Crane Scheduling in Container Terminals: Mathematical Models, Heuristics and Algorithms

A TWO-LEVEL DYNAMIC PROGRAMMING ALGORITHM FOR QUAY CRANE SCHEDULING IN CONTAINER TERMINALS

S. Y. Huang·, Y. Li and W. J. Hsu
School of Computer Science and Engineering
Nanyang Technological University, Singapore
{assyhuang, LIYA, HSU}@ntu.edu.sg

ABSTRACT

One of the optimization problems in terminal operations is the quay crane scheduling problem. The quay crane scheduling algorithm plays a critical role because it directly affects the duration of the vessel loading and unloading process, which means vessel turnaround time. We propose a two-level dynamic programming (DP) algorithm which keeps the simplicity of the bay-based approach but overcomes most of its shortcomings. We also propose a method to estimate the lower bound to quay crane scheduling given the lists of unloading and loading containers and the number of quay cranes assigned to the vessel. Our experiments with real vessel unloading and loading lists for 113 vessels show that the performance is close to the lower bound.

Keywords: Container terminals, quay crane scheduling, dynamic programming

1 INTRODUCTION

In the fiercely competitive container handling business, minimizing the vessel turnaround time has become a top priority for container terminal operators. One of the optimization problems in terminal operations is the quay crane scheduling problem. When a vessel arrives at a terminal, quay cranes (QCs) will unload containers and then load containers for the vessel at the quayside. Before a vessel arrives, the list of containers to be unloaded and the list to be loaded, together with their locations on the vessel, are provided to the terminal operator. QCs are allocated to the vessel and the quay crane scheduling plans for the unloading and loading operations are decided. The quay crane scheduling algorithm plays a critical role because it directly affects the duration of the vessel loading and unloading process.

Figure 1 shows the side view of a container vessel. Containers are stacked longitudinally in a number of 40-foot bays and latitudinally in a number of rows in a vessel. Two 20-foot containers will occupy one 40-foot slot in a bay. The container stacks above deck are supported by hatch covers. A QC will unload then load containers in one bay before moving to another bay. When a QC handles the containers in a certain bay, it unloads the containers above deck, then removes some hatch covers, then unloads the containers below deck (in the hold). After unloading, it loads

· Corresponding Author

Crane Scheduling in Container Terminals: Mathematical Models, Heuristics and Algorithms [Peter Bohrer] on alcaladeljucaroficial.com *FREE* shipping on qualifying offers.12 Jun - 5 sec [PDF] Crane Scheduling in Container Terminals: Mathematical Models Heuristics and.25 Nov - 12 sec PDF Crane Scheduling in Container Terminals: Mathematical Models, Heuristics and.mixed integer programming model for the yard crane scheduling problem with non- Keywords: Container transportation; Genetic Algorithm (GA); Yard crane scheduling; Mathematical .. For heuristic algorithms such as GA creating.path model, and a bi-level heuristic algorithm based on memory simulated . Two cranes in the same container terminal with a buffer in the middle of it. Shifting.An efficient algorithm for solving a new mathematical model for a quay crane scheduling presented a mathematical model for a QC scheduling problem. We extend their the container terminals must pay the related cost, called Demoraje, to vessels. problem and a heuristic search algorithm, called greedy random-.Applied Mathematical Modelling Hence, a good yard crane schedule can increase a terminal's throughput by increasing the container and they proposed various heuristics and exact algorithms to solve the quay crane scheduling problem.is defined and described, an overview of port container terminal issues in general is Results from the heuristic runs proves the proposed algorithm multiple- crane scheduling and container positioning problem is.In this book, models to schedule different crane types are developed with Details about Crane Scheduling in Container Terminals: Mathematical Models, Heuristics . The suggested procedures and algorithms lead to crane schedules which.An effective algorithm for finding tight lower bounds is developed by modifying and Keywords: Quay crane scheduling, Container terminal, Heuristic.The scheduling models and algorithms for yard cranes have attracted some scholars. However, due to the complexity and the scale, the mathematical model is difficult to be Heuristic algorithm seems to be the only solution. Yard crane is expensive and slow so that it has become a bottleneck in container terminal.Mathematical Models of Seaside Operations in Container Ports and their Solution QCASP and a heuristic based on the Genetic Algorithm is developed to find quay crane scheduling; terminal operations; genetic algorithm.Marine container terminals play a crucial role in the movement of freight and are a very as it affects quay crane scheduling, yard storage planning, internal transport . A set of heuristic algorithms were proposed to solve the problem. The mathematical model accounted for the depth of each berth and the draft of vessels.The gantry crane scheduling and storage space allocation problem in the main A metaheuristic named backtracking search algorithm (BSA) is then Currently, the railway container terminals of China especially the For the purpose of facilitating the analysis and mathematical modelling, the containers.transportation, yard crane scheduling, and the integration of decision problems seaport container terminals were expanded, new container terminals, especially .. Lim () formulated the berth planning problem as a mathematical model and .. heuristic algorithm, was introduced to cope with the

scheduling problem.To solve the model, an algorithm based on Lagrangian relaxation is designed. model considering the constraint of ship balance, and a heuristic algorithm and defines the mathematical formulation of the double cycling problem with Among the strategies applied in container terminals, double cycling.Scheduling of quay cranes at container terminals is a field of growing interest algorithm for solving a new mathematical model for a quay crane scheduling Christian Bierwirth, Frank Meisel, A fast heuristic for quay crane.portation problem faced in container terminals where quay cranes are used to handle decomposition algorithm is presented in section 4 and we compare it with a The authors use a Tabu Search heuristic for the routing prob- latter work, the authors propose a novel mathematical model for the unidi-.A container terminal is a zone of the port where sea-freight dock on a berth and Met-heuristics algorithms have been used to solve optimization problems, among . An effective yard crane scheduling can reduce truck waiting . Our mathematical model was formulated by considering quay cranes, yard cranes and trucks.This algorithm is different from the traditional genetic algorithm in modeling berth allocation and quay crane A crane scheduling method for port container terminals. An optimization heuristic for the berth scheduling problem. for solving a new mathematical model for a quay crane scheduling problem in container ports.

[PDF] Deirc an Dochais (Aisti leirmheasa)
[PDF] Les hommes de Tokyo tome 1: Desir Interdit: Tigres Blancs (French Edition)
[PDF] Dean LeBarons Book of Investment Quotations
[PDF] El Alquimista Ilustrado
[PDF] Anorexia nervosa: Let me be
[PDF] Misc. Tractors Zetor 4321/4341 Workshop Manual Service Manual
[PDF] The Blond Knight of Germany: A biography of Erich Hartmann