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# A multiple ship routing and speed optimization problem under time, cost and environmental objectives

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## Abstract

This work studies a multiple ship routing and speed optimization problem under time, cost and environmental objectives. This problem considers (a) fuel consumption as a function of payload, (b) fuel price as an explicit input, (c) freight rate as an input, and (d) in-transit cargo inventory costs. Given a set of cargoes, each of which with a specific weight needs to be transported from pickup port to destination port, the aim is to find the optimal routes and the optimal speed on each leg of the route for a fleet of ships. The alternative objective functions are minimum total trip duration, minimum total cost and minimum emissions. A heuristic branch and price algorithm, where the pricing problem is solved heuristically, as well as a constraint programming model are developed for this problem. Computational results of different problem variants were compared and the sensitivity of the input was analyzed.

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