamic nature of the problems, different heuristics and rolling-horizon based methods will likely play a major part.

Method

A study of the feeder line industry will be conducted together with Unifeeder, to pinpoint the central concepts and the main problems and possibilities. This will include both a qualitative part based on discussions with representatives from Unifeeder as well as a quantitative part in which we will gather data to generate a set of test instances. Relevant models and solution techniques will then be created, based on earlier liner shipping literature and other work regarding scheduling and dynamic network design. The results will be compared to earlier work as well as to current industry practice.

Expected results

The aim is to create a decision support tool to facilitate feeder line network design and scheduling, proposing adequate measures to counteract unexpected events and facilitate strategic decisions..

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