LOGMS

The 2012 International Conference on Logistics and Maritime Systems

Book of Abstracts

University of Bremen • Germany

August 22-24 • 2012

Universität Bremen

KIESERLING STIFTUNG

wiwib Wirtschaft-Wissenschaft-Bremen

Tuesday, August 21

18:30 – 20:30	**Get-together**

Wednesday, August 22

8:30	*Registration*
9:00	**Opening Ceremony and Welcome Addresses**
	Marielle Christiansen – Keynote
	Jan Miller – Keynote
10:40	*Coffee break*
11:00	Parallel Sessions (W-D-1; W-D-2; W-D-3)
12:20	*Lunch Break (Mensa)*
13:30	Parallel Sessions (W-F-1; W-F-2; W-F-3)
14:50	*Coffee Break*
15:10	Parallel Sessions (W-H-1; W-H-2; W-H-3)
16:30	*Short Coffee Break*
16:40 – 18:00	Parallel Sessions (W-J-1; W-J-2; W-J-3)
18:30 – 20:30	**Welcome Reception at Hotel Munte**

Thursday, August 23

08:30	*Registration*
09:00	Parallel Sessions (T-B-1; T-B-2; T-B-3)
10:20	*Coffee Break*
10:40	Parallel Sessions (T-D-1; T-D-2, T-D-3)
12:20	*Lunch Break (Mensa)*
13:10	Parallel Sessions (T-F-1; T-F-2; T-F-3)
14:30	*Coffee Break*
14:50	Parallel Sessions (T-H-1; T-H-2; T-H-3, T-H-4)
16:10	*Coffee Break*
16:30 – 18:10	Parallel Sessions (T-J-1; T-J-2; T-J-3; T-J-4)
19:00 – 23:00	**Conference Dinner at Hilton Bremen (downtown)**

Friday, August 24

08:30	*Registration*
09:00	Parallel Sessions (F-A-1; F-A-2; F-A-3)
10:20	*Coffee Break*
10:40	**Michel Gendreau – Keynote**
	Loo Hay Lee – Keynote
	Student's Best Paper Award and Closing Ceremony
12:10	*Short Lunch (GW1-HS Foyer)*
13:00 – 16:00	**Industry Tour 1 "Bremer Straßenbahn" / Industry Tour 2 "Airbus"**

Coffee will be served at all breaks in building **GW1-HS**. **Opening and closing ceremonies** as well as **keynote talks** are hosted in building **GW1-HS,** room H0070.

Registration desk in building **GW1-HS** is staffed during the Get-together on Tuesday (18:30 – 20:30) and on Wednesday, Thursday, and Friday from 8:30 to 15:00, respectively. If you arrive at another time please ask one of the local organizers.

Contents

Welcome to LOGMS 2012 – The 2012 International Conference on Logistics and Maritime Systems

The objective of the LOGMS 2012 conference is to provide a forum for exchanging ideas on the latest developments in the field of logistics and maritime systems among participants from universities and industry, and to seek opportunities for collaboration among these participants. Logistics activities worldwide have been rapidly increasing. As a result, global freight networks are emerging which combine maritime transport, inland waterways and onshore road and rail transportation systems.

The first conference of the LOGMS conference series took place in Busan, Korea in 2010. It has integrated various predecessor conferences like the International Conference on Intelligent Logistics Systems (IILS), held in Busan, Korea (2005), Brisbane, Australia (2006), Kitakyushu, Japan (2007), Shanghai, China (2008), and Gold Coast, Australia (2009), and the Supply Chain Management (MLOG) conference held in Singapore (2008).

At LOGMS 2012, there are four keynote talks on topics of Logistics and Maritime Systems and there are 88 presentations organized in 32 sessions, which are related to miscellaneous topics as Current Trends in Maritime Logistics, Liner Shipping Networks, Landside Transportation Systems, Hinterland Interfaces of Seaports, Vehicle Routing and Scheduling, Sustainability Issues in Maritime Logistics, Layout and Configuration of Container Terminals, Warehousing and Distribution, Future Logistics Technologies, Container Terminal Operations, Multimodal Transportation Systems, Efficiency Analysis of Logistics Systems, Logistics and Supply Chains, Intermodal Transport, Distribution Systems, Advanced Logistics Technologies, Optimization Modeling, and IT Applications of Logistics Systems. We are expecting 158 guests coming from four continents and 25 countries contributing to the success of LOGMS 2012.

The General Chairs of the LOGMS 2012 conference cordially welcome you and hope that you will enjoy the conference.

Prof. Dr. Kap Hwan Kim

Prof. Dr. Hans-Otto Guenther

Prof. Dr. Herbert Kopfer

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Conference Venue

Address:
Geisteswissenschaft 1 (GW1)
Universitätsallee
28359 Bremen

Rooms:
Building **GW1-HS**, room **HS-0070** (ground floor) and room **HS-1010** (first floor)
Building **GW1-B**, room **B0080** (ground floor) and room **B0100** (ground floor)

Welcome & closing ceremony: building **GW1-HS**, room **HS-0070**
Keynote talks: building **GW1-HS**, room **HS-0070**
Coffee & registration: building **GW1-HS**, foyer.
Lunch (Wednesday, Thursday): **Mensa**
ATM: opposite of Mensa main entrance at the red Boulevard

Registration

The Registration desk is located in the foyer of building **GW1-HS**.

The opening hours are:

Tuesday	18:00 – 20:30 during Get-together
Wednesday	8:30 – 15:00
Thursday	8:30 – 15:00
Friday	8:30 – 10:00

If you arrive at another time please ask one of the local organizers (blue badge).

Guide for speakers

- The time and the location of your session are shown in the scientific program.
- Time your talk to fit the allotted time (26 minutes including time for discussion for sessions with 3 or less presentations, 20 minutes for sessions with 4 presentations).
- Please check in with the session chair ten minutes before the start of the session.
- Provide your presentation on a USB-Stick and transfer it on the notebook before the start of the session.
- Each lecture room is equipped with a video beamer and a Windows notebook without CD rom drive. Adobe Reader and MS Office (2007 or 2010) are installed.
- You are free to use your own laptop. However, check if everything works fine before the start of your session so that all talks can proceed smoothly. If you use an Apple notebook, remember to bring the necessary equipment for video beamer connection. Electric power

supply in Germany is via sockets of type F “Schuko” (230 volt, 50 Hz) – please bring your own adaptor if necessary.

Wireless LAN

WLAN access at the conference venue is possible. Please use your personal access code and consult the separate instructions handed over to you.

Lunch at Mensa

The way from the conference venue to the Mensa is sketched on the page “Map of University”. You have received two vouchers, one for Wednesday and one for Thursday. With these you can pay at any checkout. You can stack up as much as you can carry on your tablet.

The Mensa offers a high diversity of food at seven counters. Unfortunately, the menu as well as the labels of the counters are in German only. The seven counters are labeled in German as follows:

Essen I (red)	soup, main course, dessert
Essen II	stew or pottage
Pasta, Suppen & Co. (yellow)	pasta, soups, Bio food, vegetarian pizza, etc.
Salate (green)	salad bar, arranged salad plates, wraps
Vegetarisch (green)	vegetarian meal
Wok & Pfanne (blue)	baked meat, usually prohibitive high priced for students, therefore short queues despite tasty food
Beilagen	additional side dishes

Do not hesitate to ask one of the local organizers if you need guidance.

There are some reserved tables for participants of LOGMS. After leaving the checkout area just turn to the right and then go straight ahead into the lower area.

General information and transport in Bremen

- A separate map of Bremen city center is included in the congress materials.
- You’ll find recommendations of restaurants, sights, and guided tours in the booklet “Bremen at a glance”.
- All regular and student participants of LOGMS are provided with a ticket for Bremen public transport. It is valid from Tuesday (21/8) until Friday (24/8) and can be used in the entire city area. The cost for a Single-ticket is 2.35 €, you can buy it from the driver (bus) or at a vending machine inside a tram (cash payment only). Within the first 60 minutes you are allowed to travel in all directions.
- Public transport schedules can be found at http://www.bsag.de/eng/index.php.

- Tram line No. 6 stops at „Universität / NW1“ which is in walking distance to the conference venue, Hotel Munte, and Hotel Atlantic.
- Bus lines No. 22 and No. 28 stop at „Wiener Str.“ which is even closer to the conference venue, Hotel Munte, and Hotel Atlantic; however, usually one or more transfers are required to get to city center or airport.

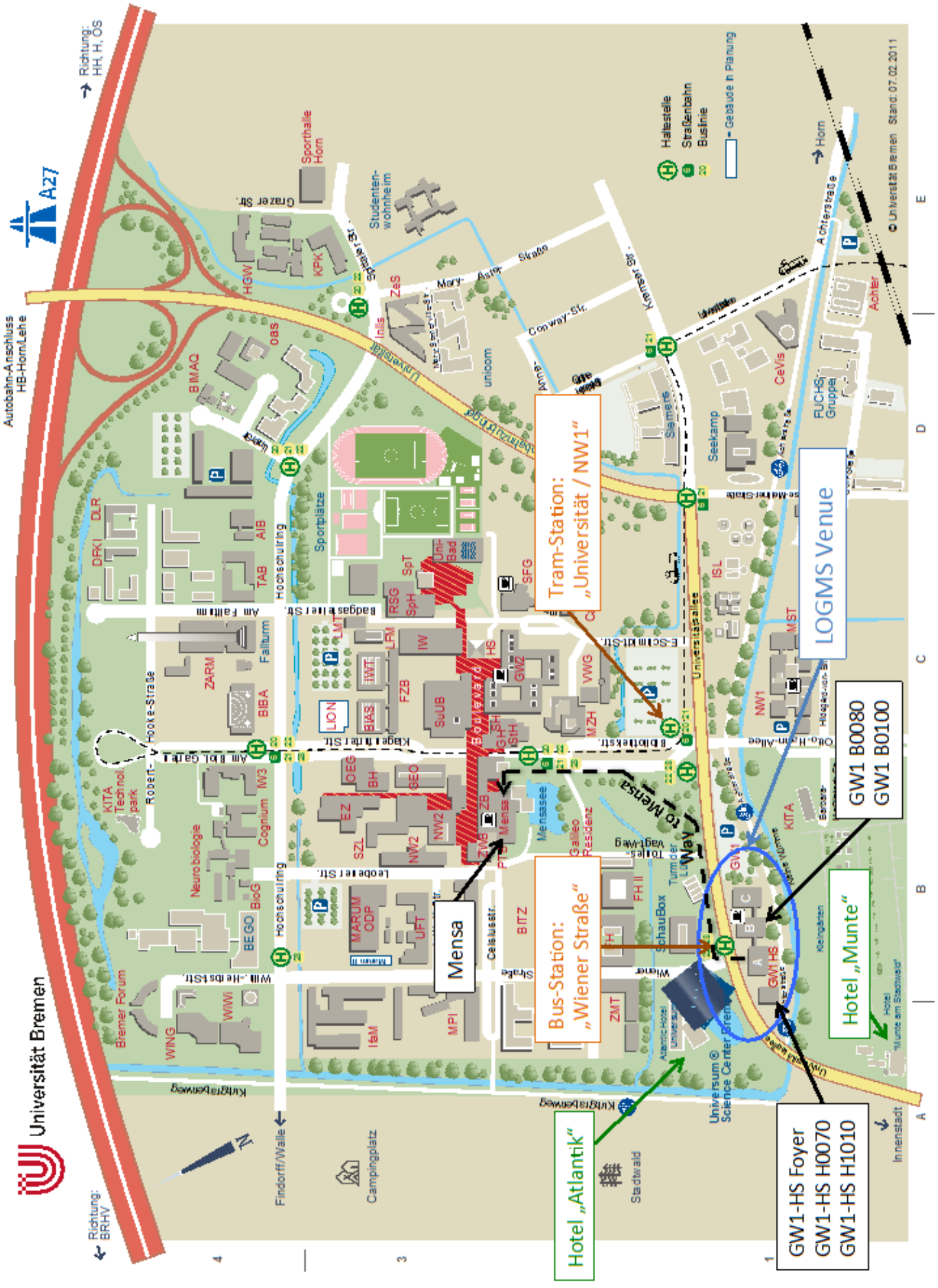
- You can call a taxi via +49 421 14 0 14. For iPhone and Android phones there is also an app called *Taxi Bremen* (in German) which helps you to get a taxi. In Germany, official taxis are beige and carry a yellow taxi sign on the roof.
- **Schedule of tram line No. 6** (Holiday Schedule)
  Tram line No. 6 connects Bremen University with Bremen airport. Important stops are *main station* and *Domsheide* (city center). Use this line if you arrive in Bremen via plane or train and stay at hotels Atlantic or Munte. We will also use this tram line in order to go to Hilton (conference dinner), Bremer Straßenbahn (industry tour 1), and Airbus (industry tour 2).
  From 05:00 to 20:00 a tram departs every ten minutes, between 21:00 and 23:00 every twenty minutes, and between 23:00 – 01:00 every thirty minutes.

Sequence of stations tram line No. 6 from University to Airport via city center.

↓ university to airport		↑ travel direction
	Klagenfurter Str.	
	Universität / Zentralbereich	
	Universität / NW 1 *board tram No. 6, direction “Flughafen” / ”Airport”*	↑
↓	Lise-Meitner-Straße	↑
↓	Berufsbildungswerk	↑
↓	Riensberg	↑
↓	Wätjenstr.	↑
↓	Emmastr.	↑
↓	H.H.-Meier-Allee	↑
↓	Joseph-Haydn-Str.	↑
↓	Brahmsstr.	↑
↓	Am Stern	↑
↓	Blumenthalstr.	↑
↓	**Hauptbahnhof / main station**	↑
↓	Herdentor	↑
↓	Schlüsselkorb	↑
↓	**Domsheide** *depart for Conference dinner at Hilton hotel, city center*	↑
↓	Wilh.-Kaisen-Brücken	↑
↓	Theater am Leibnitzplatz	↑
↓	Gastfeldstr.	↑
↓	Schleiermacherstr.	↑
↓	**BSAG-Zentrum** *depart for Tour 1 “Bremer Straßenbahn AG”*	↑
↓	Neuenlander Kämpe	↑
↓	**Flughafen / Airport**	↑
	Neuenlander Feld / Flughafen *depart for Tour 2 “Airbus”*	

Coming back from Conference Dinner: the **last tram** from Domsheide station back to Universität / NW 1 station (conference venue) departs 23:54!

Map of University and Conference Venue



Social Activities

Tuesday, 18:30 – 20:30 Get-together at Conference Venue

Registration desk is open.

Wednesday, 18:30 – 20:30 Welcome Reception at Hotel Munte

Hotel Munte is in walking distance from the conference venue, see map on previous page.

Thursday, 19:00 Conference Dinner at hotel Hilton Bremen

The conference dinner will be held at Hotel Hilton in the city center of Bremen. There is no official transfer from the conference venue to Hilton. However, Hilton can be easily reached by tram:

Go to tram station “Universität / NW 1” (see page “Map of University”). Board tram No. 6 in the direction Airport (“Flughafen”). Travel time is about 20 minutes. Get off the tram at “Domsheide” station. Walk down Marktstrasse, next to the BSAG Customer Center, and follow this road around the corner. You will then see the Hilton Bremen on the right (total walking distance is 200m)

The last tram from Domsheide station back to Universität / NW 1 station (conference venue) departs 23:54. At every time of the day there are taxis around Hilton and Bremen city center. Official taxis are beige and carry a yellow sign on the roof. You can call a taxi via +49 421 14 0 14.

Friday, 13:00 – 16:00 Industry Tour 1 Bremer Straßenbahn AG

Language of guided tour: German.

During Industry Tour 1 you will visit the head quarter and maintenance facilities of Bremer Straßenbahn AG (Bremen public transport). A separate registration is required.

Meeting point is in front of building GW1-HS at 13:00. Transfer is via tram. We’ll board tram No. 6 at “Universität / NW 1” in the direction of the Airport / “Flughafen” and get off the tram at “BSAG – Zentrum”; travel time is about 25 minutes.

Friday, 13:00 – 16:00 Industry Tour 2 Airbus Operations GmbH

Language of guided tour: English.

During Industry Tour 2 you will visit the Airbus Facilities in Bremen. A separate registration is required together with stating your passport ID. For security reasons Airbus requires you to bring your passport; without passport it is not possible to participate at the tour.

Meeting point is in front of building GW1-HS at 13:00. Transfer is via tram, again No. 6 in the direction of the Airport / “Flughafen”. Board tram No. 6 at “Universität / NW 1” station and get off the tram at “Neuenlander Feld” (terminus); travel time is about 30 minutes. Follow Cornelius-Edzard-Straße until Airbus-Allee, Gate 1.

Scientific Program – Keynotes

Marielle Christiansen: Ship Routing and Scheduling

Part of Session: W-B-1: Opening Ceremony and Welcome Adresses

GW1-HS H0070, Wednesday, 9:00 – 10:40

In this presentation, we will give a short introduction to the shipping industry and an overview of some OR-focused planning problems within maritime transportation. We focus on maritime cargo routing and maritime inventory routing in industrial and tramp shipping. Examples from several real cases, elements of models and solution methods will be given. Finally, we present some trends regarding future developments and use of OR-based decision support systems for ship routing and scheduling.

– Abstract available on USB flash drive [ID 191] –

Jan Miller: Getting Deep into Business

Part of Session: W-B-1: Opening Ceremony and Welcome Adresses

GW1-HS H0070, Wednesday, 9:00 – 10:40

The JadeWeserPort, Germany's first and only container deep water port will start operation in August 2012. This deep water port as a greenfield development has been designed to match the rising requirements of the latest generation of container vessels in terms of accessibility, technical port equipment and efficient container handling. A large logistics zone, a high-capacity rail access and a direct motorway connection are providing the necessary hinterland infrastructure to make the port a competitive destination, especially for the Asia-Europe-Supply-Chain. The presentation will give you an introduction to the project and will give you an insight into its background, into technical and operational aspects as well as into the current status of development.

– Abstract available on USB flash drive [ID 194] –

Michel Gendreau: Stochastic Vehicle Routing: an Overview

Part of Session: F-C-1: Keynotes

GW1-HS H0070, Friday, 10:40 – 12:10

There are many real-life settings where key parameters of Vehicle Routing Problems are not known with certainty at the time when routes must be constructed. In this talk, we will examine the main classes of Stochastic Vehicle Routing Problems: problems with stochastic demands, stochastic customers, and stochastic service or travel times. We will emphasize the main approaches for modeling and tackling uncertainty: a priori models, a posteriori approaches, and chance-constrained models.

– Abstract available on USB flash drive [ID 190]–

Loo Hay Lee: Simulation Optimization for Maritime Logistcs

Part of Session: F-C-1: Keynotes

GW1-HS H0070, Friday, 10:40 – 12:10

Simulation and optimization are two arguably most used operations research (OR) tools that are used in Maritime Logistics. Optimization intends to choose the best element from some set of available alternatives. Stochastic simulation is a powerful modeling and software tool for analyzing modern complex systems that arise in Maritime Logistics. Detailed dynamics of complex, stochastic systems can be modeled in simulation. This capability complements the inherent limitation of traditional optimization where uncertainties are not easily captured, so the combining use of simulation and optimization is important. In this presentation, we will discuss how we integrate these two popular tools together and what computational issues we have to face in this integration. This presentation also gives our new development to partially address the computational issue. A key component of our methodologies is a new control-theoretic simulation technique called Optimal Computing Budget Allocation which intends to maximize the overall simulation efficiency for finding an optimal decision. We will demonstrate this methodology using the problems found in the Maritime Logistics.

– Abstract available on USB flash drive [ID 168] –

Wednesday, 9:00 – 10:40

W-B-1: Opening Ceremony and Welcome Addresses

Chairs: Herbert Kopfer, Hans-Otto Günther, Kap-Hwan Kim
GW1-HS H0070, 9:00 – 10:40

Welcome Address of the Dean of the Host Faculty

Zimmermann, Jochen

Welcome Address of the Chairman of the LOGMS Steering Committee

Kim, Kap-Hwan

Keynote: Ship Routing and Scheduling

Christiansen, Marielle

In this presentation, we will give a short introduction to the shipping industry and an overview of some OR-focused planning problems within maritime transportation. We focus on maritime cargo routing and maritime inventory routing in industrial and tramp shipping. Examples from several real cases, elements of models and solution methods will be given. Finally, we present some trends regarding future developments and use of OR-based decision support systems for ship routing and scheduling.

– Abstract available on USB flash drive [ID 191] –

Keynote: Getting Deep into Business

Miller, Jan

The JadeWeserPort, Germany's first and only container deep water port will start operation in August 2012. This deep water port as a greenfield development has been designed to match the rising requirements of the latest generation of container vessels in terms of accessibility, technical port equipment and efficient container handling. A large logistics zone, a high-capacity rail access and a direct motorway connection are providing the necessary hinterland infrastructure to make the port a competitive destination, especially for the Asia-Europe-Supply-Chain. The presentation will give you an introduction to the project and will give you an insight into its background, into technical and operational aspects as well as into the current status of development.

– Abstract available on USB flash drive [ID 194] –

Wednesday, 11:00 – 12:20

W-D-1: Current Trends in Maritime Logistics

Chair: Herbert Kotzab

GW1-HS H0070, 11:00 – 12:20

Patterns of Internationalization: Assessing Network Structures in the Container Shipping Industry

Kotzab, Herbert; Prockl, Günter; Kinra, Aseem

Container shipping, due to its boundary crossing nature, is generally seen as an international or even global business, thus leading to claims on its role in globalization, and images of successful companies full of international business experience and exposure. While this generalization remains true at the industry level, this is not entirely the case at the level of individual firms. To paraphrase Orwell (1945) "All shipping companies are international, but some shipping companies are more international than others."

A first look into the container shipping industry has thus shown that container-shipping companies operate rather differently, with different motives for internationalization and globalization, and infact show different patterns to their international development. Some companies apparently act in fact rather regional while others exhibit truly global patterns of behavior (Gadhia et al., 2007). To this extent the internationalization differences of container shipping companies are explained only in part by the different strategic fundaments toward globalization because the existing research has looked only into the port calls and the overall port network structure of the largest shipping providers. However, there are other important transactional and market-oriented considerations, and overall dynamics when looking at the internationalization of container shipping companies and the industry.

The purpose of this paper is to further investigate some of these transactional and market-oriented considerations through an examination of the front-end activities and structures like sales and the overall extent of market presence.

– Extended abstract available on USB flash drive [ID 155] –

Economic Ship Travel Speed: Consequences for Maritime Logistic Strategies and Sustainability

Kotzab, Herbert; Gudehus, Timm

In this paper we show how an economic travel speed of cargo ships impacts the profit situation as well as the environmental sustainability significantly. We thereby differ between a cost-optimal and profit-optimal ship speed strategy and show, based on model calculations, how both strategies lead to lower costs as well as lower emissions. Following the dynamic network aspect, we suggest that large container ship companies can adapt both strategies under specific market conditions and allow them to act profitable as well as environmental sustainable.

– Full article available on USB flash drive [ID 117] –

Rail Landside Container Transport Interfaces

Unseld, Hans G.

This paper takes a fresh look at physical container handling from a process perspective for two reasons: when introducing automation in container handling, dynamic performance data need to be specified and the lack of that data at present makes it difficult to compare new developments with existing terminal designs and performance data on a common ground. For this reason, a modified process model for rail-inclusive interfaces is suggested along with a new characterisation data set especially for the inclusion of up-to-date criteria. The verification and validity process have started and first results look promising. This paper deals also with a particular challenge for new terminal technology development. The market environment is very competitive, personal networks play an important role and background decisions are driven by political considerations at a high extent. In this challenging context, competition means here: established tradition and scepticism of a technology-critical transport and logistics clientele. Solid and consistent data and transparency of communication and messages are needed. The new characterisation data set and the framework suggested will help to define common grounds for implementing new technologies in rail transport on the one hand, and also assist actors to better communicate between the different playing field on their strategies and needs on the other hand. This aspect is of great importance when defining future rail transport network reference designs in the context of TEN-T pilot installation for main, intermediate and small nodes.

– Full article available on USB flash drive [ID 189] –

W-D-2: Liner Shipping Networks 1

Chair: Judith Mulder

GW1-HS H1010, 11:00 – 12:20

Designing Service Networks in Liner Shipping

Mulder, Judith; Dekker, Rommert

In this paper the combined fleet-design, ship-scheduling and cargo-routing problem in liner shipping is considered. A genetic algorithm based solution method is proposed in which the ports are first aggregated into port cluster to reduce the problem size. When the cargo flows are disaggregated, a feeder service network is introduced to ship the cargo within a port cluster. The solution method is tested on a problem instance containing 58 ports on the Asia-Europe trade lane of Maersk. The best obtained profit gives an improvement of about 40% compared to the reference network based on the Maersk network.

– Extended abstract available on USB flash drive [ID 160] –

A Model for the Liner Shipping Network Design Problem with Extended Route Types

Guericke, Stefan; Steinzen, Ingmar; Suhl, Leena

The introduction of container transport more than 50 years ago had a significant impact on production and international transportation (Levinson 2008). Despite continuous growth rates (America's Container Ports 2011) and the increased operational complexity (Maersk's campaign 2011) the amount of Operations Research methods in other industries like airline or rail is significantly higher (Christiansen *et al* 2004). Notteboom and Rodrigue 2008 state that future liner networks will not just be built of hub and spoke networks, but a mix of different route types. Thus, the network heavily relies on the ability to transship containers efficiently and should be included in mathematical models (Agarwal and Ergun 2008).

This paper focuses on taking all types of routes into account which is essential to design practical networks (Hamburg Süd's Product & Service Guide 2012). To the best of our knowledge, this has not been addressed before. Thus, we extend current approaches by conveyor belt routes and evaluate their performance on the network design.

The remainder of the extended abstract is organized as follows: in Section 2 we give a brief literature overview. Section 3 presents novel methodology.

– Extended abstract available on USB flash drive [ID 157] –

The Containership Feeder Network Design Problem: The New Izmir Port as Hub in the Black Sea

Polat, Olcay; Günther, Hans-Otto; Kulak, Osman

Global containership liners design their transportation service as hub-and-spoke networks to increase the market linkages and reduce the average operational costs by using indirect

connections. These indirect connections from the hub ports to the feeder ports called feeder networks are serviced by feeder ships. The feeder network design (FND) problem determines the smallest feeder ship fleet size with routes to minimize operational costs. Therefore, this problem could be described as capacitated vehicle routing problem with simultaneous pick-ups and deliveries with time limit. In our investigation, a perturbation based variable neighborhood search (PVNS) approach is developed to solve the FND problem which determines the fleet mix and sequence of port calls. The proposed model implementation has been tested using a case study from the Black Sea region with the new Izmir port (Candarli port) as hub. Moreover, a range of scenarios and parameter values are used in order to test the robustness of the approach through sensitivity analyses. Numerical results show that the new Izmir port has great potential as hub port in the Black Sea region.

– Full article available on USB flash drive [ID 102] –

W-D-3: Landside Transportation Systems 1

Chair: Andrea Nagel

GW1 B0100, 11:00 – 12:20

Collaborative Transport Operations Planning in a Network of Complementary Producers

Nagel, Andrea; Pankratz, Giselher; Gehring, Hermann

In this contribution, we examine a strategic alliance of four suppliers in the food and beverages industry, each of them offering high-quality products that are complementary to the products offered by the other companies. The setting is characterized by several routing constraints such as time windows, capacities and backhauls as well as the requirements of a dynamic way of planning and the simultaneous planning of own-name transport and subcontracting. We propose a Pickup and Delivery approach and solve the problem implementing a Large Neighborhood Search procedure.

– Extended abstract available on USB flash drive [ID 158] –

Proportional Egalitarian Core Solutions for Profit/Cost Allocation Games with an Application to Collaborative Transportation Planning

Dai, Bo; Chen, Haoxun

For a profit/cost allocation game, one key issue is to find a fair allocation of profit/cost among its players. In this paper, a Proportional Egalitarian Core solution is proposed, which aims to find an allocation that takes account of the contribution of each player in the core of the game.

This solution concept generalizes the Egalitarian-core solution. A row generation method is proposed to compute the new solution. As a case study, the solution concept is applied to a carrier collaboration problem with numerical results on randomly generated instances.

– Full article available on USB flash drive [ID 163] –

The Impact of Payload and Vehicle Size on Fuel Consumption Minimization by Vehicle Routing

Kopfer, Heiko Wieland; Kopfer, Herbert; Schönberger, Jörn

In recent literature, several vehicle routing approaches referring to sustainable road transportation have been published. Most of these approaches aim to find transportation plans which minimize the amount of CO_2 emission caused by the fulfillment of a given set of transportation requests. Since the amount of CO_2 emission is directly proportional to the quantity of consumed fuel, almost all approaches for "green" vehicle routing strive to build "fuel-minimal" transportation plans. As an extension to existing approaches, this contribution presents an innovative approach that aims at exploiting the ecologic benefits of a heterogeneous fleet. Vehicles are classified by their fuel consumption with respect to their dead weight and actual payload. There are four vehicle categories considered in our approach. The first category is composed of vehicles with 40 tons gross weight, i.e. the largest size allowed for standard trucks in the European Community. The next vehicle category consists of medium-sized trucks with 12 tons gross weight. This corresponds to the biggest type of trucks which are allowed to use the German autobahn without road charge. The third vehicle category is constituted by trucks of 7.5 tons gross weight. Trucks of this category are as big as possible while still being allowed to be driven with an ancient driving license for passenger cars. The last category is given by small delivery trucks with 3.5 tons gross weight. They can be driven with a simple driving license and are not concerned by general speed limitations on the German autobahn. Since we assume that sub-contraction of transport requests will be applied, there are for each vehicle category as many vehicles available as needed. That is why the introduction of vehicle categories implies an enlargement of the solution space compared to corresponding problems with a homogeneous fleet. An objective function which is based on pure distance minimizing is indifferent to variations of the size of vehicles. In contrast, our objective function for fuel minimization is dependent on the actual weight of each single vehicle used for transportation (including empty weight and payload). That is why the introduction of vehicle categories has interesting effects on the amount of CO_2 emissions. It is assumed that the fuel consumption on a leg of the vehicle's route depends on the distance to be travelled, the type of the used vehicle, and the degree to which this vehicle is loaded. At first, the objectives and general assumptions of the problem at hand are presented and illustrated by means of a small example. Then, a realistic function for the estimation of fuel consumption is presented. A mathematical formulation for our ecologically oriented mixed vehicle routing problem is proposed. The objective function minimizing the total amount of CO_2 emission is based on empirical methods for estimating the fuel consumption in dependence of payload. For small problem instances, computational experiments are performed by applying CPLEX to the proposed mathematical model. Larger problems with up to 100 customers are solved by means of a Genetic algorithm. It is shown that the amount of fuel consumption needed for transportation fulfillment can be decreased tremendously by the availability and smart usage of various types of vehicles.

– Extended abstract available on USB flash drive [ID 186] –

Wednesday, 13:30 – 14:50

W-F-1: EURO Summer Institute of Maritime Logistics 1

Chair: Frank Meisel

GW1-HS H0070, 13:30 – 14:50

Studying Network Optimization in Liner Shipping

Tran, Nguyen Khoi; Haasis, Hans Dietrich

The presentation aims to review the development of ports as well as optimization study in liner network. A salient feature of port development is the integration of ports into global supply chain whereby ports are no longer starting or final points of cargo flows, but intermediates. The scope of ports has surpassed traditional sea side and included also land side connection. Literature review of network optimization concentrates on route optimization, fleet operation and container planning. Various network problems and methodologies have been realized. We emphasize that network optimization should be considered not only sea but also land network; otherwise the results are only meaningful in the water side and not suitable for the practical activities of the transport industry. Naturally, sea-related costs are only a part of the whole game, so the optimization in sea side does not mean the optimization in the whole process. Our simulation illustrates the impact of various logistics costs on total door-to-door cost of the transportation process, in particular inland and inventory carrying costs.

– Extended abstract available on USB flash drive [ID 166] –

A Matheuristic for the Liner Shipping Network Design Problem

Brouer, Berit Dangaard; Desaulniers, Guy

We present a matheuristic, an integer programming based heuristic, for the Liner Shipping Network Design Problem. The heuristic applies a greedy construction heuristic based on an interpretation of the liner shipping network design problem as a multiple quadratic knapsack problem. The construction heuristic is combined with an improvement heuristic with a neighborhood defined by the solution space of a mixed integer program. The mixed integer program optimizes the removal and insertion of several port calls on a liner shipping service. The objective function is based on evaluation functions for revenue and transshipment of cargo along with in/decrease of vessel- and operational cost for the current solution. The evaluation functions may be used by heuristics in general to evaluate changes to a network design without solving a large scale multicommodity flow problem.

– Full paper available on USB flash drive [ID 178] –

The Ship Placement Problem: Exact and Heuristic Approaches

Verstichel, Jannes; De Causemaecker, Patrick; Spieksma, Frits; Vanden Berghe, Greet

The placement of in and outbound ships in locks constitutes a daily challenge for planners in tide river harbors. In essence, this entails positioning a set of ships into as few lock chambers as possible while satisfying a number of general and specific placement constraints. These specific constraints make the ship placement problem different from traditional 2D bin packing. A mathematical formulation for the problem is presented. This formulation describes the ship placement problem of both inland locks and locks in ports, under a wide range of real-life constraints. In addition, a decomposition model is developed, which allows for computing optimal solutions in a reasonable time. A three-way best fit heuristic for the ship placement problem is introduced, and its performance is compared with that of the existing left-right-left-back heuristic. Experiments on simulated real-life instances show that the three-way best fit heuristic beats the existing solution method by a landslide, while maintaining comparable calculation times. Finally, the new heuristic's optimality gap is small, while it clearly outperforms the exact approach with respect to calculation time.

– Extended abstract available on USB flash drive [ID 170] –

W-F-2: Liner Shipping Networks 2

Chair: Rommert Dekker

GW1-HS H1010, 13:30 – 14:50

Optimizing Recovery Actions and Buffer Times in Liner Shipping

Mulder, Judith; Sharifyazdi, Mehdi; Dekker, Rommert

In liner shipping networks ships follow a fixed route within a fixed time schedule. When ships arrive delayed in a port, costs are incurred. Ships can reduce their delay by performing recovery actions, like increasing the sailing speed or port handling capacity. Furthermore, buffer times can be allocated to the schedule in order to capture a part of the delay. We use a Markov decision process to formulate this problem. A mixed integer programming formulation can be given to solve the problem. Since the MIP is large, heuristic methods are proposed to solve the problem. So far, the results of these heuristics are promising.

– Extended abstract available on USB flash drive [ID 159] –

The Impact of Seasonal Demand Fluctuation on the Containership Routing Problem

Polat, Olcay; Kulak, Osman; Taner, Mustafa Egemen; Günther, Hans-Otto

Customer demand for final products is often influenced by seasonal factors. For long-term considerations, demand figures are highly uncertain due to varying unexpected global and

local economical conditions. In sectors with high seasonality and demand fluctuations such as liner shipping, planning activities are particularly important. Liner shipping has become a constant operation model for shipping companies, and scheduling is an important issue for operation. It is well-known that a nice plan for routing of container ships will bring long-term profit to companies. However, in this sector planning methods are usually based on deterministic forecasts which may be prone to failure in the long run. In this study, a Monte Carlo simulation based on a stochastic forecasting frame is developed for situations with limited historical data. Holt-Winters seasonal exponential smoothing, artificial neural networks and seasonal autoregressive integrated moving average forecasting methods and fuzzy sets are used in the developed framework. The proposed model implementation has been tested for the containership routing problem by using a case study in the Black Sea region. This study shows that seasonal demand fluctuation has vital impact on vehicle routing problems where the vehicles have long term high value contracts such as liner shipping.

– Extended abstract available on USB flash drive [ID 103] –

Yield Management of Liner Shipping vs. Best Practices of other Industries

Rytter, Niels Gorm Malý; Boeck, Thorsten; Nielsen, Peter; Gardon, Albert

This paper reports first results of a study comparing or benchmarking Yield Management (YM) or Revenue Management (RM) of a liner shipping company with YM business models, practices and IT systems of leading companies across a range of industries, particular transportation industries. Aim of the paper is to clarify how far leading companies within different industries and businesses have progressed in professionalizing their YM and identify possible “best practices” able to be transferred / tailored to liner shipping, particular container shipping.

YM can be defined as the integrated management of customer segments, price and asset inventory / capacity to maximize the profitability of a company. YM enables a company to sell the right service to the right customer, at the right time for the right price, to achieve the highest amount of revenue possible (Kimes, 1989; Talluri and van Ryzin, 2004). YM can in principle be applied across all industries, however it is typically applied under the following favourable conditions:

- Relatively fixed capacity
- High fixed and low variable costs
- Time-variable / stochastic demand
- Segmentable markets and clients
- Perishable inventory or capacity
- Products and services sold in advance

The classical YM scenario is that in which a service provider sells a fixed number of perishable service products (air seats, hotel rooms, rental cars etc.) through a booking process which ends at a fixed deadline (the booking horizon). A revenue management system collects and stores booking records and market information and uses them to forecast the demand and learn customer behaviours. Then, during the booking horizon, it chooses optimal controls based on these input in order to maximize the revenue. Controls imply a dynamic adjustment of duration, prices and capacity allocated for levels / classes of products and service offered.

The discipline of YM can be traced back 40 years, when American Airlines implemented a computer reservations system (SABRE) in 1966, which had the capability of controlling reservations inventory. But the prevalence of revenue management came after the US Airline Deregulation Act of 1978. This act loosened control of airline prices and led to a rapid change and a rash of innovation of business and pricing models, YM practices and IT systems in the

industry. New information technologies thus play a critical role in the development of revenue management. Each advance in information technology has led to more sophisticated revenue management capabilities. YM has been credited with US$500 and $300 million of increased revenue and earnings by US Airlines and Delta Airlines, respectively (Chiang et al., 2007).

Since then YM business models, processes and related information technologies have spread to other businesses as hotels and restaurants (Hayes and Miller, 2010), or car rentals and many other industries satisfying the requirements mentioned above, as reported by Yeoman (2011) or Chiang et al (2007) providing an overview of research done on the topic.

Looking more closely on the transportation industry, other companies than passenger airlines are increasingly doing attempts to transfer and tailor airline YM principles and solutions to their type of passenger and / or cargo / freight transport business. YM is increasingly considered relevant when to improve competitiveness and profitability on an ongoing basis. Most YM research has so far been done on the passenger airline industry (Belobaba et al., 2009), but a growing number of publications is today visible on alternative transportation industries, as e.g. Becker and Wald (2010) reporting on YM challenges of a cargo airline, Armstrong and Meissner (2010) on railway YM and finally Zurheide and Fischer (2011) investigating options for simulating profitability of YM strategies in container / liner shipping.

[…]

– Extended abstract available on USB flash drive [ID 185] –

W-F-3: Landside Transportation Systems 2

Chair: Stefan Voss

GW1 B0100, 13:30 – 14:50

Decision Support to Overcome Traffic Congestion in Constrained Transport Corridors

Schwarze, Silvia; Shi, Xiaoning; Voß, Stefan

In the last decades a steady increase of traffic can be observed. A growing world population, an increasing globalization and international trade as well as urbanization are some major factors for this trend. To cope with the increasing traffic it is important to analyze the network flows and extend the network resources, accordingly. However, a proper extension is not always possible, e.g., due to environmental, political, or financial reasons. As a result, traffic congestion appears in turn having bad effects on ecological as well as economical matters. Investments into network resources have to be traded against the costs caused by congestion.

There are two points of view when considering traffic congestion: First, from the inside, being part of the traffic itself, and, second, from the outside, i.e., being a superior decision maker. In this project we attempt to compare the two points of view as centralized versus decentralized. Our study has a particular focus on constrained transport corridors (bottlenecks). For example, transport corridors have a high impact within maritime shipping where important and frequently used ocean routes lead through canals, like the Panama Canal, Suez Canal or the Kiel Canal. While passing a canal, ships are usually confronted with

restrictions on speed and size. At the same time, the number of ships using a canal simultaneously is limited and overtaking is possible only at pre-specified positions. Such bottlenecks appear also in all other traffic systems. For instance, road works and tunnels cause similar situations in road traffic. Moreover, we have single or limited numbers of track lines in railway systems and flight corridors in air traffic.

For our investigations and to provide appropriate decision support, we focus on game theoretic methods. When modeling a decentralized point of view that is controlled by several independent and selfishly acting users, game theoretic approaches are very promising as they match very well the parameters of such settings. Concerning the centralized problem with a single decision maker, classical optimization methods apply. However, also for the centralized problem, game theoretic mechanisms appear. For instance, this is the case when the central operator acts as an opponent to the decentralized user, having opposite objectives. In addition, competition among several central operators of intersecting traffic networks might take place.

In this project we aim to provide models and solution methods for congested traffic corridors considering both, the centralized as well as the decentralized point of view. Moreover, a comparison of the two points of view is addressed. In particular, the change of delay and costs when switching from decentralized to centralized models are considered together with an analysis of the interaction between both positions. By carrying out this comparison we build a bridge between the business oriented position of a decentralized stakeholder in industry and the centralized position of economics.

We have developed a time-dependent model that allows reproducing real-world scenarios where congestion increases at rush-hours. The resulting game-theoretic tools and models analyze time-dependent strategies and serve as decision support for industry such as, e.g., shipping companies (decentralized view) as well as support for analyzing flows and behavior in traffic networks from a centralized view. Although we focus on the particular properties of maritime shipping and railway traffic, our results are transferable to applications in other types of networks.

– Extended abstract available on USB flash drive [ID 182] –

The Impact of Foldable Containers on a Vehicle Routing Problem with Pickup and Delivery

Shintani, Koichi; Ishihara, Yoshiaki; Konings, Rob; Imai, Akio

This study analyses the impact that the use of foldable containers can be effective on cost savings in repositioning empty containers in the hinterland transport of seaports. Folding empty containers to be bundled in one trip offers opportunities to save truck transport costs. We model entire truck trips in the network to optimize the number and the trip distance of trucks as a vehicle routing problem with pickup and delivery. The model is used to carry out numerical experiments with empty container repositioning scenarios that are caused by extreme imbalanced trades. The study finds that foldable containers can significantly reduce the number and the trip distance of trucks compared to standard containers and hence will result in substantial cost savings.

– Extended abstract available on USB flash drive [ID 114] –

Meta-heuristics for a Multi-product Dynamic Lot-sizing and shipping problem with multiple freight container types

Kim, Byung Soo; Lee, Woon-Seek; Joo, Cheol Min

This paper analyzes a dynamic lot-sizing problem, in which the order size of multiple products and multiple container types are simultaneously considered. In the problem, each ordered products placed in a period is immediately shipped by multiple freight containers in the period. Moreover, each container has type-dependent carrying capacity restriction. The unit freight cost for each container type depends on the size of its carrying capacity and the total freight cost is proportional to the number of each container type employed. Also, it is assumed that the load size of each product is equal and backlogging is not allowed. The objective of this study is to simultaneously determine the lot-sizes and the shipment schedules that minimize the total costs, which consist of setup cost, inventory holding cost, and freight cost. Because the problem is NP-hard, we propose three meta-heuristic algorithms with a local search heuristic, simulated annealing (SA) and genetic algorithm (GA), and a new population-based evolutionary meta-heuristic called self-evolution algorithm (SEA). The performances of the meta-heuristic algorithms are evaluated from a set of simulation experiments.

– Full article available on USB flash drive [ID 139] –

Wednesday, 15:10 – 16:30

W-H-1: EURO Summer Institute of Maritime Logistics 2

Chair: Frank Meisel

GW1-HS H0070, 15:10 – 16:30

A Priority Based Online Berth Allocation Policy with Stochastic Arrival and Service Times

Ursavas, Evrim; Bulut, Onder

Consideration of uncertainty and customer differentiation are of vital importance for the decisions considering container terminal operations. A key premise in effective terminal management is recognizing that different customers --different maritime logistics firms-- may have different service level requirements or different waiting time costs. Hence, distinguishing customers in classes and prioritizing them is critical. In addition, an unavoidable consequence in practice is the presence of high variability in vessel arrival and terminal operation times. Ignoring these issues will certainly increase the system operating costs and degrade customer satisfaction. With these background facts on hand, in this study; we consider the discrete berth allocation problem with Erlangian vessel arrival and service times. We propose a dynamic allocation policy that makes use of the relevant up to date information. Namely, our policy utilizes the information on the status of the vessels that are arriving and being served. With the proposed policy, the system time (waiting time plus service time) of the vessels belonging to higher priority customer classes can be significantly reduced. We will evaluate the performance of the policy via a simulation study.

– Extended abstract available on USB flash drive [ID 165] –

Benefits of a Truck Appointment System on the Service Quality of Inland Transport Modes at a Multimodal Container Terminal

Zehendner, Elisabeth; Feillet, Dominique

The connection of a container terminal to its hinterland is a key area for competition. Therefore, more and more attention is paid to the service quality of inland transport modes such as trucks, trains and barges. An efficient allocation of internal material handling resources and the use of new strategies, such as truck appointment systems, can reduce the time vehicles spend at the terminal. We propose a mixed integer linear programming model, based on a network flow representation of the terminal, to determine the number of appointments to accept per time slot and an allocation of internal resources minimizing service times of trains and barges simultaneously. By comparing container terminals with and without appointment systems, we show that a truck appointment system is beneficial for trucks as well as for trains and barges.

– Full paper available on USB flash drive [ID 164] –

Simulation and Optimization Models for Planning the Rail Port Cycle

Cavallini, Claudia; Sacone, Simona; Siri, Silvia

The worldwide phenomena – mainly globalization and production delocalization – which have characterized the economy and trade of the last decades, have completely changed the pattern and volumes of goods moving around the globe. In particular, the lengthening of supply chains have led to an increase of the maritime transport and, consequently, to an enhancing in the use of ports.

The road transport is currently the most utilized mode to ship goods from the ports towards the hinterland and vice versa; however it causes highly negative externalities such as the congestion of the transportation network, not sized to burden the actual goods volumes, and the environmental pollution. For such reasons, the railway transport, which is characterized by the capacity of moving higher quantity of goods in a more sustainable way, has to be definitely increased and favoured. This is even more important for those ports (such as the Italian ones) that, suffering from the lack of space, have to free the port space in a rapid way in order to move a high quantity of goods.

Nevertheless the railway transportation in ports is affected by several criticalities: infrastructural issues inside the port domain and affecting the external rail network, organizational problems concerning for instance the coordination among the actors involved in the rail transport, and other types of criticalities, such as the rail tariffs or the rail market liberalization.

In literature, several simulation studies have addressed the study of the port system, both utilizing System Dynamics (SD) and Discrete Event Simulation (DES), with different goals [1], [2], [3] and [4]. As regards the modelling and optimization techniques for planning and managing seaport terminals, some interesting works can be found in [5], [6] and [7].

The present research proposes different methodologies in order to address and partially solve some issues affecting the rail port system. More specifically the authors propose to apply, on one side, the simulation approach (both SD and DES for addressing the problem both at an aggregate level and at a more detailed one) in order to identify and analyse the bottlenecks of the system and, on the other side, the optimization methodology in order to plan the port railway cycle. More specifically, for what regards the latter approach, a queue-based optimization model has been defined, in which the system dynamics is modelled with discrete-time equations. The resulting optimization problem is a mixed-integer linear programming problem in which the decision variables regard the handling capacity of the different resources and the timing of trains in the port. The final goal is to use this model in order to plan the port railway cycle, at an aggregate level, by evaluating different operating scenarios and analysing the maximum capacity of the system with different handling resources.

The boundary of the models here proposed takes into consideration, in import, from the moment in which containers are unloaded from ships and stored in the port terminal yard, until they leave the terminal by rail transport mode (vice versa for the export cycle).
The two methods, i.e. simulation and optimization, have been applied to various case studies regarding some container terminals in Northern Italy, by using real data, with the objective of planning and sizing port railway terminals, as well as evaluating different scenario performances.

For what concerns the simulation models, the Powersim software has been utilized for enabling SD, while the DES model has been implemented with Simio software; the optimization model has been instead implemented in Matlab, utilizing Cplex as mathematical programming solver.

Actual and future work is devoted to extend the simulation-optimization framework implemented in this research. More specifically, the authors are working on the modelling and synchronization of the import cycle with the export one.

– Extended abstract available on USB flash drive [ID 167] –

W-H-2: Hinterland Interfaces of Seaports 1

Chair: Joachim R. Daduna

GW1-HS H1010, 15:10 – 16:30

Transport Systems for Linking Seaport Container Terminals and Dedicated Satellite Terminals

Daduna, Joachim R.; Stahlbock, Robert; Voß, Stefan

For many seaports considerable problems arise when it comes to expanding their facilities as the needed areas are not available due to historically grown urban settlement structures and their (usually more profit-oriented) forms of land use. These circumstances limit the quantitative and qualitative performance enhancement, which is, nevertheless, fundamental for international competition in times of increased demand. Hereof *seaport container terminals* (SCT) are strongly affected because process structures in container transport require sufficient space and fitting technological equipment. A repeatedly discussed solution persists in building *satellite terminals* (ST), which are established in the close vicinity of the SCT. Nevertheless, one critical aspect of this solution is the design of a sufficient transport infrastructure between SCT and ST, which, on one hand, must be enforceable from the transport policy point of view and, on the other hand, must be able to secure a sufficient performance.

Here (fully automated) railway and (guided) road traffic systems, heavy-lift cable car and overhead conveying systems as well as underground tunnel systems are under consideration for container transport. Existing as well as conceptualized systems are analyzed and assessed with regards to their possible usability for shuttle transports between SCT and ST. Fundamental for this are operational aspects (i.e. accessible capacity, velocity and security), the question of technical feasibility, arising investment and operational costs as well as (political) enforceability. Based on these aspects it is determined which of the possible solutions is the most qualified one to link the SCT in the port of Hamburg and potentially to-be-established ST.

– Full article available on USB flash drive [ID 181] –

The Thailand Canal and its Impact on Maritime Logistics

Stahlbock, Robert; Voß , Stefan

Global maritime transport is a prerequisite for global trade since maritime transport and in particular containerization result in low transport costs due to economies of scale. Governments and nongovernmental organizations of economically powerful nations attempt to find and support projects for supporting, improving, and speeding up global trade. Maritime transport is limited by nature, i.e., oceans, waterways etc. or landmass, respectively. People improved main global maritime transport by building canals. For example, the Suez Canal shortens the transport distance among Europe and Asia enormously (avoiding a route round South Africa, Cape of Good Hope), or the Panama Canal connects the Pacific Ocean and the Atlantic Ocean thus avoiding a trip round South America (Cape Horn). A similar project was discussed in the past by the Thai government. The considered Thailand Canal is located at one of the most important spots of the global maritime traffic. The idea was initiated in 1950 and repeatedly discussed in the following decades. The last publications can be found in 2005. From a scientific point of view, interesting questions are, for example, why the advanced project plans are not discussed anymore since 2005. What about the relevance of advantages? What are current expectations and impact? Which interest groups are involved, and which objectives are pursued? Detailed planning records and reports are not accessible for the public because the Thai government withholds information regarding that project. A comprehensive concept of the canal project has not been published yet, and an analysis of its future importance and impact is missing. This paper investigates how the Thailand Canal project fits today's realities. The canal's impact on maritime logistics is estimated and put into perspective of today's maritime logistics including related updates in available data projections.

– Extended abstract available on USB flash drive [ID 171] –

Analysis of Key Operational Variables for the Buenaventura Seaport in Relation with Trends on Coffee National Exports

Halabi Echeverry, Ana X.; Montoya-Torres, Jairo R.; Duque, Juliana; Martínez, Jaime A.; Peña, Daniela; Liévano, Luisa; Velasco, Ángela

In some South American countries, a crisis is being experienced, since the lack of investment on infrastructure and general improvement on the seaports and access roads are holding the country back, when referring to competitiveness and supplying the increasing demand. For the particular case of the Colombian seaport of Buenaventura (BUN), it has shown a slow growth. This issue actually concerns the national development because some of the most significant exports are held such as sugar and most remarkably, coffee. In order to help predict the coffee exports by means of BUN seaport, we have handled the appropriate empirical observations and measurements allowing collecting data of the most important port performance indicators (PPI) related to the amount exported. Linear regression model was designed in order to determine relevant variables that help to explain the behavior of coffee exports. With the resulting cases from the linear regression, we generated a time series model in order to forecast the second semester of 2011.

– Extended abstract available on USB flash drive [ID 161] –

W-H-3: Vehicle Routing and Scheduling 1

Chair: Dirk C. Mattfeld

GW1 B0100, 15:10 – 16:30

Dynamic Supply Truck Routing for Automotive Manufacturing Plants

Meisel, Stephan; Ulmer, Marlin; Mattfeld, Dirk

This contribution proposes a rolling horizon approach to a dynamic supply truck routing problem, such as it often occurs in automotive manufacturing plants. First, the optimization problem to be solved repeatedly over time is formulated as a linear program. Second, small problem instances are solved optimally by use of a branch and cut procedure. Finally, an evolutionary algorithm for solving large problem instances is both introduced and tested empirically.

– Extended abstract available on USB flash drive [ID 193] –

A Sustainable Inventory Routing Problem – Based on a Case Study from the Petrochemical Industry

Treitl, Stefan; Nolz, Pamela C.; Jammernegg, Werner

In many cases, the focus of sustainable supply chain management literature is on production processes or network design decisions. Transport processes are often only accounted for in a rather simplified way and are rarely analysed on a high level of detail. Thereby, the actual impact of transport processes on the economic and environmental performance of companies is distorted and its potential for improvements is ignored. This work focuses exclusively on the detailed analysis of transport processes in a supply chain under vendor-managed inventory. We propose an inventory routing model that is extended to incorporate environmental aspects and apply the model to a case study from the European petrochemical industry. The results obtained from the analysis are then compared to a situation where no collaboration in a supply chain exists in order to show the positive impacts of collaboration on economic as well as on environmental sustainability.

– Extended abstract available on USB flash drive [ID 123] –

Wednesday, 16:40 – 18:00

W-J-1: Sustainability Issues in Maritime Logistics

Chair: Thalis Zis

GW1-HS H0070, 16:40 – 18:00

Environmental Impacts of Ships in Ports and Possible Mitigation Techniques

Zis, Thalis; Angeloudis, Panagiotis; Bell, Michael G.H.

In recent years a major concern in all transport operations has been the quantification and management of environmental impacts. However, the air emissions that originate from the shipping sector are still increasing in absolute terms and are expected to continue to do so. In supply chains, vessels often have to be stationed at ports for extended periods of time, and therefore an important part of the shipping sector's emissions is generated in ports. The port is considered as a system comprising several different parts, all of which contribute to its environmental footprint. This paper presents a framework for examining these impacts with a particular focus on the environmental footprint of ships approaching and berthing at ports, where their emissions impact directly on local air quality and on the exposure of the local population. Speed reduction of approaching ships and cold ironing for berthing ships are examined as potential mitigation techniques, and their scope for the reduction of emissions for CO_2,SO_2 and NO_x are assessed. A case study using data from the port of Felixstowe and the UK National Grid is then used to compare the impact of these two techniques on local air quality and on emissions of global pollutants.

– Full paper available on USB flash drive [ID 162] –

Dynamic Determination of Vessel Speed and Selection of Bunkering Ports for Liner Shipping under Stochastic Environment

Sheng, Xiaoming; Lee, Loo Hay Lee; Chew, Ek Peng

In this work, we study a liner shipping operational problem which considers how to dynamically determine the vessel speed and refuelling decisions, for a single vessel in one service route. Our model is a multi-stage dynamic model, where the stochastic nature of the bunker prices is represented by a scenario tree structure. Also, we explicitly incorporate the uncertainty of bunker consumption rates into our model. As the model is a very large scale mixed integer programming model, we adopt a modified rolling horizon method to tackle the problem. Numerical results show that our framework provides a lower overall cost and more reliable schedule compared with the stationary model of a related work.

– Full article available on USB flash drive [ID 108] –

A Multi-objective Model and a Meta-heuristic for Reducing Truck Emissions at Container Terminals

Chen, Gang; Govindan, Kannan; Golias, Mihalis M.

A seaport is a significant source of exhaust emissions and air pollution for the local region. This study addresses the truck emissions in container terminals and investigates the trade-off between truck emissions and truck arrival patterns. First, a queueing network based on fluid-based approximations is proposed to analyze time-dependent truck queueing processes at the gate and the yard of a container terminal. Then, a multi-objective optimization model is developed to minimize both truck waiting times and number of shifted arrivals. Furthermore, emissions reduction from truck engine idling is analyzed through a post-optimization phase of truck waiting time. Lastly, a real case study demonstrates that truck emissions could be significantly reduced by a small shift in truck arrivals.

– Full article available on USB flash drive [ID 192] –

W-J-2: Hinterland Interfaces of Seaports 2

Chair: Sebastian Sterzik

GW1-HS H1010, 16:40 – 18:00

The Cooperation and Competition in the Dual Gateway-Port System

Lee, Chung-Yee; Yu Mingzhu

This paper studies the cooperation and competition relations in a simple dual gateway-port system, where there are two ports and each port contains one container terminal. The port governments invest in hinterland logistics service level improvement. The terminals compete for container flow through service prices. We propose different models to analyze port government cooperation, and terminal competition.

We derive the terminal equilibrium service prices, and equilibrium hinterland logistics service levels in the system. By comparing the results obtained in different models, we find the condition under which the government cooperation leads to higher hinterland logistics service levels. We also provide the investment cost allocation scheme between the two port governments in the cooperation process. Through the model application to Shenzhen port and Hong Kong port in the Pearl River Delta area of China, it is suggested that the two port governments should cooperate with each other, and the cooperation strategy will be supported by the terminal operators. (This paper was fully supported by a grant from the Research Grants Council of the HKSAR, China, T32-620/11)

– Extended abstract available on USB flash drive [ID 115] –

Marine Highway Logistics Design: M580 and M80

Price, Willard

Global supply chains have become a dominate share of product cost as their reach has extended further around the planet and as manufacturing and materials movement have achieved complexity with out-sourcing/off-shoring partnering. A large share of global networks involves logistics operations passing through seaports, creating land-sea interfaces requiring intermodal transportation sourcing.

Competition between transportation modes provides a challenging reality for transport carriers and, desirably, an opportunity for originators, shippers and consignees to reap benefits from such competition. Supply chain research must provide an understanding of alternative logistic design, modal technologies, development partnerships, resulting cargo performance as well as commercial viability for actors in the logistic network.

In the case presented here, marine highways are studied that parallel Interstate 580 along the San Joaquin River and Interstate 80 along the Sacramento River. Both marine highways transit the Northern California Delta east of the San Francisco Bay. Cargo enters the Port of Oakland and is transferred to barges for inland movement to the Ports of Sacramento and Stockton. These imports are more viable when matched by the reverse flows of exports.

Marine highways substitute river transport for truck/train movement on congested urban roadway systems, caused by locating seaports in major metropolitan regions. Barge traffic allow intermodal transfer to ground transport further inland and/or away from denser surface traffic. The benefits of marine highways are primarily reduction of congestion, carbon and cost.

This case accomplishes these learning objectives:

1. Model the marine highway from origin via an ocean vessel → coastal port → barge → inland port →truck and/or train for final transit to destination. The modal details the role of each actors/partners engaged in all stages of cargo transfer via either direction of this marine highway segment.
2. Describe measures of cargo movement and suggest how network design affects service performance and competitive advantage. Innovative choices for technology and methods also posit effects on marine highway performance.
3. Critique the development process or project, specifying a public-private partnership to conduct design, construction and operation of the marine highway. The partnership involved seaports, project consultants and logistics operators who share risk for capital investment, operating costs and revenues.
4. Evaluate creative delivery alternatives and technology innovations while identifying hurdles to development and commercial success.

– Extended abstract available on USB flash drive [ID 124] –

A Sequential and a Simultaneous Solution Approach for a Hinterland Container Transportation Problem

Sterzik, Sebastian; Kopfer, Herbert

In the hinterland of a seaport terminal, inbound as well as outbound containers have to be moved by a trucking company between the company's depot, the considered terminal and the company's customer locations. There are two types of customers. While the first customer type receives goods by inbound containers, the second customer type ships goods by outbound containers. Additionally, there are empty inbound containers and empty outbound

containers available in the local area. For solving the problem one has to consider not only vehicle routing and scheduling but also empty container repositioning. This contribution presents a two-step model formulation as well as an integrated routing model formulation. Both formulations consider the routing of the means of transports as well as the routing of the transportation resources. Randomly generated test instances are employed and solved with the commercial tool CPLEX. The results show the effectiveness and efficiency of the sequential approach compared to the integrated routing solution approach.

– Full article available on USB flash drive [ID 107] –

W-J-3: Vehicle Routing and Scheduling 2

Chair: Dorota Slawa Mankowska

GW1 B0100, 16:40 – 18:00

A Vehicle Routing Problem with Cargo Transfer Options

Mankowska, Dorota Slawa; Bierwirth, Christian; Meisel, Frank

Vehicle routing problems address the routing of a vehicle fleet for serving a set of customers. In the capacitated version of the classical vehicle routing problem, vehicles are loaded only at a depot. This restricts the demand of customers visited on the route to the load capacity of the vehicle. In this paper, we investigate an extension of the problem, where one vehicle can replenish another vehicle at so-called transferring points. The replenished vehicle can continue its route and serve further customers without having to return to a depot. We describe the problem and formulate a mixed-integer programming model for including cargo transfer operations into vehicle routing. A numerical example and computational results are provided for illustrating the potentials of saving travel distance and vehicle operation time by enabling transfer of cargo among vehicles.

– Full article available on USB flash drive [ID 138] –

An Evolutionary Local Search with Threshold Accepting for the Capacitated Vehicle Routing Problem

Prins, Christian

A new metaheuristic called MS-ELS-TA and derived from iterated local search (ILS) is proposed for the capacitated vehicle routing problem (CVRP). The method can be viewed as a kind of multi-start evolutionary local search (ELS), an ILS in which each iteration generates several children-solutions using mutation and local search. Moreover, the search alternates between solutions encoded as TSP tours (vehicle capacity is ignored) and CVRP solutions, and children may exceed the cost of their parent by a threshold value which is progressively reduced during the iterations. The resulting algorithm is evaluated on two sets of standard CVRP instances and competes with the seven best metaheuristics published.

– Full article available on USB flash drive [ID 116] –

An Adaptive Neighborhood Search Approach for the VRPSPDTL

Polat, Olcay; Kulak, Osman; Günther, Hans-Otto

The Vehicle Routing Problem with Simultaneous Pickup and Delivery with Time Limit (VRPSPDTL) is a variation of the Vehicle Routing Problem where the vehicles serve delivery as well as pick up operations of the clients under time limit restrictions. The VRPSPDTL determines a fleet of vehicle routes starting and ending at a central depot by serving all clients just once under the objective of minimizing the total distance travelled. For this problem, we propose a mixed integer mathematical optimization model and a novel adaptive neighborhood search algorithm combined with the classic savings heuristic, variable neighborhood search, and a perturbation mechanism. The numerical results show that the proposed method produces superior solutions compared to those reported in the literature for a number of well-known benchmark problems and reasonably good solutions for the remaining test problems.

– Full article available on USB flash drive [ID 104] –

Thursday, 9:00 – 10:20

T-B-1: Layout and Configuration of Container Terminals

Chair: Daniela Ambrosino

GW1-HS H0070, 9:00 – 10:20

Analysis of Various Dispatching Strategies at Short Sea Container Terminals

Taner, Mustafa Egemen; Kulak, Osman; Polat, Olcay; Koyuncuoğlu, Mehmet Ulaş

Being advanced technologies, automated guided vehicles (AGVs) and automated lifting vehicles (ALVs) have been lately used in container terminals to improve efficiency as they are practical on the repetitive nature of the terminal operations. Due to their low berth deepness, container terminals in Turkey are built as artificially filled near the coasts. The most common layouts in these terminals are Π, *L*, or Ψ berth typed. In this paper, in order to analyze the effect of transporter number, transporter request rules and intersection rules on the performance of the short sea container terminals, an object-oriented simulation model is developed for berth type Π, *L* and Ψ. Actually, the effects of AGV dispatching rules on the determined performance criterion of total container handling in quay cranes is the issue we focus on. According to the results of the simulation, it can be said that terminal layouts have significant effects on the performance of the terminals and the number of the AGVs used.

– Full paper available on USB flash drive [ID 101] –

Two Mixed Integer Programming Models and their Relaxations for the Multi-Port Master Bay Plan Problem

Ambrosino, Daniela; Anghinolfi, Davide; Paulucci, Massimo;Sciomachen, Anna

In this paper we extend the problem of determining how to stow a given set of containers of different types into the available locations of a containership, that is, the so-called Master Bay Plan Problem (MBPP), to the Multi-Port Master Bay Plan Problem (MP-MBPP). In the MP-MBPP the whole route of the ship is investigated; in particular, at each port of the route different sets of containers must be loaded for being shipped to next ports. Note that, differently from MBPP, in MP-MBPP at each port the sequence of two different handling operations affects the effectiveness of stowing plans: first, the import containers must be unloaded from the ship, then the export containers can be loaded.
We first introduce two exact mixed integer programming (MIP) formulations for the MP-MBPP; successively, we propose two heuristic approaches based on the solution of different relaxed formulations of the proposed MIP model. We report the computational tests performed on both random instances and real size ones which show the effectiveness of the models and the related proposed resolution methods.

– Full paper available on USB flash drive [ID 134] –

Multi-Objective Container Storage Arrangement for Transshipments

Nishimura, Etsuko; Urushibara, Yoshiyasu

This study addresses the container storage arrangement on the yard with various number of block partitions. We consider the minimization of both total handling time and yard space used as objective functions. This problem is formulated as a mixed integer programming, we re-arrange the basic multiple objective tabu search (MOTS) which Hansen(1997) proposed in order to obtain the solutions. From comparing the results with those by single objective with minimizing handling time, in all cases, the time and space utilizations obtained by multi-objective are smaller than those by single one. For the continuous berthing pattern, the greater the number of partitions is, the shorter the time becomes. However, for the discrete berthing pattern, we obtain the shortest time in the order 16 and 8 partitions at four-berth terminal. This means that all berthing positions for the discrete pattern are located at close to the paths among yard blocks with 8 and 16 partitions, and the yard trailers do not have to go a long way for keeping one way. It is clear that the relationship between berthing location pattern and number of partitions effects on the yard trailers' routing, and more that is also do that on the total handling time and block utilization.

– Full paper available on USB flash drive [ID 122]–

T-B-2: Warehousing and Distribution

Chair: Axel Hahn

GW1-HS H1010, 9:00 – 10:20

A Study on the Design and Performance of a Zone-Picking System with Cooperation Area Between Neighboring Zones

Ho, Ying-Chin; Chen, Jia-Chyun

In a zone-picking system, pickers cannot enter zones that they do not belong to. As pickers are performing their picking tasks, some pickers may be busier than the others. In other words, the workload between zones is not balanced. The unbalanced workload between zones can hinder the performance of the entire system. Furthermore, the picking time span cannot really be minimized because of the no-zone-crossing restriction. In this paper, we propose a new zone-picking system that has cooperation area set up between neighboring zones. Pickers can enter the cooperation area of their neighbouring zones to perform the cooperation task. The problems associated with this new system include the item clustering problem, the problem of assigning item groups to zones, the storage assignment problem, the cooperation area design problem and the cooperation-strategy problem. Various methods will be developed for the above problems. Simulation experiments will be conducted to test the performance of these methods and to show that setting cooperation area between neighbouring zones is beneficial to our zone-picking systems.

– Full paper available on USB flash drive [ID 125] –

Multi Agent Simulation of a Warehouse

Schwarz, Christoph; Hahn, Axel; Sauer, Jürgen

Multi-agent-based simulations are increasingly studied in recent years. Such simulations are generally adaptable and easily parallelizable. A major advantage of these systems is the possibility to model individuals, for example individual drivers of reach stacker trucks who make different decisions about which order to pick next. Material handling systems for container ports and related logistic sceanrios are nowadays largely simulated by discrete event simulations. In this paper, we show that a simulation of these systems as a multi-agent based simulation with individual decision makers is possible. With this simulation the influence of individual decisions on the system can be studied. All decision-makers (ports, cranes, etc.) were simulated by agents. Beside presenting our approach we also present an evaluation with an existing stockyard.

– Full paper available on USB flash drive [129]–

A Fixed Zones Parcel Distribution Strategy in the Case of Excess Demand

Bjelić, Nenad; Popović, Dražen; Vidović, Milorad; Radivojevic, Gordana

Due to the decision of large number of companies to outsource distribution part of business, parcel distribution companies (PDC) are faced with large amount of pick-ups and deliveries (P&D) on every day basis. However, the biggest challenge PDCs are facing with is stochastic nature of distribution process in terms of P&D locations, sizes and weights. Besides that, another important aspect of PDCs' operation is consistent service of clients with the same drivers. The most important reason for this consistency requirement is service efficiency due to layout familiarity of a driver in consistently served zones, as well as due to the trust relations established between driver and customer during the time which eventually leads to reduction of P&D service times. In this paper we compare efficiencies of two operational planning strategies for realizing delivery part of distribution process in situation when overall capacity of distribution vehicles is exceeded and additional vehicle must be introduced. The first strategy is well known strategy of using sweep vehicle to service excess of demand in each delivery zone. The second strategy is new one and it implies minimization of both inconsistent deliveries, i.e. deliveries made by not consistent driver (vehicle) and tour lengths.

– Full paper available on USB flash drive [ID 176] –

T-B-3: Future Logistics Technologies 1

Chairs: Haasis, Hans-Dietrich; Kim, Hak-So

GW1 B0080, 9:00 – 10:20

Opening Address and Introduction

Haasis, Hans-Dietrich; Kim, Hak-So

Keynote Speech: Globalization and Smart Logistics

Kim, Sung-Jin

A Study on Saving Energy Costs in Container Terminals

Kim, Woo Sun

Thursday, 10:40 – 12:00

T-D-1: Container Terminal Operations 1

Chair: Herbert Kopfer

GW1-HS H0070, 10:40 – 12:00

Testing, Tuning and Training Terminal Operating Systems: A Modern Approach

Boer, C.A.; Saanen, Y.A.

A terminal operating system (TOS) is essential for efficient and productive terminal operations, as it supports planning, scheduling and equipment control. Increasingly, functions in the TOS are automated. As scope and level of automation are increasing, it is crucial that the software is well tested and fine-tuned before putting it in live operation. The traditional ways of testing and tuning the terminal operating system, as well as training its users are limited, leading to unnecessary risks. In this paper, we present a meanwhile proven, safe and inexpensive approach to test and tune the terminal operating system and train operators on an emulated virtual terminal. This novel approach in the field of container terminals has been successfully applied at over twenty container terminals during the previous past years.

– Full paper available on USB flash drive [ID 113] –

Joint Modeling of Loading and Unloading Operations at a Container Terminal

Roy, Debjit; de Koster, René

This paper presents a method to model joint ship loading and unloading operations at a container terminal. The model includes quay crane operations, transport between the quay and stack by ALVs -automated lifting vehicles-, and stacking operations. The model is based on semi-open queuing network analysis. The model gives rapid estimates for key performance measures, such as throughput, lead times, and queue lengths of vehicles. First experiments indicate that the performance measures are sufficiently accurate to be used in container terminal design selection. The model is sufficiently flexible to allow various extensions, including stack size optimization, dwell point selection, and vehicle choice.

Today, more than 60% of the deep-sea cargo volumes are transferred using containers. High demands on container-mode transportation have put a tremendous pressure on container terminals to improve their operational efficiencies. The flow of containers at a seaside terminal is composed of an *import flow*, i.e. unloading of containers from the incoming vessels and storing them at the stackside, and an *export flow*, i.e. transport of containers from the stackside storage area and loading them to the outgoing vessels. The operations at an automated container terminal such as vessel loading and unloading, and stacking of container vessels for intermediate storage, are performed using a fleet of quay cranes, automated vehicles, and stacking cranes. For instance, the container loading operations to an export vessel include transport of containers from the stacks using stacking cranes, transport of the

containers to the quayside area using vehicles, and subsequent transfer of the containers to the vessel using quay cranes.

Performance analysis of the container handling operations is of immense interest to stevedoring companies because it can not only provide estimates for the throughput capacity and expected throughput times but it can also be used to optimize the system design parameters for better performance. The main research focus has been on building simulation and optimization models of isolated systems to address strategic and tactical issues such as container stowage problem at ships and in the stack, as well as performance analysis of control policies such as vehicle dispatching rules and quay crane scheduling (De Koster et al., 2004; Liang and Mi, 2007).

Analytical models have also been built to analyze specific system design aspects, for instance, Canonaco et al. (2008) developed a queuing network model to analyze the container discharge and loading at any given berthing point. Hoshino et al. (2005) propose an optimal design methodology for an Automated Guided Vehicles (AGV) transportation system by using a closed queuing network model. However, in literature, integrated analytical models for jointly analyzing the performance of loading and unloading operations by considering some of the stochastic inputs are scarce (Vis and de Koster, 2003; Steenken et al., 2004).

Simultaneous management of loading and unloading of containers at a terminal is extremely complex because it requires coordination of activities among multiple resources, such as quay cranes, vehicles, and stack cranes. When an import vessel arrives at a container terminal, quay cranes are first assigned for unloading the containers. Since more containers are present at the middle of the vessel (due to larger vessel depth) than the number of containers present along the vessel periphery. Therefore, once the quay cranes complete unloading the containers that are assigned to the cranes, the cranes begin loading containers to the vessel. Since some quay cranes (assigned at the middle) are still unloading containers whereas others begin loading containers to the vessel, vehicles may unload a container in one cycle whereas load a container in the subsequent cycle. Likewise, the stack crane handles both loading and unloading operations.

[...]

– Extended abstract available on USB flash drive [ID 119] –

The Direct Ship-to-Ship Container Transshipment Problem at a Maritime Terminal

Monaco, M. Flavia; Sammarra, Marcello

Transshipment operations at a maritime container terminal are usually implemented according to the ship-yard-ship cycle. The sojourn time of the containers in the yard is in general sufficiently long to guarantee that the loading and discharging operations can be scheduled independently. Terminal planners are recently considering the feasibility of a new operational modality, called *live connection*. In this modality a discharged container is immediately transshipped to the outgoing vessel, completely skipping the yard storage phase. Live connection assumes a partial overlapping of the berthing time windows of the involved ships, whose discharging/loading phases are no longer independent. In this paper we introduce the Direct ship-to-ship Container Transshipment Problem (DCTP) and derive a Mixed Linear Integer formulation.

– Full paper available on USB flash drive [ID 151] –

T-D-2: Multimodal Transportation Systems

Chair: Manfred Gronalt

GW1-HS H1010, 10:40 – 12:00

Optimizing Security Manpower Scheduling with Multiple Security Levels at Airports

Seo, Sangwon; Lee, Chulung

In this paper, we developed an integer programming model and implemented a multi-objective genetic algorithm (MOGA) for security manpower scheduling problem arising at airports. Airport security manpower scheduling problem is to decide how many security checkpoints to operate in each time period and how to allocate security teams into the required security checkpoints in order to satisfy operational constraints such as passenger demands, work hours limits, and security levels. In order to validate the proposed approach, we conduct a case study to test the efficiency of proposed methods based on real data obtained from the airport. The results show that the integer programming model always confirms an optimal solution and the MOGA approach also generates an optimal solution or very close to that of the optimal solution within a short amount of time. For further extension, this paper proposes the passenger monitoring methods to reduce overall passenger waiting time and the performance is validated with the developed simulation model. The results of simulation shows that the proposed passenger monitoring method helps to improve security line balance problem, and its effectiveness works better when the expected passenger waiting time is longer than usual.

– Full paper available on USB flash drive [ID 174] –

Capacity Evaluation of Inland Container Terminals – The Simulation Based Approach of Simcont

Gronalt, Manfred; Posset, Martin; Rojas-Navas, Soraya

In this paper we show the SimConT approach in simulation of inland container terminals. SimConT was developed and used during the last years in several projects on capacity evaluation of inland container terminals. We present the structure of the SimConT approach and modules and show how we apply it in real life applications. The first step is collection of infrastructure data, train related and load carrier data. Further, the detailed operation of the yard hat to be modelled and finally during the analysis phase the study has to proceed stepwise to reach the marginal productivity rate of the Container Terminal. For this we are using a scenario tree in order to move from simulation result to the next scenario in order to generate a feasible capacity expansion line. We show the results from a real life application to demonstrate our approach.

– Full paper available on USB flash drive [ID 141] –

Endosymbiotic Evolutionary Algorithm for Vehicle Routing Problem with Delivery and Installation

Kim, Kyoung Cheol; Sun, Ji Ung; Lee, Shi W.

Efficient and effective planning methods to provide visible and invisible goods are required to satisfy demands of business and customers in a competitive market. Vehicle routing problem (VRP) has been extensively studied for various issues with special needs, as one of important planning methods to reduce waists and maximize profits. In this paper, a VRP with unique characteristics of the electronic market industry is considered. The VRP deals with two types of customers' demands and two types of service vehicles, delivery and installation. In order to solve the VRP under consideration, an endosymbiotic evolutionary algorithm (EEA) is proposed to handle the two different services simultaneously and implemented with appropriate and efficient processes. The computational results show the performance of the proposed algorithm with a comparison among other approaches to the VRP under consideration.

– Full paper available on USB flash drive [ID 130] –

T-D-3: Future Logistics Technologies 2

Chairs: Haasis, Hans-Dietrich; Kim, Hak-So

GW1 B0080, 10:40 – 12:20

Container Terminal IT Control Strategies

Henke, Stefan

A Case Study of Terminal Asset & Container Tracking System (Eagle Eye TM)

Son, Jeong Min

Virtual Terminals Support the Planning, Start-Up and Operation of a Container Terminal During its Whole Life-Cycle

Schütt, Holger

Thursday, 13:10 – 14:30

T-F-1: Container Terminal Operations 2

Chair: Kwang Ryel Ryu

GW1-HS H0070, 13:10 – 14:30

Storage Charging and Re-Marshaling for Outbound Containers in Container Terminals

Kim, Kap Hwan

This paper discusses a method of determining the storage charge and planning the re-marshaling operation for outbound containers in a container yard. The space is pre-allocated to outbound containers of each vessel and a layout plan for the outbound containers is prepared in advance before they arrive at the terminal. Because the space that can be allocated to each vessel is limited, a storage fee is charged for restricting the duration-of-stay (DOS) of containers at the yard and the re-marshaling operation is performed for efficiently using the storage yard. This study analyzes the impact that these operational tools have on the space requirement, the cost, and the revenue for terminal operators. Some mathematical formulations are suggested to optimize the decision parameters for the storage charge, including the free-time-limit and the storage charge per day, and to determine the re-marshaling time.

– Full paper available on USB flash drive [ID 112] –

Crane Scheduling for Opportunistic Remarshaling in an Automated Container Terminal

Choe, Ri; Kim, Tae Sung; Yang, Youngjee; Ryu, Kwang Ryel

The productivity of a seaport container terminal is critically dependent on the operational efficiency of the quay cranes (QCs) which load or unload containers onto or from the vessels. The efficiency of QC operation is determined by how efficiently the containers are handled at the stacking yard where the containers are temporarily stored before loading or after discharging. The stacking yard is divided into a number of blocks each of which consists of hundreds of container stacks arranged in a number of bays and rows. A block in an automated container terminal is typically equipped with twin automated stacking cranes (ASCs) which stack or retrieve containers as requested. For a maximum throughput at a block, the two ASCs must operate in such a way to promote cooperation and to avoid mutual interference.

One difficulty with handling containers in a block is that there often arise some extra preparatory jobs to be done before the main jobs can be done. Notice that the export containers should be loaded in a pre-planned sequence taking account of the weight balance of a vessel and the convenience of operations at the intermediate and the final destination ports. When the container to be retrieved next is not at the top of a stack, all the containers above the target container must be relocated to some other stacks before it can be picked up. These rehandling works are examples of mandatory preparatory jobs which become the major

source of inefficiency of loading, causing QC delays. Loading operation is also delayed if an ASC needs to travel a long distance to fetch a container to be loaded. The delay of loading caused by rehandling or long travelling can be avoided if the export containers are arranged in an ideal configuration respecting the loading sequence. However, appropriate stacking of incoming containers is difficult because most of the containers are carried into the terminal before the loading plan is made available.

Remarshaling refers to the optional preparatory task of rearranging the containers during the idle times of ASCs to avoid as much rehandling and long travelling as possible at the time of loading. Some previous works on remarshaling assume that the idle time is long enough to rearrange all the containers to be loaded onto a target vessel (Hirashima et al. 2006, Kang et al. 2006, Kim and Bae 1998, Lee and Hsu 2007, Park et al. 2009). Under this assumption, it is determined where to move the export containers in which order to maximize the efficiency of not only the loading operation but also the remarshaling operation itself. In real container terminals, however, not all the export containers can be remarshaled because the crane idle time is usually not long enough and the loading plan is fixed only a few hours before the loading operation starts. More recent works on remarshaling take into account this time constraint, and focus on the problem of selecting the set of containers that can be rearranged within a given time to avoid the loading delay as much as possible (Park et al. 2010a, Park et al. 2012). However, these works still assume that a certain amount of continuous period of time is available for the remarshaling jobs to be done in a batch.

In this paper we propose a method for scheduling the twin ASCs in such a way that the remarshaling jobs are performed intermittently while the ordinary jobs are performed. This method is an extension of our previous works on scheduling the twin ASCs (Park et al. 2010b, Yuan et al. 2011), in which the ASCs are iteratively rescheduled for a predetermined fixed-length look-ahead horizon whenever an ASC finishes a job. What we do for opportunistic remarshaling in this work is to mix some remarshaling jobs with the ordinary jobs for scheduling an upcoming horizon unless the load of the ordinary jobs within the horizon is heavy. When we select the remarshaling jobs from the list of all the remarshaling jobs for mixing with the ordinary jobs, we select those that contribute the most to the reduction of the delay of loading according to the heuristics suggested by Park et al. (2012). The number of remarshaling jobs to be mixed is determined by estimating the workload of each remarshaling job. Since our objective function for scheduling takes account of the delay of the ordinary jobs as well as the makespan of the two ASCs, the remarshaling jobs are appropriately positioned in the schedule by utilizing the idle times of the ASCs. The results of simulation experiments show that the opportunistic remarshaling can really improve the loading efficiency with little delay of the ordinary jobs.

– Extended abstract available on USB flash drive [ID 137] –

Real-Time Container Storage Location Assignment at a Seaport Container Transshipment Terminal Part II

Petering, Matthew E. H.

This study shows how a seaport container terminal's overall productivity depends on the system that is used for automatically selecting storage locations for export containers in real time as they arrive at the terminal. This research expands upon the work that was presented at LOGMS 2010. In 2010, we defined the problem and presented the results of an initial experiment. The results illustrated the main trade-offs involved in container storage decisions and validated our main methodological approach: discrete event simulation. The current study considers three major extensions of our 2010 work. First, we do a comprehensive evaluation

of the relative importance of four different objectives for making container storage decisions. This evaluation is surprisingly rare in that we are essentially testing a real-world decision making system being sold to transportation and logistics companies—in this case the Expert Decking system sold by Navis—in a controlled academic environment. Second, we investigate the role of math programming in making container storage decisions. Here, we use a simulation model to directly compare decision-making algorithms that are strictly rule-based to those that have a math programming component. Third, we perform the first academic study of a DOS (duration of stay)-based storage system for export containers at a container terminal and, to our knowledge, the most comprehensive academic study of a real-time DOS-based storage system in any setting. The DOS storage concept was introduced by Goetschalckx and Ratliff in a Management Science article in 1990. Our experimentation considers a multiple-berth, vessel-to-vessel transshipment terminal and the container storage system's interaction with other decision making systems.

– Full paper available on USB flash drive [ID 121] –

T-F-2: Efficiency Analysis of Logistics Systems

Chair: Verena Flitsch

GW1-HS H1010, 13:10 – 14:30

DEA Applications to Port Efficiency Measurement and Future Research Possibilities

Jahn, Carlos; Flitsch, Verena

In order to measure improvement initiatives and benchmark efficiency of ports several performance measurement tools have been developed and applied frequently. Based on a number of advantages favouring the application to a complex port system the non-parametric method Data Envelopment Analysis (DEA) evolved to be one preferential tool. The aim of this research paper is to evaluate differences of DEA applications to the port sector on the basis of 37 articles published in 21 different academic journals between 1993 and 2011 and to derive future research possibilities to measure the efficiency of ports interlinking in maritime supply chains. The main differentiation criteria proposed are (1) number and type of Decision Making Units (DMUs), (2) selected input and output criteria, (3) accessed data sources and timely data coverage, and (4) applied DEA type or combination of methods. Concluding, possible gaps in DEA applications to port supply chains are highlighted to stress future research opportunities.

– Full paper available on USB flash drive [ID 133] –

Performance Analysis of Transfer Platforms in Frame Bridge Based Automated Container Terminals

Hu, Hongtao; Lee, Loo Hay; Chew, Ek Peng; Lee, Byung Kwon

Nowadays, port operators face a challenge to increase the port productivity to meet the increased demand of service level for mega vessels under the limited land area. In order to satisfy the demand requirement, the introduction of automated container terminals (ACTs) has become a popular way among port operators. Recently, Shanghai Zhenhua Port Machinery Company (ZPMC) introduced a new design of ATCs consisting of frame bridges in the apron, frame trolleys to transport container on the bridges, ground trolleys to transport containers beside blocks in the yard, and transfer platforms to hand over containers to (from) frame trolleys from (to) ground trolleys. This new design concept is referred to as the frame bridge based ACTs (FB-ACTs) in this study.

FB-ACTs has two main structures: the frame bridges are basically installed to guide frame trolleys at the apron between quay and yard sides. The frame bridges consist of several rows of rails which are arranged under the back extension of the quay crane and parallel to the quay crane rail track. Each row of frame bridges would be equipped with several layers of rails extending along the length direction of the frame bridges; the travel rails are installed beside each block for guiding the ground trolleys served by yard cranes installed at blocks.

Despite typical ACTs use trucks or automated guided vehicles (AGVs) for transporting containers between quay cranes and yard cranes, the FB-ACTs uses three kinds of transport equipment, namely, ground trolleys, transfer platforms and frame trolleys. As for the operation processes for unloading a container, a container is unloaded by a quay crane from a vessel, a frame trolley mounted on a row of frame bridges receives the container and transport it to a transfer platform corresponding to a block, the transfer platform picks the container up from the frame trolley and transfer it to a ground trolley, and the ground trolley transport the container to beside of the pre-assigned storage location and let a yard crane pick it up and store it to the location. The operation processes for loading a container is the opposite direction of the processes of the unloading operation.

In accordance with the operation processes, the container flows are expected to be bottlenecked by the transfer platforms since the transfer platforms control the handover activities between frame trolleys and ground trolleys. Thus, it is worth to estimate the performance of the transfer platforms so that can possibly find an opportunity to improve the system performance.

This study develops a performance model for a transfer platform providing the handover service to multiple frame trolleys and ground trolleys. The performance model is based on the Markov property. It means that the processing rates of all machines are mutually independent and identical, and follow the exponential distribution, and the system state is changed once per action. The system is modelled as a closed loop queueing network with servers for transfer platforms, quay cranes, and yard cranes, and customers for frame trolleys and ground trolleys. On the basis of the proposed model, the sensitivity analysis on the various combinations of the numbers of frame trolleys and ground trolleys for a transfer platform is conducted through numerical experiment. The performance effect on the processing rates among quay cranes, yard cranes, and the transfer platforms is also compared with each other under the various combinations.

It is expected that this study shows the performance of FB-ACTs from the design perspective. Although this study concentrates on the performance analysis of the transfer platforms, the modelling approach would be applied to estimate the system performance as well.

– Extended abstract available on USB flash drive [ID 140] –

A Toolbased Approach to Assess Technology Introduction in Transportation Systems Demonstrated by the LNG Introduction for Ship Propulsion

Hoerstebrock, Tim; Denker, Christian; Buss, Tammo; Hahn, Axel

Liquefied Natural Gas (LNG) promises to be an ecological and economical favourable fuel alternative for ship propulsion in comparison to heavy oil. Considering its introduction, port authorities and ship owner face a stalemate due to missing fuelling infrastructure (ship owner's view) or missing modified ships (port's view). Therefore, strategies must be developed that create incentives to make the step towards the new technology. This is a complex task which cannot be solved by statistical approaches since they lack temporal and spatial resolution. In order to assess the introduction of new propulsion systems in existing transportation systems (including its required infrastructure), we propose a multi-agent simulation (MAS) framework. Our approach consists of three layers which include basic functionality of a MAS, concrete agents for traffic systems and a specific implementation of ship models. We demonstrate that all relevant data in different aggregation levels can be integrated in order to assess certain setups of technical ship and infrastructure equipment and to evaluate different LNG introduction strategies.

– Full paper available on USB flash drive [ID 131] –

T-F-3: Future Logistics Technologies 3

Chairs: Haasis, Hans-Dietrich; Kim, Hak-So

GW1 B0080, 13:10 – 14:30

Aspects of Automation for Container Terminals

Cederquist, Hans

Maritime Crane Simulation – Team based Training and Research for Maritime Cargo Operations

Oesterle, Alexandra; Schimmelpfennig, Martin

Thursday, 14:50 – 16:10

T-H-1: Container Terminal Operations 3

Chair: Shell Ying Huang

GW1-HS H0070,14:50 – 16:10

Constraint Programming Approach to Quay Crane Scheduling Problem

Unsal, C. Ozgur; Oguz, Ceyda

This study examines quay crane scheduling problem (QCSP) in container terminals. QCSP requires completion of all loading and unloading operations of a berthed vessel under various constraints. A constraint programming (CP) model, which consists of global constraints and propositional logic, is constructed by taking numerous properties of the problem such as safety margins, travel times and precedence relations into account. The performance of the proposed CP model is compared with some powerful algorithms presented in recent QCSP literature. The result from the computational experiments indicates that the proposed CP model is able to produce good results for the QCSP while reducing the computational time.

– Full paper available on USB flash drive [ID 148] –

Off the Beaten Track with Free Ranging AGVs

Duinkerken, Mark B.; Ottjes, Jaap A.; Lodewijks, Gabriel

Routing of Automated Guided Vehicles (AGVs) is the process of determining routes for a set of AGVs to fulfill their respective transportation jobs. Routing has a relatively large impact on the productivity and flexibility of AGV systems. In most existing systems, for instance on automated container terminals, AGVs use a map of predefined, fixed paths that are combined to obtain routes. However, theoretically free ranging capabilities of AGVs allows them to use the entire traveling area. In this paper an approach is proposed to improve the flexibility and capacity of AGV-systems by determining individual routes based on optimal control theory. The model describes AGVs as economic individuals, optimizing their costs. This approach leads to a new control method for AGVs, using their free ranging and positioning capacities. The developed routing algorithm dynamically determines trajectories that are optimized regarding arrival time while avoiding static obstacles and collisions with other AGVs.

– Full paper available on USB flash drive [ID 179] –

ADAPT-RT: A Demand-Adaptive Topology Reconfiguration and Routing Method for Free-Range AGVs in Automated Container Terminals

Jeon, Su Min; Huang, Shell Ying; Hsu, Wen Jing; Kim, Kap Hwan

Automated Guided Vehicles (AGVs) play crucial roles in automated container terminals, connecting the quayside with the storage yard. Currently, AGVs follow fixed path topologies

due to consideration of simple control of and safety of container transportation, which have achieved various levels of success. While the fixed paths cater to long-term transport requirements, they are insensitive to the specific transport requirements in a shorter time horizon, which can lead to unnecessarily prolonged travels, inflexible and vulnerable routing operations. To alleviate these problems, this paper presents ADAPT-RT which embodies a new approach for determining the shortest-time route paths that are tailored to the given transport requirements. ADAPT-RT consists of an integer program and a simulation model, and the final AGV route paths are obtained through an iterative refining process.

The mathematical model finds the optimal route topology based on the transport demands and the projected delays during the planning horizon, whereas the simulation model refines on the projection by re-computing the AGV travel time on the specified route paths as well as the waiting time at the intersections, merging position, transfer points.

This demand-adaptive topology routing is compared against the fixed topology with randomized routing in terms of the performance of AGV transportation system by simulation study. A container terminal with one berth of the length of 320m, 4QCs and 7 yard blocks, as shown in Figure 1, was modelled. Five vehicles were assigned to each QC. During the simulation, each vehicle was dedicated to a single QC. The simulation study was conducted for two delivery patterns: distributed delivery pattern and concentrated delivery pattern. In the distributed delivery pattern, each QC will have containers to be loaded/unloaded to/from **x** different yard blocks. In the concentrated delivery pattern, each QC will have containers to be loaded/unloaded to/from **Y** different yard blocks. Because of this difference, the resulting transportation tasks involving the same QC will have different numbers of yard blocks as the source/destination and therefore different routes.

In the fixed topology, the directions of the traffic lanes are fixed and pre-determined (two neighbouring horizontal/vertical lanes will have opposite directions of traffic. A vehicle will make a randomized decision of the next node to travel to when travelling from its source to its destination.

Table1 shows the comparison of average travel time and travel distance of AGVs per transportation task between the ADAPT-RT approach and the fixed topology approach. Our on-going evaluation confirms that the ADAPT-RT approach significantly reduces the travelling costs. Thus the new approach offers better flexibility and performance, and it may find useful applications in future planning and operations.

Table1. Comparison of average travel time, Average travel distance of ADAPT-RT / fixed topology with randomized routing (FR) with two scenarios.

Delivery pattern	Average travel time by ADAPT-RT /FR (%)	Average travel distance by ADAPT-RT / FR (%)
Distributed	68.8	73
Concentrated	72	76

[…]

– Extended abstract available on USB flash drive [ID 150] –

T-H-2: Logistics and Supply Chains

Chair: Hans-Otto Günther

GW1-HS H1010, 14:50 – 16:10

An Optimization Framework for Global Supply Chain Sustainability Applied to the European Automotive Industry

Kannegiesser, Matthias; Günther, Hans-Otto; Gylfason, Olafur

In global industry supply chains sustainability optimization addresses the overall consumption of resources and energy, the reduction of carbon emissions and generated waste. In this paper, we develop a sustainability optimization framework to model the strategic design of industry supply chains under consideration of economic as well as ecologic objectives. The framework is flexible to incorporate multiple sustainability indicators, alternative sustainability optimization strategies as well as a variety of internal and external industry-specific factors which impact the sustainability of the entire industry supply chain. We demonstrate how this framework can be applied to analyze the European automotive industry supply chain. Numerical experiments based on empirical data show the impact of optimization strategies on overall costs and emissions in the industry and the possible long-term development of the industry supply chain including the relocation of production facilities, the choice of the transportation mode and the change towards more energy friendly products such as electric vehicles.

– Extended abstract available on USB flash drive [ID 152] –

Raw Material Procurement with Fluctuating Prices using Speculative Inventory and Intermodal Transport

Reiner, Gerald; Jammernegg, Werner; Gold, Stefan

High price volatility on the raw material procurement market may considerably impact the profit margin of manufacturing companies or even vitally threaten corporate survival altogether. Volatile procurement prices represent a specific form of supply uncertainty and thus, according to Lee (2002) may be responded to by a risk-hedging supply chain strategy. Major risk-hedging effects can potentially be derived from various forms of contracting and inventory management as well as the right combinations of these two. Particularly for extended procurement distances, the choice of the transport mode may be considered a strategic decision that opens room for manoeuvre regarding transport cost and speed, procurement volume, and inventory management.

Motivated by a real-world business-to-business supply chain in the chemical industry, we present in this paper a procurement model and a framework for the performance evaluation of procurement strategies for raw materials in a dynamic environment. While the demand for the final product is stable (low demand uncertainty) and has always to be fulfilled (forced-compliance situation), the price of the raw material varies considerably over time on the supply-side. Thereby, one possibility is to procure the raw material on the spot market. Alternatively, the manufacturing company can procure the raw material by a supply contract based on the so-called European contract price (ECP), which is fixed by two dominating

companies in this area every quarter of a year. Hence, these specific supply contracts exert hedging effects against abrupt price rises, similar to, for example, futures or options contracts that are often used for commodity procurement. The manufacturing company may procure the raw material from different suppliers by the ECP contract or it may pay the spot market price. It is also possible to combine short-term procurement on the spot market and medium-term supply contracts to so-called portfolio procurement strategies. Another opportunity is to hedge against the supply uncertainties by holding speculative inventories and by applying specific transport modes.

The following *fundamental managerial decision* problem presents the core aspect of the presented study, i.e., each period the responsible managers have to make a decision about whether to procure raw material or not; in case of procurement the follow-up questions concerns the "optimal" procurement quantity and the adequate transport mode. We will *develop an algorithm* based on *demand models* depending on the *reservation price*, i.e. the highest price a buyer is willing to pay for a good (cf. e.g. Talluri and van Ryzin, 2004), and considering the characteristics of the supply process sketched above.

Based on the procurement price, transport costs and inventory costs the performance of various strategies is compared using dynamic process analysis. This research setting is meaningful because price fluctuations have a high leverage for the performance of the supply processes and may substantially impact the overall business performance of the manufacturing company. We apply dynamic process analysis, since generalized versions of models considering stochastic prices, combinations of different contract types, intermodal and multi-optional transport, and restricted inventory capacity cannot be solved analytically because of the high complexity (for analytical approaches see e.g., Arnold et al., 2009).
[…]

– Extended abstract available on USB flash drive [ID 149] –

A Logistics Planning Method for the Two-Echelon Distribution Systems

Leu, Jun-Der; Huang, Yuan-Kuei

The two-echelon distribution systems have been introduced in many different industries, such as express delivery service companies, e-commerce, hyper-markets products distribution, and so on. For realization of an effective two-echelon distribution system, the logistics execution plays a significant role, wherein the market demand should be fulfilled under given available transportation capacity, besides, the inventory and in-transit materials should be minimized. Since the logistics mechanism of a two-echelon distribution system is quite complex, a computer-based planning tool is normally needed. In this study, we decompose a distribution system into two levels, the first level connects the original depot to the intermediate depots and the second one connects the intermediate depots to the customers. The objective is to maximize the market demand fulfillment considering the time urgency and product value of the demand orders. The developed method is integrated with a googlemap environment and applied to the regional logistics center for a consumer electronics company to validate its solution quality.

– Full paper available on USB flash drive [ID 120] –

T-H-3: Future Logistics Technologies 4

Chairs: Haasis, Hans-Dietrich; Kim, Hak-So

GW1 B0080, 14:50 – 16:30

Traffic Management for Maritime Chokepoints

Hahn, Axel

A New Hybrid Strategy for the Multi-Port Stowage Planning of Large Containerships

Ha, Won-Ik

Port Logistics Information Service based on Smart Device

Yang, Aiden H.S.

T-H-4: Intermodal Transport 1

Chair: Nikolay Kolev

GW1 B0100, 14:50 – 16:10

Investigating the S&T Activities in the Global Value Chain of the Bulgarian Automotive Enterprises

Gedinach, Victoria; Antonova, Diana

In the context of globalization the division of manufacturing processes between different countries as a result of globalization of value chains becomes increasingly important. Cooperation in research and development (R&D) and innovation activities is a part of the globalization of value chains and is characterized by: (1) widening the range of scientific and technological (S&T) tasks, which are solved through joint efforts; (2) increasing the costs for R&D activities; (3) emergence of new collaborative R&D organizations; (4) growth of integration between large, medium and small industrial enterprises, combining their advantages; (5) active collaboration between universities and private sector; (6) increasing the share of government funding to support collaborative research, etc. In comparison with other European countries with developed innovation activity, Bulgarian foreign affiliates of multinational companies account for a smaller share of S&T activities than of the processing sector.

– Full paper available on USB flash drive [ID 199] –

Supplier Evaluation and Selection Decision Making Methods

Kolev, Nikolay

The paper deals with the procurement process as an integral part of logistics activities and more specifically with one of its core elements – supplier evaluation and selection. As business organisations are becoming increasingly dependent on their suppliers, and both direct and indirect consequences from erroneous decisions can be significant and affect the company's profitability, there is a need for systematic and transparent approach to handle partner evaluation and selection. Logistics procurement research in the past decades has proposed multiple methods and techniques for supplier evaluation but the complexity of the process requires further attention and investigation. Utilisation of appropriate methods can improve the effectiveness of decision making by means of proper structuring of tasks, formulation of relevant evaluation criteria and modelling of the selection process. On the basis of combination of existing procurement frameworks, the paper critically reviews established techniques, allocates them to the appropriate selection stages and proposes an appropriate combination of methods and techniques for the development of a complete model for supplier evaluation and selection.

– Full article available on USB flash drive [ID 195] –

Algorithm for Factor Determination of Innovation Activeness of Machinebuilding SMEs (The Case of Bulgaria, Example of Ruse Region)

Kunev, Svilen; Antonova, Diana; Ruskova, Svilena

The paper presents an algorithm for investigating the impact of factors influencing the innovation activeness of SMEs from machine-building sector in Ruse region. The approbation includes sequential defining the profiles of the enterprises under study, reflecting the interrelation between three main strategic variables, with the main purpose to describe the impact of factors influencing the innovation activity of the business entities while at the same time analyzing their effect on the strategic management and localization of the enterprises. The ***Initial profile*** organizes SMEs into four groups according to the directions of the innovation activity demonstrated: product innovators, organizational innovators, marketing innovators A and marketing innovators B. The ***Secondary profile*** of the innovation enterprises includes information about the innovation activeness of the enterprises under survey, giving an answer to the question which entities conduct innovation activity and how; which factors influence the innovation activeness and which ones affect the localization and the strategic directions of the business entities. The ***Integral profile*** of the innovative enterprises shows not only which factors have an influence on the enterprises with different innovation activeness, but also what their force of impact is. It distinguishes SMEs between technological innovators, product innovators, service innovators and process innovators.

– Full paper available on USB flash drive [ID 203] –

Thursday, 16:30 – 18:10

T-J-1: Container Terminal Operations 4

Chair: Henrik Heitmann

GW1-HS H0070, 16:30 – 18:10

Simulation of Rail Mounted Gantry Crane Systems in a Container Terminal Yard

Emmer, Nina; Stahlbock, Robert; Voß, Stefan

The decade before the last global financial crisis has seen a considerable growth in world-wide container transportation and with it an indispensable need for optimization. On one hand the crisis has eased the situation on some terminals, e.g., with respect to the utilization of capacities. On the other hand the crisis gave terminals the opportunity to rethink and redesign their equipment as well as their processes for improving the handling and storing of containers. Because of high traffic and competition, the terminals are under strong pressure to match the volume with the right amount of capacity. Ports located near major cities usually have problems with the limited space for storage of containers. The key for matching the increase in traffic with a fixed storage space is the use of highly automated cargo handling equipment for in-yard transportation, stacking and storing. These facilities can help to increase the throughput and decrease the ship turnaround time at the terminal. Nowadays, improvements are realized through the use of various (semi-)automated vehicles such as automated guided vehicles (AGVs), automated rail mounted gantry cranes (RMG), automated rubber tired gantry cranes (RTG), or automated double rail mounted gantry cranes (DRMG). There are still new developments to further increase a terminal's efficiency and throughput. For example, Container Terminal Burchardkai (CTB) in Hamburg, Germany, is implementing a triple rail mounted gantry crane (TRMG) system (see, e.g., Hamburger Hafen und Logistik AG (a) and (b) (no date)). In a TRMG configuration, a pair of twin cranes running on the same rails in addition to a larger cross-over crane running on its own rails is used.

One of the major research questions is whether an additional gantry crane per block results in increased productivity. Assuming that it does, what is the extent of the increase in productivity? What are the prerequisites and conditions for improvements? How to deal with crane interferences and what is their impact on productivity? Moreover, what are the differences of an end loaded block and a side loaded block? Side loading can be found in many container terminals worldwide, but also at intermodal transshipment terminals. Latest technology developments consider side loading, too. For instance, the latest automated container system of ZPMC (see, e.g., Shanghai Zhenhua Port Machinery (no date)) utilizes an automated grid system on the waterside while accessing the blocks/stacks by side loading. Some other publications are related to RMG, twin RMG, DRMG and TRMG operations (see, e.g., Cao *et al.* 2008, Dorndorf and Schneider 2010, Kemme 2011, Kemme (to appear), Kim *et al.* 2002, Klaws *et al.* 2011, Saanen (no date), Saanen and Valkengoed 2005, Stahlbock and Voß 2010).

This paper provides insights regarding the question to which extent a DRMG or TRMG system can help to improve a container terminals' efficiency. A simulation study is conducted for evaluating and comparing different online algorithms for sequencing and scheduling of

jobs within a DRMG or TRMG environment with or without permitting overtaking operations of the larger crane. The crane system serves a terminal's end loaded or side loaded storage block. Advantages as well as problems and limitations of the proposed algorithms and the specific crane systems are investigated taking different scenarios into account. Furthermore, the influence of the horizontal transport at the block's interfaces is examined.

– Extended abstract available on USB flash drive [ID 177] –

A Novel Approach for Effective Solution of Yard Crane Scheduling at Seaport Container Terminals

Koyuncuoğlu, Mehmet Ulaş; Kulak, Osman; Polat, Olcay; Taner, Mustafa Egemen

Conditions of competition in container terminals, which are the exit gates of the international networks of the container deployment tools, depend on the efficiency of these terminals. Effective use of the terminal equipments such as cranes in berths and in storage areas and the transporter vehicles between these two areas are the most important factors which affect the efficiency of the terminals. Yard Crane Scheduling (YCS) which are used in the operations generated in the storage areas has an important role in improving the efficiency of the terminals. In this paper, a new approach to free and restrictive deployment's rules, which is used in yard crane scheduling, is presented and also customer priority and assignment rules are investigated in combination. In this context, for the purpose of minimizing the total completion time of the operations, a mixed-integer linear mathematical model is proposed in order to solve the problems of assigning one or more yard cranes simultaneously and of routing. Results of this model, which is analyzed by using a genetic algorithm based approach, are presented with statistical analysis.

– Full paper available on USB flash drive [ID 184] –

Yard Crane Scheduling and Routing

Heitmann, Henrik; Kemme, Nils

As a decoupling point between waterside and landside transport, the container yard plays a major role for the competitiveness of container terminals. One of the latest trends in container yard operations is the automated rail-mounted-gantry-crane system, which offers dense stacking along with low labour costs. The operational performance of the crane system in terms of waiting times for up- and downstream transport vehicles in the handover areas of the storage yard is to a great extent determined by job scheduling and crane routing decisions. In this work, mixed integer programmes for the simultaneous job scheduling and crane routing of twin, double and triple rail-mounted-gantry-crane systems are introduced and a computational-efficient solution procedure is presented and evaluated based on numerical experiments.

– Extended abstract available on USB flash drive [ID 180] –

Yard Crane Dispatching to Minimize Job Tardiness in Container Terminals

Huang, Shell Ying; Guo, Xi; Hsu, Wen Jing; Lim, Wei Lin

For container terminals to provide efficient services to its customers, one of the most important objectives in operation planning is to minimize vessel turnaround time. This means the vehicles have to reach the quay cranes such that they minimize the quay crane waiting time for them. This in turn means when vehicles go to yard blocks, they have deadlines for their loading/unloading jobs. The yard cranes should try to finish the vehicle jobs with minimal tardiness. Two provably optimal algorithms are presented to find the optimal YC job sequence for serving a fleet of vehicles for delivery and pickup jobs with scheduled deadlines and predicted vehicle arrival times. Some of these jobs require reshuffling of other containers. The objective is to minimize the total tardiness of incoming vehicle jobs. The first algorithm MTA* is based on the well-known A* search along with a proposed admissible heuristics. The second algorithm MT-RBA* is a recursive backtracking algorithm which uses the same admissible heuristic and a prioritized search order to accelerate the computation. Experimental results show that both algorithms significantly outperform the Earliest Due Date First and the Smallest Completion time Job First heuristics in minimizing job tardiness. When handling a planning window of 10 jobs, MT-RBA* only takes a few seconds to complete in most cases and half a minute in the very heavy workload cases.

– Full paper available on USB flash drive [ID 153] –

T-J-2: Distribution Systems

Chair: Chulung Lee

GW1-HS H1010, 16:30 – 18:10

A Study on M2M Based Container Tracking System Framework for Global SCM

Choi, Hyung Rim; Lee, Jin Wook; Son, Hee Mok; Shin, Joong Jo; Shon, Jung Rock

Logistics paradigm is changing from logistics cost cutting to safe transportation and requiring diverse information services. And transportation volume of global container is increasing as trade grows larger than before based on lifting trade barriers. At the same time, participants using logistics service require real-time based information of container location, security for preventing a robbery case, and temperature/humidity/impact. But existing system based on bar code, EDI, RFID technology is possible to communicate only part of point in all logistics network. In addition, constructing infrastructure cost high because logistics network is based on all over the world these days. Container tracking system that is suggested in this research is one of the methods for realizing Smart SCM(Supply Chain Management). This would provide feature for managing container as communicating data between tracking device and information gathering server based on real-time. Moreover, suggested prototype system is applied to TSR(Trans-Siberian Railroad) which has a length of 9,288Km in Russia, and then

application result is analysed. In the result of analysing the data collected in the case of TSR transportation, from the viewpoint of Smart SCM, it was possible to find out whether the container transportation is punctual and whether the cargoes are damaged or not. In addition, from the viewpoint of constructing and operating the container tracking system, considering the efficiency of the battery use of real-time container tracking devices, it was necessary to select a mobile communication company in accordance to the country which the container is transported to.

– Full paper available on USB flash drive [ID 169] –

Hybrid Genetic Algorithms for the Three-Dimensional Multiple Container Packing Problem

Moon, Ilkyeong; Feng, Xuehao; Shin, Jeongho; Kim, Sungchan

The Three-Dimensional Multiple Container Packing Problem (3DMCPP) aims to pack a set of given finite three-dimensional rectangular items into the minimum number of identical containers without overlapping. The problem's decision framework consists of two main activities: item assignment and packing. This paper presents new hybrid genetic algorithms (HGAs) that address current limitations related to the 3DMCPP and enable a relatively small number of used containers. Specifically, the rotation constraints are also addressed. One HGA is developed for problems that are large in size, and the other HGA is for problems that are small in size. Both of the HGAs combine the Deepest Bottom Left Fill (DBLF) strategy, which is an item assignment strategy, and a basic Genetic Algorithm (GA). Experiments were conducted to demonstrate the performances of the algorithms with two different types of data sets. The results show that the proposed algorithms can achieve fairly small numbers of used containers and within reasonable time limits compared with other algorithms.

– Full paper available on USB flash drive [ID 106] –

A Flexible Optimisation Model for the Railway Crew Scheduling Problem

Hanafi, Rosmalina; Kozan, Erhan

Addressing the Crew Scheduling Problem (CSP) in transportation systems can be too complex to capture all details. The designed models usually ignore or simplify features which are difficult to formulate. This paper proposes an alternative formulation using a Mixed Integer Programming (MIP) approach to the problem. The optimisation model integrates the two phases of pairing generation and pairing optimisation by simultaneously sequencing trips into feasible duties and minimising total elapsed time of any duty. Crew scheduling constraints in which the crew have to return to their home depot at the end of the shift are included in the model. The flexibility of this model comes in the inclusion of the time interval of relief opportunities, allowing the crew to be relieved during a finite time interval. This will enhance the robustness of the schedule and provide a better representation of real world conditions.

– Full paper available on USB flash drive [ID 110] –

T-J-3: Intermodal Transport 2

Chair: Francesco Mari

GW1 B0100, 16:30 – 18:10

Metaheuristic Approach for Fuzzy Transport Planning

Santana, Julio Brito; Pérez, José A. Moreno

Transport route planning is one of the most important and frequent activities in supply chain management. The design of information systems for route planning in real contexts faces two relevant challenges: the complexity of the planning and the lack of complete and precise information. The Fuzzy Set Theory provides a suitable methodological approach for dealing with uncertainty which is a product of the imprecise nature of the information and decisions. Metaheuristics and Hyper-heuristics are optimization tools appropriated for complex problems while dealing with the flexibility of some of their components. The Soft Computing approach integrates specific fuzzy-based methodologies with the flexibility of the heuristic procedures for providing Intelligent Information systems for the development of transport route planning in uncertainty decision making contexts. Several fuzzy optimization models can be used to address the imprecision and/or flexibility in the vehicle routing problem formulations. These problems are then solved using hybrid metaheuristics combines their features that are capable to adapt to dynamic changing environment by using hyperheuristic based collaborative approaches.

– Full paper available on USB flash drive [ID 197] –

A Cluster-Based Heuristic for Allocation Products in Multi-Level Warehouses

Guerriero, F.; Mari, F.; Musmanno, R.; Pisacane, O.; Rende, F.

One of the major issues in *Warehouse Management* is to optimally assign the product classes to the storage locations (*slots*, for short) on the basic principle that the most required items have to be allocated closer to the I/O doors (*Products Allocation Problem*-PAP). The aim of this paper is to study a special version of PAP considering a multi-layers warehouse with compatibility constraints among the classes (two aspects that, at the best of our knowledge, have not been addressed in scientific literature yet). First, we modelled the problem (as already described in Guerriero et al (2012)) with the aim of minimizing the total logistics costs (due to the handling operations and the products decentralization in the warehouse) satisfying specific operational constraints (for example, compatibility and capacity constraints). However, since on large-scale instances the complexity of the model (in terms of number of decision variables and constraints) becomes computationally intractable by optimization solvers, we also design, implement and test a cluster-based heuristic approach for overcoming this limitation. Finally, we compare the results from two points of views: the solutions quality and the computational overhead.

– Full article available on USB flash drive [ID 196] –

T-J-4: Future Logistics Technologies 5

Chairs: Haasis, Hans-Dietrich; Kim, Hak-So

GW1 B0080, 16:50 – 18:10

Container Scanning Technologies

Ries, Hermann

Technology of WIG (Wing in Ground Effect) Crafts and its Applications

Kang, Cahng Gu

Thursday, 19:00 – 23:00

Conference Dinner

Hilton Hotel (Böttcherstraße 2, Downtown)

The conference dinner will be held at Hotel Hilton in the city center of Bremen. There is no official transfer from the conference venue to Hilton. However, Hilton can be easily reached by tram:

Go to tram station “Universität / NW 1” (see page “Map of University”). Board tram No. 6 in the direction Airport (“Flughafen”). Travel time is about 20 minutes. Get off the tram at “Domsheide” station. Walk down Marktstrasse, next to the BSAG Customer Center, and follow this road around the corner. You will then see the Hilton Bremen on the right (total walking distance is 200m)

The last tram from Domsheide station back to Universität / NW 1 station (conference venue) departs 23:54. At every time of the day there are taxis around Hilton and Bremen city center. Official taxis are beige and carry a yellow sign on the roof. You can call a taxi via +49 421 14 0 14.

Friday, 9:00 – 10:20

F-A-1: Container Terminal Operations 5

Chair: Riska Asriana Sutrisnowati

GW1-HS H0070, 9:00 – 10:20

Identification of Lateness Factors in Container Handling Process Using Bayesian Network from Event Log

Sutrisnowati, Riska Asriana; Jeon, Daeuk; Bae, Hyerim, Song, Minseok; Lee, Hoon; Bae, Joonsoo

The handling of containers in port logistics can be classified into different business process types, such as discharging, loading, gate-in, and gate-out each of which includes related, structured activities that are carried out using various equipments, including quay cranes, and yard crane, among others. The high interdependency of processes and equipments on various factors, schedules can be missed in real time, resulting in undesirable process down time and lateness. So that if there is one late container process can negatively affect the scheduling of successive processes. Identifying the causes of lateness, therefore, is a necessity. The specific purpose of the present study was to identify the most significant causes of lateness by considering various factors related cargo types, workers, and others. First, we examined the event logs obtained from port information systems and discovered process models from an open source process miner, ProM, using Heuristic Miner. Next, we derived a method for generation of Bayesian Network from the process models, and also applied additional variables to that Network. Finally, we could identify the most significant causes of lateness. These, significantly, can be used to reengineer existing processes for better performance.

– Full paper available on USB flash drive [ID 173] –

F-A-2: Advanced Logistics Technologies

Chair: Moritz Quandt

GW1-HS H1010, 9:00 – 10:20

Design and Implementation of CSD (Conveyance Security Device) Platform

Park, Soohyun; Jeon, Seongwoo; Kwon, Joonho; Hong, Bonghee

With increasing container cargo traffic every year, the risk of terrorism and smuggling is also on the rise. One solution is by using a container security device, and U.S. Department of Homeland Security has suggested the relevant technologies[Department of Homeland Security, 2007]. CSD system consists of organized user applications, CSD platform, and CSD. CSD functioned as a container security device. It sends an alarm message when the door is illegally opened. CSD platform receives CSD messages. Organized user applications are able to check the container status by accessing the platform. CSD data basically consists of door opening and locking data[Department of Homeland Security, 2007][ISO18185, 2007]. Extending CSD data is possible as per user demands such as location, humidity, temperature, and etc. The CSD is made from some vendors; such as e-Seal of Savi Technology, CSD (Container Security Device) of GE Commerce Guard. Those devices have different sensor module slightly; and a platform only supports a certain vendor's device. Therefore we cover design and implementation of CSD platform that supports extended sensor data and considers CSD specificity.

– Extended abstract available on USB flash drive [ID 188] –

Effects of Information Communication Technology on Productivity in Logistics Industry

Moon, Sang Young; Kang, MooHong

The adoption of information and communication technology(ICT) has made it possible to experience high levels of visibility, control and connectivity across the entire logistics industry. Many researches such as Kim and Yu(2011), Broersma and van Ark(2007), and Cainelli, Evangelista and Savona(2004) pointed out that use of ICT has positive effects on innovation and growth of service industries. ICT plays a key role in innovation of logistics industry which has insufficient own R&D.

The objective of this paper is to examin effects of investment proportions of ICT on total factor productivity(TFP) in logistics industry for policy implications.

Most previous researches have focused on labor productivity(LP) rather than TFP for a measure of producitivty changes mainly because a measure of LP is easier than a measure of TFP. Theoretically, LP should increase as capital increases since increases in capital usually relates to increases in revenue.

However, TFP should be considered for estimation of effects of ICT on efficiency of logistics industry since TFP is a measure which accounts for effects in total output not caused by tranditionally measure inputs. If all inputs are accounted for, then TFP can be taken as a measure of an economy's long-term technological change or technological dynamism.

– Extended abstract available on USB flash drive [109] –

Improving Planning and Control of Logistics Processes within the Offshore-Wind Industry by Applying Simulation-Aspects

Schweizer, Anne; Beinke, Thies; Quandt, Moritz; Scholz-Reiter, Bernd

Logistic processes within networks of the offshore wind industry are heavily affected by dynamic effects. They vary from weather conditions over material availability up to the demand of special trained personnel (Schweizer et. al 2011). Most planning- and control-systems enable an optimization of processes of one actor of a logistics network. Control and improvement of interfaces is the maximum planning- and controlling focus of these systems. The overall planning and control, supported by simulation of logistics processes within the network as well as the installation-processes at the offshore-site by an IT-system is urgently required but not jet established at the market.

This contribution shows the need for such a system and gives an overview of the developed approach. One of the basic requirements is the mapping and the presentation of all current-status information within a logistics network. Based on this information, control strategies can be developed and performed. Therefore, the status of the installation-processes of an offshore wind park could be available for every actor of the logistics network. Aspects like weather conditions, production status and stock will be used as an input-data to simulate the current or changing status. The design of a system like that – a composition with simulation, planning and control aspects – needs wide process knowledge. This process information will be presented in the paper as well as special disturbances that influence the processes. The central processes of the actors of the logistics network: producer of components, logistics service provider for transport and terminal operation, ships owner and installation employees - will be presented. Planning and performing of installation processes posses the most variances that lead to a detailed process explanation within the paper. Variances arise from different options and dependencies within the logistics processes. For example: four different ship types can be used for transport and installation of the components at site. Every ship offers different ship’s deck layouts and capacities and they require different installation equipment like swimming cranes. Moreover, they vary regarding installation and travel times. The installation processes also vary, as the components bear different concepts regarding their assembly. To give short examples: it is possible to pre-assemble gondola, hub and two blades which is called “bunny”, the “star” results from a pre-assembly of hub and the three blades. These pre-assembly influences e.g. the handling at the terminal, loading-scenarios of the installation vessels as well as the needed weather conditions for the installation. The different options and requirements will be organized by the developed system for simulation, planning and control for logistics networks of the offshore wind industry, that will be presented and discussed within the contribution.

– *Extended abstract available on USB flash drive [146] –*

F-A-3: Optimization Modelling and IT Applications of Logistics Systems

Chair: Herbert Kopfer

GW1 B0100, 9:00 – 10:20

Hybrid Bacterial Foraging Optimization Approach for Design of PID Controller in Maglev Transportation System

Cho, Jae-Hoon; Kim, Young-Tae

This paper presents a hybrid bacterial foraging optimization method for the design of a proportional-integral-derivative(PID)-based levitation controller for a magnetic levitation(Maglev) transportation system with an electromagnetic suspension system(EMS). Since the EMS-type Maglev system is mainly loop unstable, highly nonlinear, and has time-varying parameters, an effective stable controller is required the suitable performance. In this paper, a hybrid bacterial foraging optimization with a mutation-based queen-bee optimization method was used to optimize the PID controller parameters of an EMS-type Maglev system. The effectiveness of the proposed method was verified by numerical simulations and the simulation results showed that the proposed method is more efficient than conventional intelligent methods.

– Full article available on USB flash drive [ID 144] –

Friday, 10:40 – 12:10

F-C-1: Keynotes

Chairs: Hans-Otto Günther, Kap-Hwan Kim, Herbert Kopfer

GW1-HS H0070, 10:40 – 12:10

Keynote: Stochastic Vehicle Routing: an Overview

Gendreau, Michel

There are many real-life settings where key parameters of Vehicle Routing Problems are not known with certainty at the time when routes must be constructed. In this talk, we will examine the main classes of Stochastic Vehicle Routing Problems: problems with stochastic demands, stochastic customers, and stochastic service or travel times. We will emphasize the main approaches for modeling and tackling uncertainty: a priori models, a posteriori approaches, and chance-constrained models.

– Abstract available on USB flash drive [ID 190] –

Keynote: Simulation Optimization for Maritime Logistics

Lee, Loo Hay

Simulation and optimization are two arguably most used operations research (OR) tools that are used in Maritime Logistics. Optimization intends to choose the best element from some set of available alternatives. Stochastic simulation is a powerful modeling and software tool for analyzing modern complex systems that arise in Maritime Logistics. Detailed dynamics of complex, stochastic systems can be modeled in simulation. This capability complements the inherent limitation of traditional optimization where uncertainties are not easily captured, so the combining use of simulation and optimization is important. In this presentation, we will discuss how we integrate these two popular tools together and what computational issues we have to face in this integration. This presentation also gives our new development to partially address the computational issue. A key component of our methodologies is a new control-theoretic simulation technique called Optimal Computing Budget Allocation which intends to maximize the overall simulation efficiency for finding an optimal decision. We will demonstrate this methodology using the problems found in the Maritime Logistics.

– Abstract available on USB flash drive [ID 168] –

Student's Best Paper Award

Kim, Kap-Hwan

Closing Ceremony

Kopfer, Herbert; Kim, Kap-Hwan; Günther, Hans-Otto

LOGMS2013: Presentation and Invitation

Kim, Kap-Hwan

Friday, 13:00 – 16:00

Industry Tours

Industry Tour 1: Visit of Bremer Straßenbahn AG

Separate registration required, tour in German only. See social activities.

Industry Tour 2: Visit of Airbus facilities in Bremen

Seperate registration required, bring your passport. See social activities.

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