

Modeling for Ship Shifting and Berthing Jobs Scheduling at Dockyard

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ABSTRACT

In this paper, shipyard's ship shifting and berthing job scheduling is analyzed and researched, so it provides the ideas of solution for the problem model. On this basis, using the related mathematical knowledge and modeling techniques, is built up the shifting job scheduling arrangements of varying stages of complex dynamic programming model. Finally use the bellman algebra theory and the mathematical knowledge to solve the model.

KEY WORDS: Shipyard; shifting and berthing; dynamic programming; bellman algebra

INTRODUCTION

In the ship-building and ship-repairing yard (especially in a repairing yard), there are two basic hardware resources: dock and pier. How to scientifically use the dock and pier will directly affect the total production value and economic performance benefit of shipyard, because amount of the dock and pier determine how many ships the shipyard can carry on, in other words, when the number of the dock and pier are determined, how to efficiently use and dispatch the dock and pier will affect the production control of repairing ship at dockyard.

However, a large and fussy number of shifting and berthing jobs will consume a large amount of resource of the shipyard, and it will make some even all of the consequent production be interrupted during ship shifting and berthing, and the production efficiency will be greatly reduced too. If we can optimize the sequence of the shifting and berthing, it will be a great benefit due to improving the productivity of the shipyard.

The topic of this paper is focus on the research of the shifting and berthing job scheduling. Throughout a large amount of information which has been published, there are some research about the berth allocation problem, but most of those are focus on the port scheduling (especially on the container port) (Imai, A, 2001). It is no direct research and discussion for the yard's shifting and berthing.

In this paper, firstly the inbeing of shifting and berthing job scheduling is analyzed and researched, and the system of the problem is divided into a discrete system and a dynamic programming problem system, which provides a theoretical solution idea for the mathematical model building. On this basis, a mathematical model of a variable stage complex dynamic programming about ship shifting and berthing scheduling problem is gradually established by using the relevant mathematical knowledge and modeling theory. Finally by using the bellman algebra theory and relating knowledge, the mathematical solution of the model is solved. The more important target of this paper is in the hope that an in-depth and systematic research of shifting and berthing job scheduling system in the shipyard pier would be promoted through the model analysis and research in the paper.

SHIFTING AND BERTHING JOBS SCHEDULING

Before analysis on the target issues, the elaboration of the shifting and berthing job will be defined in order to be facilitated with formulation.

To simplify the problem, a dock may be regarded as a special kind of dock. The specific feature of the dock can be configured as boundary condition, in this paper, regards the dock as a general pier, no longer to consider it as a dock. All the analysis and modeling process will be in accordance with taking into account the characteristics of the general pier.

The shifting and berthing problem of the ship can be described as follows: The ship a_{ij} ($i = 1, 2, 3, \dots, M$; $j = 1, 2, 3, \dots, N$) to be moved to the target location a'_{ij} , how to arrange the ship's shifting is to be discussed following description. Where M is amount of double berth or more; N is amount of the wharf.

The shifting and berthing job is restricted not only by the number of dockyard pier, but also subjected to other conditions of the shipyard. The first is the shipyard resource conditions, such as amount of the tug boat and its' horsepower also determine the capacity of one-time-shifting ship. The second is the natural conditions, such as the channel's width and depth, as well as the channel tide also determine