International Journal of Innovative Computing, Information and Control
Volume **7**, Number **5(B)**, May **2011**

ICIC International ©2011 ISSN 1349-4198
pp. **2763–2773**

DISRUPTION MANAGEMENT MODEL AND ITS ALGORITHMS FOR BERTH ALLOCATION PROBLEM IN CONTAINER TERMINALS

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Received January 2010; revised April 2010

Abstract. *In this paper, the disruption management problem of berth allocation is studied to deal with the unforeseen disruptions in container terminals. A berth allocation model considering the scheduling of quay crane is developed first. Then a disruption management model is developed to recover the berth schedule when unexpected events happen, and simulation optimization approach is proposed to solve the model. To improve the computation efficiency of simulation optimization approach, algorithms based on local rescheduling and tabu search is designed. Numerical experiments indicate that local rescheduling based algorithm can improve the computation efficiency comparing to full rescheduling based algorithm. Moreover, the disruption management model considers the benefit of different parties, thus increases the scientificity of recovery schedule.*
Keywords: Berth scheduling, Disruption management, Simulation optimization, Container terminals

1. **Introduction.** Berths are important resources of container terminals and the good scheduling of berths can improve customers' satisfaction, increase throughput and lead to higher revenues of container terminals. The objective of the berth scheduling is to determine the berthing times and positions of containerships in container terminals, thus to minimize the penalty cost resulting from delays in the departures of ships and the additional handling costs resulting from non-optimal locations of ships in a container terminals.

Quay cranes (QCs) scheduling problem is another vital factor for efficient terminal operations. The scheduling of QCs significantly affects the operation efficiency of container terminals, and thus determines the makespan of a container vessel, which is the latest completion time of all operation tasks of a container vessel. QC operation rate is one of the most important indexes to measure the performance of operation system in container terminals. Moreover, berth allocation and QC scheduling are two inter-related problems, e.g., the change of QC-to-Vessel assignment influences the operation times of container vessels. Therefore, the integration solution of BAP and QCSP is needed.

Numerous studies have been conducted regarding the improvement of the efficiency of berth allocation and QC scheduling. And many models and algorithms are developed to optimize the berth allocation and QC scheduling. However, during operation, the planned schedules often have to be revised because of disruptions caused by severe weather, equipment failures, technical problems and other unforeseen events. Once these