PROCEEDINGS OF ABSTRACTS AND PAPERS (ON CD-ROM) OF

THE SECOND INTERNATIONAL INTELLIGENT LOGISTICS SYSTEMS CONFERENCE 2006

Edited by Erhan Kozan

LOGISTICS RESEARCH

Proceedings of Abstracts and Papers (On CD-ROM) of

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Edited by

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Proceedings of Abstracts and Papers (On CD-ROM) of the Second International Intelligent Logistics Systems Conference 2006

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PREFACE

Queensland University of Technology welcomes all participants from Australia, Germany, Finland, Hong Kong, India, Japan, Netherlands, Singapore, South Korea, Taiwan and USA to the Second International Intelligent Logistics Systems Conference 2006 held in Brisbane, Australia, in February 2006.

It is my honour, on behalf of the Second International Intelligent Logistics Systems Conference organising committee to present these proceedings, which provide a unique opportunity to maintain currency with container logistics issues. An encouraging feature of the papers is the breadth they cover in both theory and application. The proceedings contain a range of papers and abstracts dealing with different issues relating to the theme of the workshop. The majority of them deal with application and analysis. Some of the papers are theoretical and discuss the techniques required to analyse real life applications.

The editor of this proceedings wishes to express his appreciation to all authors for their contribution to container logistics of their latest findings. I would also like to thank the members of the International Advisory Committee and Organising Committee.

This publication consists of a CD ROM proceedings which accompanies the booklet of Abstracts. Facilitated by the advancement of Information Technology, it is advantageous to include colour graphics and even some simple animations in the proceedings on CD ROM. Readers can use either the Table of Contents or the Authors Index to quickly access the paper in which they are interested.

In particular a special welcome to keynote speakers Rommert Dekker Erasmus University, Netherlands; Mitsuo Gen, Waseda University, Japan; Hans-Otto Guenther, Technical University Berlin, Germany; Peter Keyte, Port of Brisbane Corporation, Australia; Kap Hwan Kim, Busan National University, Korea; Pitu Mirchandani, University of Arizona, USA; Stefan Voß, Institute of Information Systems, University of Hamburg, Germany have accepted our invitation to present.

The reader is reminded that although invited reviewers for technical and editorial quality have reviewed the manuscripts, the contents prepared by the author were electronically reproduced into the CD ROM Proceedings. Therefore, the views and opinions are those of the authors, and readers having questions about a paper should contact the authors.

We expect everyone who attends this conference will receive value from the broad range of topics available in the program, to have informal discussions with the international professionals and enjoy the atmosphere and surroundings of this first class venue.

Erhan Kozan

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TECHNICAL CONTRIBUTIONS

ADVANCED METHODS FOR CONTAINER STACKING

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ABSTRACT

A container terminal's view is determined by large gantry cranes and large container stacks. Containers have been designed in such a way that they can be stacked on top of each other without any supporting shelf or rack structure. The disadvantage of this fact is that when the bottom container is needed, all the other containers need to be moved aside, which means a lot of unproductive moves if the containers are stacked high. In this presentation we first give an overview of container stacking problems, on a strategic, tactical and operational level. The first level is especially important if automated stacking cranes are used, such as in Rotterdam's ECT or Hamburg's CTA. During the design important decisions have to be made concerning stack dimensioning and equipment capacity. On a tactical scale one has to make decisions about stack capacity in relation to equipment about the choice of operational strategies, including a decision about whether to apply stack reorganizations or not. Finally at an operational level one has to decide on where to put a container given information on its foreseen retrieval. Important aspects are with which modality it will leave the stack and when. At an operational level it is important to avoid container reshuffles and to have enough handling capacity, e.g. by being close to the location of the departure modality. Next we give the results of a detailed simulation study on stacking rules in an automated stacking system as used by ECT. We discuss main advantages and limitations of the design chosen. Finally, we discuss the role of the stack not only as main decoupling point between transport modalities, but also as virtual stocking point in the intercontinental supply chain.

Key Words: *Container Stacking, Simulation.*

EVOLUTIONARY TECHNIQUE FOR LOGISTICS NETWORK DESIGN: STATE-OF-THE-ART SURVEY

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ABSTRACT

The use of evolutionary techniques in the logistics networks design has been growing the last decades due to the fact that the logistics networks design problem is an NP hard problem. This paper examines recent developments in the field of evolutionary optimization for logistics. A number of papers in various areas are highlighted that give good points of evolutionary techniques. A wide range of strategies to approach the problem is covered as follows: first, we apply the hybrid Genetic Algorithm (hGA) approach for solving Fixed Charge Transportation Problem (fcTP). We have done several numerical experiments and compared the results with those of a simple GA. The proposed approach is more effective in larger size than benchmark test problems. Second, we give the recent GA approach for solving Multistage Logistic Network Problems. Third, we introduce Vehicle Routing Problem (VRP) and variants of VRP. We apply the priority-based Genetic Algorithm (pGA) approach for solving Multi-depot vehicle routing problem with time windows (mdVRP-tw). Fourth, we discuss the distribution centre location problem of a distribution system which consists of customers and a number of distribution centres to be located. We adopt a hybrid genetic algorithm (hGA) method to find the global or near global optimal solution for the location-allocation problem. Fifth, as a case study model, practical logistics applications to find the optimal routing will be introduced. Last, we model an automated guided vehicles (AGV) system by using network structure. This network model of an AGV dispatching system has simplex decision variables; considering most of the AGV problem's constraints. Furthermore, we apply an evolutionary approach for solving this problem with minimizing the time required to complete all jobs (i.e., makespan). The aims of this paper are to illustrate state-of-the-art survey in the evolutionary technique for logistics network design.

Key Words: *Evolutionary Technique, Genetic Algorithm, Fuzzy Logic Controller, Logistics Network Design Multistage Logistic Network.*

SIMULATION OF TRANSPORTATION ACTIVITIES IN AUTOMATED SEAPORT CONTAINER TERMINALS

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ABSTRACT

A container terminal represents a complex system with highly dynamic interactions between the various handling, transportation and storage units and incomplete knowledge about future events. Hence, decentralized planning is the only realistic mode to govern logistics control of automated container terminals. We classify the specific logistics planning and control issues arising in seaport container terminals with respect to the decision level (terminal design, operative planning, real-time control) and the type of handling equipment involved. In particular, the efficient use of transportation equipment determines the performance of the entire terminal. A simulation study of transportation activities in container terminals is presented, where automated vehicles can be employed in different dispatching modes. The design of the simulation study reflects conditions, which are typical of a real automated terminal environment. Major experimental factors are the size of the terminal and the degree of stochastic variations. The main issues addressed in the simulation experiments are the relative performance of various transportation modes and dispatching strategies and the impact of stochastic variations in handling and transportation times. In addition, directions of future research are highlighted, for instance, the application of local search principles for vehicle scheduling and approaches for integrated scheduling of cranes and vehicles.

Key Words: *Simulation, Transportation, AGV Dispatching.*

PORT OF BRISBANE CORPORATION – "BUILDING CAPACITY – BEATING CONGESTION"

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ABSTRACT

The essence of the PBC presentation will focus on the need for sound planning principles when assessing the logistical requirements of operating an international port. Focus will be on three critical areas of Port Access, ie: Road, Rail and Sea. A key message will be the need to consider all of these access points in the prime equation, to ensure an efficient operational port, and that any relaxation of concentration in any one area can result in significant logistical and economic loss. Some of the keynotes will also cover aspects of the impact on logistics of the new maritime security provisions, and the building of defence relationships with international partners. The presentation also provides a history of the port and how the port has evolved in line with significant changes to international trade supply chain advancements, such as containerisation and the introduction of mega-vessels. Future changes to the supply chain are contemplated and some of the future issues are highlighted whereby logistical solutions are being sought. Above all the Port of Brisbane is seeking to "future-proof " the port, ensuring that access to the port remains efficient and infrastructure is provided in line with growing demand.

Key Words: *Port Planning, Port Operation, Maritime Security.*

MODELS AND METHODS FOR EFFICIENT OPERATIONS IN PORT CONTAINER TERMINALS

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ABSTRACT

Because container vessels spend a large portion of transportation time in ports, it is essential to improve the productivity of various handling activities in port container terminals. Also, because port construction requires a large amount of investment, it is important to efficiently utilize the internal resources of container terminals. This presentation introduces various operations in container terminals and decision-making problems that require support by scientific methods. Models and methods in previous researches are reviewed and classified according to their characteristics.

Key Words: *Container Terminal, Port Operation, Productivity.*

REAL-TIME LOGISTIC RECOVERY UNDER SCHEDULE DISRUPTIONS

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ABSTRACT

Logistic and transportation system might be susceptible to unexpected costs and delays due to unforeseen events, such as vehicle breakdown, traffic delay/accident, road works and medical emergency. In such situations, a priori algorithmic solution may deteriorate and the fleet plan needs to be adjusted in real-time as a function of the dynamic system state. The real-time logistic recovery can be approached as a dynamic version of the static logistic problem (e.g, vehicle scheduling/routing) where assignments are generated dynamically. Logistic recovery problem arises in a wide array of practical applications. Instances include school bus routing, goods delivery and pickup, operational planning of public transportation systems, industrial/hospital refuse collection, mail delivery, and telecommunication systems.

When an unexpected event occurs, some existing vehicles need to be rescheduled and some extra vehicles from the depot may be allocated to conduct the recovery. Vehicle breakdown might be the worst case among unexpected events, since it demands picking up the passengers/cargo from the breakdown vehicle. The selection of the backup vehicle involves several factors such as the time when the trip was disrupted, the position of the remaining vehicles, the available capacity of the potential backup vehicles, and the itinerary compatibility among trips. Additional issues may be required in the different problems.

The purpose of static logistic problem is usually to minimize the total fixed vehicle and operating costs. Nevertheless, the delay cost plays an important role in real-time logistic recovery problem, since the significant delay deteriorates the quality of service. If the purpose of a rescheduling approach is only to minimize the fixed vehicle, operating and delay costs, the new schedule might be considerably different from the original schedule.

These changes can put the crews into a difficult situation, since it is essential that all teams know the itinerary of each new trip. Although it is

almost impossible to obtain a solution without effecting the initial schedule, it is possible, in order to decrease the number of possible changes in the initial schedule, to introduce penalties in the cost of some arcs of the vehicle scheduling networks.

Therefore, a general logistic recovery problem can be defined as follows. Given a depot or several depots and a series of trips (or customers), given the travel times between all pairs of locations, and given an unexpected event, find a feasible reschedule with minimum-costs, including fixed vehicle, operating, delay and rescheduling costs, in which (1) all vehicles, including existing vehicles and new vehicles from the depots, perform a feasible sequence of trips, and (2) all passengers or cargo affected by the unexpected event are served. Furthermore, in order that crew can be reassigned on a new schedule, the computation needs to be carried out as fast as possible. Considering the different problems, some additional constraints need to be included. For example, in vehicle routing problem with hard time window, it should be guaranteed that service time has to be within the time window.

The following is the outline of the presentation:
• A framework for decision/control will be presented and some typical “real-time” logistics and transportation scenarios will be illustrated
• The notions of “on-line” and “real-time” algorithms and “routine” and “infrequent” disruptions will be introduced and discussed.
• Models and solutions for “Real-time Vehicle Rescheduling” and “Real-time Vehicle Re-Routing” will be formulated and studied.

This research is in collaboration with Jing-Quan Li, PhD student, The University of Arizona, and Dr. Denis Borenstein, Universidade Federal do Rio Grande do Sul, Porto Alegre, Brazil.

Key Words: *Real-Time Logistic, Vehicle Rescheduling, Vehicle Re-Routing.*

CONTAINER TERMINALS AND OPERATIONS RESEARCH - A SURVEY WITH SPECIAL EMPHASIS ON PLANNING AND SCHEDULING OF DOUBLE RAIL MOUNTED GANTRY CRANES

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ABSTRACT

In the last four decades the container as an essential part of a unit-load-concept has achieved undoubted importance in international sea freight transportation. With ever increasing containerization, the number of seaport container terminals and the competition among them has become quite remarkable. Operations are nowadays unthinkable without effective and efficient use of information technology as well as appropriate optimization (operations research) methods. In this paper we first describe and classify the main logistics processes and operations in container terminals.

Containers came into the market for international conveyance of sea freight almost five decades ago. The breakthrough was achieved with large investments in specially designed ships, adapted seaport terminals with suitable equipment, and availability of containers. Today over 60% of the world's deep-sea general cargo is transported in containers, whereas some routes are even containerized up to 100%. International containerization market analysis still shows high increasing rates for container freight transportation in the future. This leads to higher demands on seaport container terminals, container logistics and management as well as on technical equipment, resulting in an increased competition between seaports. The seaports mainly compete for ocean carrier patronage and short sea operators as well as for the land-based truck and railroad services. The competitiveness of a container seaport is marked by different success factors, particularly the time in port for ships, combined with low rates for loading and discharging. Therefore, a crucial competitive advantage is the rapid turnover of the containers, which corresponds to a reduction of a ship's time in port and of the costs of the transshipment process itself.

In recent years the number of publications and the methodological advances regarding container terminal operations has considerably increased. For a detailed description and a comprehensive list of references

see Steenken et al. (2004). While we have conducted a comprehensive survey on operations research approaches related to container terminal

operations, one aspect came to mind that had not fully been exploited in the literature. While there are many obvious differences between a container terminal and related problems, there are also some more or less obvious commonalities that allow for some interrelated observation. This holds for problems, e.g., in large so-called mega-hubs as they can be found for airports and major train stations. The first objective of this paper is to provide a comprehensive survey for container terminal logistics and to show possible correspondences that may be used as a means for looking over the fence with respect to related problems and solution approaches in not always different areas.

Moreover, we present some new research field within specific container terminals. That is, often restricted space is forcing incumbent operators of seaport container terminals to think in new directions. Automation is playing a major role for increasing efficiency. For instance, automated double rail mounted gantry cranes (DRMGs) represent the latest design of storage equipment in modern container terminals and are able to work more efficiently than RMG-systems with a handshake area.

To the very challenging problems arising out of the operational scheduling of DRMGs belong the sequencing and the assignment of jobs as well as the prevention or handling of blocking situations, since these cranes are able to concurrently serve the whole storage block and transfer lanes. The main objective is to prevent delays in the horizontal transport of water-side import and export containers. We report on intensive simulation studies performed to determine well-suited, efficient scheduling strategies for the DRMGs. Among the tested methods are priority-rule based constructive heuristics and meta-heuristics. Preliminary results show the potential of this technology in practice.

REFERENCES

Steenken, D., Stahlbock, R. and Voß, S. (2004), Container terminal operation and operations research – A classification and literature review, *OR Spectrum* **26**, 3 - 49.

Key Words: *Container Terminal Operation, Scheduling, Gantry Crane.*

IDENTIFYING THE FLEET MIX IN A MILITARY SETTING

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ABSTRACT

When assessing land vehicle fleet capabilities in off-shore military operations, it is necessary to develop and apply a reliable mechanism for creating and testing different fleet structures. In this paper, we introduce a vehicle fleet mix problem under military environment, discuss the complexity of the problem and present a fleet-optimization system for deciding an appropriate vehicle fleet mix by optimizing multiple objectives while satisfying the system constraints. The system is based on a number of heuristics that can answer a number of key questions required for long term capability planning such as utilization of current fleet, mix of different vehicle and modular units for a given scenario, and overall fleet structure. We demonstrate the effectiveness of our system through a case study based on a simple example dataset.

Key Words: *Vehicle Modularisation, Heuristics-Based Fleet Optimisation, Fleet Scheduling.*

AN APPLICATION OF ONE-MACHINE SEQUENCING GAMES TO FAIR SHARING OF DEMURRAGE CHARGES IN SHIPPING

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ABSTRACT

In this paper the problem of fair cost-sharing of demurrage charges for shipping in the presence of a vessel queue is considered. A recent example of the occurrence of this problem in Australia was the vessel queue at Dalrymple Bay coal terminal in Queensland. Dalrymple bay is utilised by a number of coal producers. Capacity constraints at Dalrymple Bay coal terminal have led to a lengthening of the vessel queue to around 50 ships in early 2005. Delays in loading coal for export onto these ships mean that produces incur demurrage charges for the delay. The costs to the Australian coal industry of demurrage charges at Dalrymple bay were forecast in 2005 to be between $350-550 million for the year. If cost savings could be generated and fairly passed on to producers utilizing the port these charges could be substantially lower.

The main contribution of the paper is to apply the theory of one-machine sequencing games to the problem of fair sharing of demurrage costs which arise due to vessel queueing. This paper is concerned primarily with cost sharing between multiple users. Consequently, the problem is one of a coalitional form sequencing game for sharing the costs of an efficient job processing schedule.

An overview of the sequencing games literature is outlined. Sequencing games involve situations in which multiple decision makers wish to minimize total costs by finding the order of jobs to be processed on 1 or more machines.

The approach taken can be extended to allow for the calculation of demurrage charges on the basis of due dates and to allow for improved handling of cargo at the port due to improved equipment and facilities and the general expansion of capacity.

Key Words: *Sequencing games, Vessel Queues, Scheduling*

A CONTAINER STORAGE HANDLING MODEL FOR HIGH TECH AUTOMATED MULTIMODAL TERMINALS

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ABSTRACT

Multimodal Container Terminals are complex systems which require careful planning and control in order to perform efficiently. The containers may require being stacked in multiple levels to maximise storage usage. The position of the container in the storage area affects the handling time, and this time dramatically increases with rehandling jobs that must be performed to access that container. A model for minimising transfer tardiness in the storage area is developed in this paper. A computer program based on meta-heuristic and simulation techniques is designed and implemented to optimise non-trivial problems. A performance and sensitivity analysis are carried out and suggestions are made for future research in this area.

Key Words: *Multimodal, Container, Meta-Heuristics.*

AN OPTIMAL TRANSPORT ALGORITHM FOR MULTIMODAL TRANSPORT

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ABSTRACT

Because of rapid expansion of third party logistics, fierce competition in the transportation industry, and the diversification and globalization of transportation channels, an effective transportation planning by means of multimodal transport is badly needed. Accordingly, this study aims to suggest an optimal transport algorithm for the multimodal transport in the international logistics. Cargoes and stopovers can be changed numerously according to the change of transportation modes, thus being a NP-hard problem. As a solution for this problem, first of all, we have applied a pruning algorithm to simplify it, suggesting a heuristic algorithm for constrained shortest path problem to find out a feasible area with an effective time range and effective cost range, which has been applied to the Label Setting Algorithm, consequently leading to multiple Pareto optimal solutions.

Meanwhile, as a way of evaluating these multiple Pareto optimal solutions, this study has introduced a mathematical model and MADM model. Also, in order to test the efficiency of the heuristic algorithm for constrained shortest path problem, this paper has applied it to the actual transportation path from Busan, port of Korea to Rotterdam, port of Netherlands.

Key Words: *Multimodal Transport, Constrained Shortest Path, Label Setting Algorithm.*

A STUDY ON THE TECHNOLOGY DEVELOPMENT FOR NONSTOP AUTOMATED GATE SYSTEM

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ABSTRACT

With the appearance of the super large container, a lot of studies are actively being made to enhance competitiveness of the port logistics industry, trying to bring about a logistics revolution by grafting high-tech information technology. The introduction of an automated container terminal is expected to break through the limit of a traditional container terminal and bring a revolution on the whole port logistics industry. Some business models are being performed in Korea in order to realize the environment of an automated container terminal. However, those business models are undergoing difficulty because of lack of studies on technology introduction strategy and insufficient knowledge of actual problems.

This paper has tried to suggest a nonstop-automated gate system to realize an automated container terminal. To this end, this study has presented some types of a nonstop-automated gate and suggested a detailed technology alternative for each type. Also, by means of validity evaluation, this paper has tested the technology alternatives of each type as well as introduction procedures. We expect that this paper will contribute to establishing a practical guideline for the introduction of a nonstop-automated container terminal.

Key Words: *Container Terminal, Nonstop Automated Gate System, Identification Systems (RFID, OCR, DSRC, ACDI, Mobile).*

A DECISION SUPPORT SYSTEM FOR INTERMODAL TRAIN PLANNING

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ABSTRACT

Train planning is the process of assigning containers to certain wagons on an intermodal train. Currently, there is limited decision support used for train planning in Australia leading to costly rehandles when loading trains. Intermodal terminals are highly integrated systems that create a difficult planning environment for computerised decision support systems. We have addressed this difficulty for the specific problem of train planning by developing a detailed mathematical optimisation model. This paper describes the model and how it was implemented within a software system called ITP - Intermodal Train Planner. Numerical experiments are presented to demonstrate the effectiveness of ITP.

Key Words: *Intermodal, Container.*

ACCOUNTING FOR REVERSE FLOWS

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ABSTRACT

Traditional logistics systems are aimed at minimising total (logistics) costs. At the same time, these systems focus on forward material and information flows in the supply chain. Concerns for the environment, and warranty-related product returns have led to both end-of-life and commercial product take-backs, introducing the question of reverse material flows in these systems. These are backward moving inventories that have to be (re-)processed and show several coupling points to the forward materials flows in the logistics system. We argue that modern accounting systems are challenged with the phases of remanufacturing and refurbishment in the reverse supply chain. Many reverse logistics and reprocessing activities are integrated in other corporate processes, and their costs are difficult to separate from other cost objects, thus hindering correct costing of reverse flows. By an analogy to safety management accounting, this paper proposes an activity-based method to account for the costs of reverse material flows. Accounting for these costs will help to take a more holistic view on total logistics costs.

***Key Words**: Reverse Logistics, Management Accounting, Activity Based Costing.*

BOTTLENECKS IN INTERMODAL TRANSPORTATION – THE CASE OF THE BALTIC REGION

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ABSTRACT

Due to trends in globalisation and outsourcing, container traffic is increasing at a rapid speed. Reflecting this development, several new ports and container terminals are built around the Baltic Sea. However, as many ports have previously been serving liquid materials from pipelines, port hinterlands currently lack the connectivity for the further transportation of solid materials to and from the ports. Rail connections between ports and major cities in the region are virtually non-existent, and many roads in the Baltic States are not built for the truck sizes and weights required for intermodal container traffic. The situation of the transportation infrastructure in the region is improving very slowly; therefore shippers need alternative solutions to ensure the movement of their freight in and out of these ports. This paper examines and assesses the bottlenecks for freight movement in the Baltic States from the perspective of intermodal transportation. A framework for conducting the examination of the perceived bottlenecks on different levels is proposed. Bottlenecks for intermodal transportation are found on organisational, regional, but also international levels.

***Key Words**: Baltic States, Intermodal Transportation, Bottleneck Analysis.*

ISSUES AND CHALLENGES WITH LOGISTICS OF RAIL MAINTENANCE

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ABSTRACT

Detection and rectification of rail defects are major issues for all rail players around the world. Some of the defects include worn out rails, weld problems, internal defects, corrugations and rolling contact fatigue (RCF) initiated problems such as surface cracks, head checks, squats, spalling and shelling. If undetected and/or untreated these can lead to rail breaks and derailments. There are challenges to the infrastructure maintenance people with logistics for effective inspection and cost effective rectification decisions. If these issues are addressed properly then inspection and rectification decisions can reduce potential risk of rail breaks and derailments. Inspite of continuous efforts by all rail operators around the world to reduce costs, a substantial amount of railway budget is spent on inspection and maintenance of rails. These costs are further increased by inaccurate logistics decisions related to maintenance and inspection personnel, equipment, and planning. This paper addresses the issues and challenges related to logistics of rail maintenance with an aim to reduce costs and risk related to rail operations.

Keywords: *Rail Inspection, Rail Maintenance, Logistics, Cost, Risk.*

THE CHALLENGE OF TECHNOLOGY TRANSFER IN A CROSS-CULTURAL ENVIRONMENT – FROM THE U.S. TO THE GREATER CHINA REGION

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ABSTRACT

The capabilities of technology transfer (TT) within organizations are the key elements of competition in the era of innovation. In the early 1990s, faced with the rapid growing of global competition, American companies were actively searching for opportunities of product outsourcing and technology transferring to Asia countries, particularly to the Greater China Region (Taiwan and PR China). However, those multinational corporations (MNCs) in the U.S. are confronted with a challenge – the impact of cross-cultural issues in TT. Even though the cross-cultural impact in TT gives rise to the influences in MNCs, a literature review indicates abundant related works dealing with this topic, only few addresses specifically to the effects of cultural differences affecting the effectiveness of TT and suggests complete and practical solutions. This investigation examines the impact of cross-cultural issues on managing TT from the U.S. to the Greater China Region and presents a validated model for those project managers who manage this type of projects in MNCs.

Key Words: *Cultural Differences, Multinational Corporations, Technology Transfer.*

PERFORMANCE EVALUATION OF YARD CRANES IN CONTAINER TERMINALS

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ABSTRACT

Various different types of yard cranes are used in container terminals. Examples are rubber tired gantry cranes, rail mounted gantry cranes, overhead bridge cranes, dual rail-mounted gantry cranes, and automated stacking cranes. The kinematics and handling characteristics of these yard cranes are different from each other. This study analyses characteristics of each type of yard crane and compares various performances - including throughput capacity and storage capacity - for different handling requirements.

Key Words: *Yard Cranes, Handling Characteristics, Performance.*

SIMULATION ANALYSIS OF ALGORITHMS FOR CONTAINER STORAGE AND YARD CRANE SCHEDULING AT A CONTAINER TERMINAL

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ABSTRACT

The average quay crane (QC) rate at most marine container ports is currently hovering around 25 moves per hour. In many cases, under current operating conditions, this rate can be improved only marginally by increasing the number of yard trucks (YTs) and yard cranes (YCs) per QC. However, a QC is technically capable of making 40 moves per hour when YTs are always on hand at the quay to deliver/receive the appropriate containers to/from the QC. How, then, can ports ever achieve QC rates approaching 40 moves per hour? Using a home-made simulation model of a container terminal, we show that the answer lies in the container storage and YC scheduling algorithms used within the container yard. For two different container terminals, we propose and evaluate various combinations of container storage and YC scheduling algorithms, and we identify which combination is the best. Our study ignores YTs and focuses on the question of whether it is possible to schedule YCs so they meet the deadlines set by QCs working at 40 moves per hour. Results show the speed, efficiency, and effectiveness of the proposed algorithms.

Key Words: *Maritime Container Terminal, Cargo Handling, Yard Crane Scheduling.*

A MULTI-AGENT APPROACH FOR ANALYSING MATERIAL FLOW IN A MANUFACTURING SUPPLY CHAIN

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ABSTRACT

In the last decade, supply chain operations have received tremendous attention in manufacturing and business sectors due to an increasingly challenging marketplace. This paper presents a multi-agent approach for analysing material flow in a manufacturing supply chain under information sharing. The model is capable of handling complex networks with many tiers, each tier with many business units and complex interactions among them. We have discussed the multi-agent architecture and run simulations for analysing the operational aspects under both deterministic and stochastic demand. This will allow companies to quantify different interacting parameters in the supply chain and support improvement in operations.

Key Words: *Supply Chain, Multi-Agent Approach, Material Flow.*

MODELING THE GLOBAL LOGISTICS BUSINESS PROCESSES FOR OPTOELECTRONICS FIRMS

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ABSTRACT

Optoelectronics is one of the fastest growing industrial sectors in the world. Industries in this sector produce components such as liquid crystal flat panel displays that are used in a diverse range of electronic products including notebook computer screens, flat panel televisions, mobile phones, and Personal Digital Assistants (PDA's). Since optoelectronic components are primarily used for consumer goods, manufacturing companies must be efficient and agile to respond to the ever-changing market needs. Thus, a well managed global logistics hub frequently becomes the core value and competitive advantage for these firms. This research surveys optoelectronics firms in Taiwan to map their current, as-is, logistics models. Using Petri Net theory, the business process models and the container logistic operations of the prime (i.e., the optoelectronic end-product manufacturer) and the inter-organizational operations between the prime and its supply and demand chains are studied. These processes are then modified to construct idealized logistics processes (the to-be models) for components supply and goods shipment. Since global logistics management plays a critical role in optoelectronics industry, the derived to-be logistics and business models help optoelectronics industry visualize and improve logistics operations. The derived models cover goods tracking, safety inventory, and global logistics coordination.

Key Words: *Global Logistics, Optoelectronics, Petri Net, Electronic Commerce, TFT-LCD.*

ALLOCATING STORAGE SPACES FOR TEMPORARY INVENTORIES CONSIDERING HANDLING, TRANSPORTATION, AND STORAGE CAPACITIES

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ABSTRACT

Space may be a scarce resource in manufacturing shops, warehouses, freight terminals, and container terminals. This paper discusses how to locate temporary storage inventories in limited storage areas. A typical inventory is delivered from the location of the preceding process to the storage area and stored in the storage area during a certain period of time. It may then be relocated from the original storage position to another storage position. Finally, it is delivered from the final storage area to the location of the next process. Because this logistic process for an inventory requires handling activities, transportation activities, and storage spaces, the limitation in capacities of handling equipment, transportation equipment, and storage space must be considered when allocating spaces to the inventory. This problem is modeled as a multicommodity minimal cost flow problem. A numerical example is presented to validate the model.

Key Words: *Space Allocation, Multicommodity Network Flow Problem, Inventory, Container Terminal.*

AN INTEGRATED APPROACH IN OPTIMISING CONTAINER PROCESS AT SEAPORT CONTAINER TERMINALS

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ABSTRACT

A container terminal yard acts as an interface/buffer between ships and the hinterland for container transfers. To achieve shorter ship service time, hence minimum ship delay and greater throughput of the port, containers in the yard should be stored at the most suitable location. However, such locations are limited resources and may not always be available. On the other front, the container process is analogous of a multi-stage flowshop with parallel machines. To increase the efficiency of the port, it is also important to reduce machine slack and blocking times. This paper investigates container storage location, and the sequencing and scheduling of machine operations in the port. An integrated approach is proposed to minimise ship service time. Meta-heuristic algorithms are developed to solve the problem. Numerical investigation is also presented.

Key Words: *Optimisation, Scheduling, Yard Planning.*

NOTES

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