The Hong Kong Polytechnic University
Department of Logistics and Maritime Studies
Research Seminar

Three studies on bulk shipping management

by

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Venue: R503, Shirley Chan Building
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(Conducted in English)

Abstract:

Bulk shipping plays a vital role in the world economy. According to the estimates of UN Conference on Trade and Development (UNCTAD) (2017), seaborne trade volumes accounted for over 80 percent of total world merchandise trade in 2017 and over 40 percent of the world fleet is composed of bulk carriers. This series of studies discuss (i) a bulk ship scheduling problem faced by industrial corporations, (ii) an integrated fleet management and voyage planning problem faced by tramp shipping companies, and (iii) how big data can be utilized to improve the operations of shipping companies.

In the first study, we consider a ship scheduling problem for an industrial corporation that manages a fleet of bulk ships under stochastic environments. The considered problem is an integration of three interconnected sub-problems from different planning levels: the strategic fleet sizing and mix problem, the tactical voyage planning problem, and the operational stochastic backhaul cargo canvassing problem. To obtain the optimal solution of the problem, we provide a two-step algorithmic scheme. In the first step, the stochastic backhaul cargo canvassing problem is solved by a dynamic programming (DP) algorithm. In the second step, a mixed-integer programming (MIP) model that jointly solves the fleet sizing and mix problem and the voyage planning problem is formulated using the results from the first step.

The second study considers an integrated fleet management and voyage planning problem for a tramp shipping company. The problem mainly involves three interconnected decisions. The first decision relates to the annual fleet management of the company. That is the company should decide, at the beginning of a year, which ships to charter in and out. The second decision is related to the selection of transportation offers. Each year, the company is offered with a series of Contract of Affreightments (COA), and it should decide for each of them whether to accept or to decline. In the last decision, the company plans voyages to transport cargoes in the COAs. The voyage planning problem is a combination of a vessel routing problem, a bunkering optimization problem, and a speed optimization problem. An MIP model is formulated for the problem and solved by a branch-and-cut algorithm.

Our last study will focus on the integration of big data technologies into the shipping operations. We will look at the possibilities of utilizing big AIS data to promote a smarter, greener, and more sustainable shipping industry.

Bio:

WU Lingxiao is currently a Ph.D. student under the supervision of Dr. WANG, Shuaian. His research interests are port operations, liner shipping, and optimization algorithms.

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All are welcome!