Newsletter

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Dear readers,

the team of the "IT in Production and Logistics" department wishes you a successful year 2016! Again, an exciting year has passed. One highlight has surely been the 16th ASIM Dedicated Conference on Simulation in Production and Logistics, which we had the honour to organize in cooperation with the Institute for Transport Logistics in our faculty. Having organized this reputable conference myself four times in Berlin since 1998, we have been proud to be nominated now again in Dortmund. A more detailed report on the international success is documented in this newsletter. The next conference we are involved in is the Winter Simulation Conference in Arlington (near Washington D.C.) next December. In cooperation with Prof. Dave Goldsman (GeorgiaTech) we are setting up a track on "Logistics, SCM, and Transportation". The program committee is already established, and we are looking forward to another outstanding event in the states.

Time flies so fast – our department, started from scratch in autumn 2010, has already passed its fifth anniversary. Our new master profile is now well-established, and we are happy to have good (in some cases even surprisingly high) participation figures. Obviously, our intention to educate "interpreters" or "ambassadors" at the edge between production, logistics, and computer science is addressing a significant demand. Also from industry we have received very positive feedback leading to a significant number of guest lectures from IT enterprises. In addition, I had the chance to spread some knowledge outside our institution by guest talks myself, especially as a visiting professor at the Interdisciplinary Internet

Institute (IN3) of the Universitat Oberta de Catalunya (Barcelona) in 2015.

Other news relates to our research activities. Most important for us, we could start a new EU H2020 project in June together with partners from Greece, Italy, Luxembourg, and the United Kingdom, lasting for three years. While the first PhD candidates that started in 2011 und 2012 are already targeting the finalization of their research work, new PhD topics have been approached in the last year, partially in cooperation with industry. We could launch quite a few publications at conferences as well as two journal papers. Currently, I am busy with a second guest editor issue of the Journal of Simulation (JOS), planned as issue 02/2016, focussing on production and logistics simulation. As a member of the JOS advisory board I am also responsible for the production and logistics field.

Thus, there are enough prospective challenges that will keep our life at ITPL interesting! We have tried to summarize some of the major developments in this little newsletter, and we keenly hope that you enjoy the reading!

Markus Rabe

It Is Time for a U-TURN: New Model for Urban Food Transportation

Since June 2015, the ITPL is represented in the European project “Reducing impacts and costs of freight and service trips in urban areas “(U-TURN). It is funded for a three-year period by the European Union's Horizon 2020 research and innovation programme. The project consortium is made up of representatives from consulting companies, users and logistics service providers, technology providers and, of course, universities and academic institutions.

The U-TURN project is addressing freight urban distribution, focusing on food logistics. The project will contribute to our understanding of freight distribution in urban areas, especially addressing the special requirements and needs of food transportation, and will suggest innovative collaboration practices and tools towards achieving more efficient operations from both an environmental and cost perspective. The project will analyse existing freight urban flows, identify synergies and winning logistics sharing and collaboration strategies and will assess them in three ways: through comparative analysis based on actual market data, through simulation experimentation and via pilot execution in the United Kingdom, Italy and Greece. U-TURN will further contribute to the adoption of these strategies through managerial assessment, quantifiable benefits and the provision of tools, including a "smart" transport matching tool, a collaboration platform, a simulation tool and an economic assessment model. The project aims to exploit the opportunities that currently exist for consolidation of transportation flows from food manufacturers to the various point-of-sales located in urban areas, as well as from local food producers and online retailers directly to consumers, and the high industrial interest behind this topic.

TU Dortmund University, represented by the ITPL and the Institute of Transport Logistics (ITL), is responsible for the work package “Simulation Modelling and Experimentation”. Its main tasks are, therefore, the design of the simulation model, development and testing of the simulation tools and the simulation experimentation and impact assessment. This work will rely on the in-depth experience that the involved chairs have on supply chain simulation, traffic simulation, logistics optimization, and consideration of multi-criteria problems considering cost, logistic KPIs and environmental performance.

For further information please visit the projects’ official website http://u-turn-project.eu

ASIM Conference on Simulation in Production and Logistics in Dortmund, September 2015

The 16th ASIM conference dedicated to the production and logistics applications of discrete-event simulation took place with huge success in Dortmund (Germany) from 23rd to 25th September 2015.

The conference, which is taking place biennially, has developed over the past 20 years to the most important venue on this topic. 73 papers out of more than 120 exposé submissions from practice and science have been published in the conference proceedings “Simulation in Production and Logistics 2015”. Additionally, seven outstanding papers will be published in a special issue of the “Journal of Simulation” (JOS).

This year marked the highest rate of international participation since this conference was born with around 200 researchers and practitioners from Austria, Canada, Denmark, France, Germany, Italy, Spain, Sweden, Switzerland, The Netherlands, Greece, Turkey and the United States of America.

The pre-conference day gave the participants the opportunity to attend several tutorials: the first tutorial was held by Prof. Gernot Liedtke, who presented a way to simulate traffic, followed by the vendor tutorial given by Sergej Suslov introducing AnyLogic. The last tutorial was held by Prof. Dave Goldsman bringing insights to statistics.

At the opening of the conference, Prof. David Kelton (University of Cincinnati, USA) gave an impressive keynote on irregular simulation and showed ways of input modeling and applications. The plenary speech in the evening was given by Prof. Metin Tolan, who put James Bond in the focus of physics in an entertaining way. The evening event in the “Dortmunder U” closed an active and long day with good food, drinks, and fruitful discussions.

The last day of the conference started with Andreas Marschner’s keynote with an illustration of how Deutsche Post DHL deals with redesigning a parcel network for growth.

Coffee breaks and lunch gave options for intense discussions about detailed topics that have been presented and discussed in parallel sessions.

At the supplementing exhibition in the Rudolf-Chaudoire-Pavillon, simulation enterprises presented their recent developments and tools. We are glad that the following exhibitors have been part of the ASIM conference in 2015: AnyLogic North America (USA), DUALIS GmbH IT Solution, EDAG Production Solutions GmbH & Co. KG, FlexSim, Fraunhofer-Institut für Materialfluss und Logistik IML, INCONTROL Simulation Solutions, Miebach Consulting GmbH, RIF e.V. Institut für Forschung und Transfer, Siemens Industry Software GmbH,

Simio, SimPlan AG and VDA AG Ablaufsimulation.

In 2017 the 17th ASIM Dedicated Conference will take place in Kassel (Germany).

Farming for Mining – Simulation in Process Models for Knowledge Discovery

In times of growing data streams, information extraction and its analysis are becoming more and more important. A huge amount of data is created within supply chain nodes. Well hidden in the huge amounts of data, there are structurally anchored principals of cause and effect, which can be modelled and understood using adequate techniques. Such an adequate technique is knowledge discovery in databases (KDD) and a lot of processes models coexist. The most important step in the KDD process is called data mining, which is defined as the extraction of implicit, previously unknown and potentially useful information from data. But, which of the process models is most suitable for the extraction of supply chain data? And how can KDD work if no data exist, e.g. in the planning phase? This research addresses the mentioned questions. For this purpose, a new process model is developed which deals with the special needs of supply chain data. Additionally, the model constitutes a solution for combining simulation and Know¬ledge Discovery techniques in the field of Supply Chain support and demonstrates relationships among them. The research discusses how simulation and Knowledge Discovery will be applied as a part of data farming. Data farming is a technique where data can be generated by using simulation. But, setting up data farming scenarios in the field of Supply Chains is a big challenge, because complex input data must be specified and careful input data management as well as precise model design are necessary. As a consequence, a lot of work and adaption is needed, but in the end the process model which integrated the data faming in the KDD process can be summarized as Farming for mining.

Towards more Dynamic Data Mining Models

In the ever growing global market, increased competition, demand for reduced time to market as well as higher complexity of products and processes compel manufacturing and logistics companies to obtain higher overall efficiency. To achieve this goal, knowledge plays a key factor in the better understanding of deficits and helps to create appropriate solutions. In the recent years, data mining methods have shown great potential in analyzing huge amounts of data, detecting patterns and extracting highly sought new knowledge. However, there are hurdles which discourage widespread usage of data mining for smaller businesses. One of these obstacles is the necessity of providing minimum amount of relevant data which featuring a certain quality level. In addition to data collection requirements, other drawbacks usually lie in time-consuming procedures of data preparation and model development. They often lead to a prolonged realization timespan. Moreover, the reusability of the developed models is often significantly restricted due to over-specialization. The high amount of resources necessary for modification of the existing models for a new instance, even in the same problem domain, makes developing new models the more attractive option. In contrast, a dynamic data mining model for a specific application domain can be used to create instances for a variety of problems. It increases the reutilization of models and addresses the mentioned obstacles. There exist two major tasks: creating a generalized meta-model for a subdomain of problems and customizing it to generate an appropriate solution instance for a given problem. In the present research, ITPL focuses on proposing a novel hyper-heuristic approach to tackle these challenges in the domain of supply chain. The proposed methodology would introduce a new approach for domain-based generalization of data mining models to develop meta-models and utilize hyper-heuristic to create problem-specific solutions derived from meta-models. This approach is expected to exhibit a more robust ability for dynamic adaptation to complex variations of data subsets in supply chains.

What are the Right Actions to Improve our Logistics Network?

Large logistics networks are very complex systems. Even nowadays, with analytical insights into supply chain situations with the help of Data Warehouse technology, supply chain management remains a challenge. In order to cope with complexity, companies have built specific logistics departments, dedicated to provide their managers with accurate business reports and the background information they need to decide about the right adjustments in their network. Specifically, Performance Measurement Systems with Key Performance Indicators (KPIs) as well as catalogues with possible actions for certain network situations have been developed in the past. Unfortunately though, the effects of all the actions in the catalogues are very hard to predict analytically for the managers. In many situations, they are groping in the dark when it comes to decide about the right actions to take. The task becomes even more difficult if the managers try to predict the consequences of a change in the network regarding multiple KPIs at once, including the temporal development of the network. Therefore,

especially trading businesses are demanding for better predictive solutions to plan their actions in the logistics network. ITPL is facing this challenge by developing a smart Decision Support System, which uses a Discrete-Event Simulation (DES) model of the supply chain network internally to predict the consequences of possible actions in the logistics network. As a foundational work, a method to measure real world Data Warehouse KPIs on the simulation data has been developed and published in 2015. In order to continuously support the managers with their decision making, the team of ITPL aims to couple the DES model with a machine learning agent. The agent would interact with the model and learn from these interactions. It would learn over time for each situation which actions lead to an improvement and which actions lead to a deterioration. Finally, the system should be able to suggest smart combinations of actions for many different supply chain situations. A solid architecture has already been developed and the team now aims to finish the prototype of this self-learning, simulation-based Decision Support System for large logistics networks.

Dynamic Production Systems: a Simheuristic Challenge

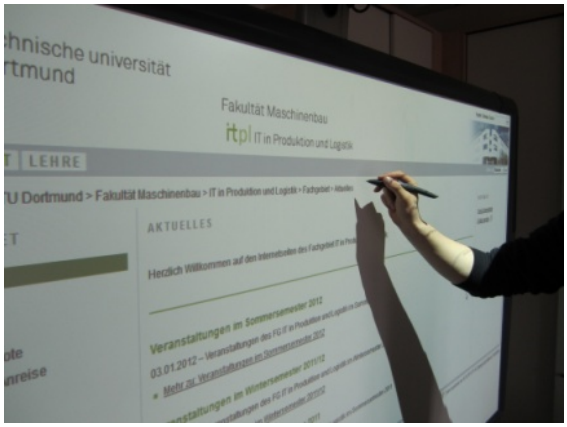
In the industrialized countries, production environments become more and more dynamic. Customers expect individual products, high quality and short delivery times. As a result, the product variety has exploded and manufacturers are faced with high numbers of individual orders. In order to determine whether an order can be fulfilled and whether the production will be economically beneficial, a system is necessary that is able to schedule every order with respect to existing and future resources and constraints. Such a system requires a proper model of the considered production system. In order to represent a transformable system, the model needs to be transformable, too. Such a model would allow for analysing the future behaviour of a system, including changes that are applied to comply with upcoming requests. This research task is faced at ITPL using Timed Hierarchical Object-related Nets (THORNs): The production system is considered as a combination of modules. Each module is represented through a small THORN model that may be connected to other modules. This way, an existing production system can be modelled and single modules may be removed, added or exchanged at any point of time. The variation of the model will be controlled through a heuristic optimisation that dynamically creates different scenarios which are evaluated against existing and expected orders. Each evaluation run will be based on a discrete event simulation that is built up on THORNs. For reducing the number of simulation runs, a filter will be applied that decides whether the chosen input data will be evaluated using simulation or not. As a result, combing optimisation, simulation and transformable models, a simheuristic methodology will be created that supports a planner with his or her decision whether an order should be accepted or not. The planner will be provided with a schedule for the orders and a list of timed changes that would have to be applied to the production system.

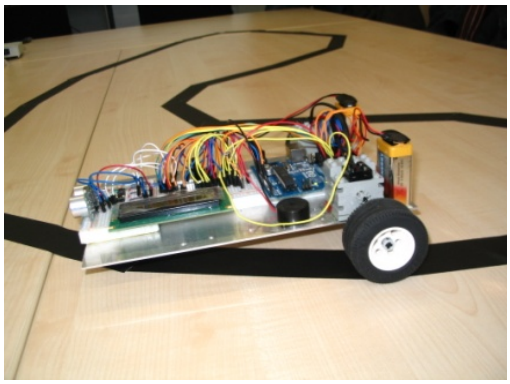
Keeping Manufacturing Execution Systems in the Automobile Industry up-to-date

In the last decades, the requirements for manufacturing control were constantly growing. This is especially true for the automobile industry where the diversity of variants was keenly growing while product life cycles reduced. Nowadays, plants or even production lines should be able to produce a high variety of products, in short cycle time, with a high flexibility, always on time which leads to a growing complexity. Manufacturing Execution Systems (MES) are a class of IT systems that should facilitate production processes and integrate them into the information architecture of a company. Therefore, they build the layer between business planning (ERP) and the shop floor. To be able to adapt to the constantly changing requirements from production, MES need to be updated on a regular basis. Updating an MES is very expensive and time-consuming nowadays and can often only be carried out during production-free time periods. Therefore, ITPL conducts research to facilitate the rollout of updates for MES under the special requirements of the automobile industry, with the goal to develop a process model for MES rollouts. The research is conducted in collaboration with Volkswagen AG, Wolfsburg.

Master Profile “IT in Production and Logistics”

Today, large logistics providers are investing more in information technology than in the “hard” assets. Thus, the success of IT projects is obviously of utmost importance. Frighteningly, investigations have shown that only around one third of such IT projects can finally be considered as successful, while the other two thirds deliver only a part of the intended results or even fail completely. The reasons are rarely in the technology, but in the communication and management of the projects. It becomes obvious that frequently the software engineers don’t understand the real needs of their customers, while the production and logistics companies are not able to communicate their specific requirements in a clear and comprehensible way. This gap needs urgently to be closed if the enterprises want to stay successful in





a world that is driven and sometimes even dominated by information technology.

The department ITPL, positioning itself in the interdisciplinary border area between IT and the production or logistics enterprises, has faced this challenge by implementing a new master profile "IT in Production and Logistics" within the master of mechanical engineering program, accredited in 2012 as one of seven profiles offered to our students. Therefore, engineers graduating from the profile will combine a solid engineering knowledge with technical and managerial skills of information system development and deployment.

Basic Lectures at the Faculty of Mechanical Engineering

Our department is teaching a wide range of IT-related topics in the faculty's bachelor degree programs. The mandatory course "Engineering Informatics" is aimed at students of mechanical engineering as an introduction to the computer science world, comprising programming capabilities as well as knowledge in basic information technology, such as databases, networks, or IT security. An important part of this course is the project group. Students, organized in small groups, can choose between different medium-sized programming challenges that cover car behaviour models, house heating models, and also some more sophisticated tasks like robot programming or elevator controls. The "IT-Systems in Industrial Production" course is a lecture series of different departments under the direction of ITPL. The third course deals with one of our key expert fields – discrete event simulation. The general objective of this "Foundations of simulation in production and logistics" course is a brief insight into the simulation area. This offer is completed by the course "material flow simulation" in the master degree program and our specialist labs concerning engineering technologies and business process modelling (in collaboration with the Fraunhofer Institute for Production Systems and Design Technology in Berlin).

Contributions to Bodies

Association of German Engineers (VDI)

- VDI GPL Fachausschuss 204 Modellierung und Simulation; Member Markus Rabe
- VDI Richtlinienausschuss (Guideline Committee) 3633.9 „Simulation und Tabellenkalkulation" (VDI 3633 Blatt 9); Member Markus Rabe
- VDI Richtlinienausschuss (Guideline Committee) 3633.10 „Geschäftsprozessmodellierung" (Business Process Modelling); Chairman Markus Rabe
- VDI Richtlinienausschuss (Guideline Committee) 3633.13 „Verifikation und Validierung" (Verification and Validation); Chairman Markus Rabe; Member Maik Deininger
- VDI Richtlinienausschuss (Guideline Committee) 4465.1 „Modellbildungsprozesse" (Model Building Processes); Member Markus Rabe

German Simulation Society (ASIM)

- Working Group „Simulation in Production und Logistics" (SPL); Deputy Chairman Markus Rabe
- Expert Group "Dedicated Conferences"; Chairman Markus Rabe; Member Arzu Kocyigit
- Expert Group „Consideration of Energetic Impact Factors in SPL"; Member Markus Rabe

Conference Organization

- ASIM Dedicated Conference „Simulation in Produktion und Logistik"; Chairman Markus Rabe 1998, 2000, 2004, 2008, 2015
- ASIM Dedicated Conference „Simulation in Produktion und Logistik"; Program Committee Markus Rabe 1993-2015
- Winter Simulation Conference; Local Chair Markus Rabe 2012 (Berlin)
- Winter Simulation Conference; Track Chair Markus Rabe 2012, 2013, 2014, 2016, 2017
- International Conference on Engineering, Technology, and Innovation (ICE); International Review Committee Markus Rabe 2005-2015

Board memberships

- Graduate School of Logistics; Board Member Markus Rabe

Journals

- Advisory Board Journal of Simulation (Palgrave); Member Markus Rabe
- Journal of Simulation 9 (2015) 4, Special Issue Simheuristics; Guest Editor Markus Rabe

Publications 2015

Juan, A. A.; Faulin, J.; Grasman, S. E.; Rabe, M.; Figueira, G.: A Review of Simheuristics: Extending Metaheuristics to Deal with Stochastic Combinatorial Optimization Problems. Operations Research Perspectives 2 (2015) 1, S. 62–72.

Juan, A. A.; Rabe, M.; Faulin, J.; Grasman, S.E.: Guest Editorial – Special Issue Simheuristics. Journal of Simulation 9 (2015) 4, S. 261-262.

Pfeilsticker, L.; Juan, A. A.; Rabe, M.: Development of a Simheuristic Approach for Solving Realistic Inventory Routing Problems. In: Rabe, M.; Clausen, U. (Hrsg.): Simulation in Production and Logistics 2015. Stuttgart: Fraunhofer Verlag 2015, S. 60-68.

Rabe, M.; Clausen, U. (Hrsg.): Simulation in Production and Logistics 2015. Stuttgart: Fraunhofer Verlag 2015.

Rabe, M.; Deininger, M.: Discrete Event Simulation of Modular Production System Models using Petri Nets. In: Rabe, M.; Clausen, U. (Hrsg.): Simulation in Production and Logistics 2015. Stuttgart: Fraunhofer Verlag 2015, S. 388-396.

Rabe, M.; Deininger, M.; Scheidler, A. A.: Verification of Petri-Net-based Simulation Models Using Coverage Metrics. SIGSIM-PADS'15, London, 10.-12. Juni 2015, S. 247-255.Rabe, M.; Deininger, M.; Scheidler, A. A.: Verification of Petri-Net-based Simulation Models Using Coverage Metrics. SIGSIM-PADS'15, London, 10.-12. Juni 2015, S. 247-255.

Rabe, M.; Dross, F.: A Reinforcement Learning Approach for a Decision Support System for Logistics Networks. In: Yilmaz, L.; Chan, W. K. V. ; Moon, I.; Roeder, T. M. K. ; Macal, C.; Rossetti, M. D. (Hrsg.): Proceedings of the 2015 Winter Simulation Conference, Huntington Beach (CA). IEEE 2015, S. 2020-2032.

Rabe, M.; Dross, F.; Vennemann, A.: A Procedure Model for the Credible Measurability of Data Warehouse Metrics on Discrete-event Simulation Models of Logistics Systems. In: Rabe, M.; Clausen, U. (Hrsg.): Simulation in Production and Logistics 2015. Stuttgart: Fraunhofer Verlag 2015, S. 168-176.

Rabe, M.; Sari, M. U.; Fechteler, T.; Ruini, L. FF.: Discrete Event Simulation as a Strategic Decision Instrument for a CO2– and Cost-efficient Distribution Chain Applied in the FMCG Sector. International Journal of Advanced Logistics 4 (2015) 1, S. 47-53.

Rabe, M.; Scheidler, A. A.: Farming for Mining – Entscheidungsunterstützung mittels Simulation im Supply Chain Management. In: Rabe, M.; Clausen, U. (Hrsg.): Simulation in Production and Logistics 2015. Stuttgart: Fraunhofer Verlag 2015, S. 671-679.

Theses and Scientific Project Works 2015

Appanavar, S.: Development of a Generic PLC Integration Concept for a Graphical Simulation System. Master thesis, 2015.

Beckmann, N.: Untersuchung des Einsatzes von Vorgehensmodellen des Knowledge Discovery in Databases für Bereiche der Logistik. Master thesis, 2015.

Cetinkaya, Ö: Untersuchung statistischer Verteilungen in der ereignisdiskreten Simulation von Supply-Chain-Prozessen. Scientific project work, 2015.

Eckhardt, I: Konzeptentwicklung für die Kopplung heuristischer Optimierung und ereignisdiskreter Simulation für Ablaufplanungsprobleme. Master thesis, 2015.

Grafe, J.-N.: Ein Vergleich agiler und klassischer Vorgehensmodelle des IT-Projektmanagements bei der Einführung von Big-Data-Management-Systemen. Master thesis, 2015.

Gürez, E: Zuordnung von Data Mining-Methoden zu problemspezifischen Fragestellungen von Supply Chain Management-Aufgaben. Bachelor thesis, 2015.

Kopp, J. C.: Entwicklung eines Konzepts zur Nutzung von Traceability für die Optimierung von Produktions- und Logistikprozessen mit Hilfe von ereignisdiskreter Simulation. Master thesis, 2015.

Köster, C: Vorgehen zur Berücksichtigung von Wissen zu Wirkzusammenhängen in Simulationsstudien für Suppy Chains. Master thesis, 2015.

Liesebach, T. J.: Vorgehensmodell zur proaktiven Integration unternehmensexterner Produktionsprozesse in Wertschöpfungsketten. Master thesis, 2015.

Ortmann, D.: Konzeptentwicklung für agentenbasierte Produktionsplanung mittels ereignisdiskreter Simulationssoftware. Master thesis, 2015.

Pfeilsticker, L: Development of a Simheuristic Approach for Solving Realistic Inventory Routing Problems, Master thesis, 2015.

Schmitt, D: Analyse und Erweiterung eines Petri-Netz-basierten Konzepts zur Abbildung wandlungsfähiger Produktionssysteme. Scientific project work, 2015.

Renk, O.: Untersuchung von Optimierungspotentialen in unternehmensübergreifenden Prozessen des Wareneinganges und davon abhängigen Prozessen am Beispiel eines Handelsunternehmens. Master thesis, 2015.

Vennemann, A: Vorgehensweise zur Aufbereitung von Eingangs- und Ergebnisdaten einer ereignisdiskreten Simulation eines Logistiknetzwerkes des Werkstoffhandels zur glaubwürdigen Messbarkeit von komplexen Data-Warehouse-Kennzahlen. Master thesis, 2015

Ziegler, J.: Systematische Untersuchung von möglichen Datenkategorien in Supply Chains. Bachelor thesis, 2015.

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