LogDynamics
Summer School

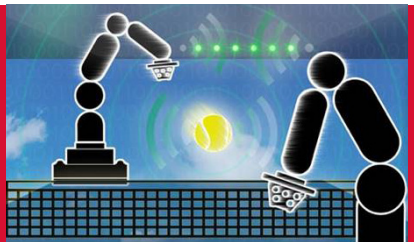
Summer School Program

LogDynamics Summer School (LOGISS) 2016
Control Interfaces in Logistics: Data and Algorithms
Bremen, Germany, February 29 - March 4, 2016

Organized by
Bremen Research Cluster for Dynamics in Logistics (LogDynamics)

www.summerschool.LogDynamics.de





Universität Bremen*

*EXZELLENT.

Overview

The complexity of logistic networks and systems is growing in today's globalized world. Individual customer requirements cause a significant increase in the number of product variants and services as well as shorter product life cycles. This implies new technical and economic challenges for logistic systems and processes. In order to meet these challenges, innovative control methods are required to flexibly adapt to continuously changing conditions. The ability to incorporate and utilize the dynamic aspect is essential for successful manufacturing and transport logistics. Moreover, it guarantees strategic advantages in terms of competitiveness on the world market, but also enables green and sustainable logistic solutions.

The goal of this course is to introduce students to methods and tools to develop distributed control algorithms and interfaces. To this end, the students will learn how to use and combine logistic data (e.g., tour plans, bills of material, sensor information, demand forecasts, etc.). The idea is not only to provide students with the ability to use tools to monitor and control the flows of material, energy, people, and information in a variety of dynamic logistic environments from global networks via urban areas to the shop floor. Instead, the students will study information and algorithmic properties, which allow to increase efficiency, reduce emissions, or create robust processes on free scales.

The course is designed for PhD students or advanced Master students in Logistics, Computer Science, Industrial Engineering, or related fields. It is assumed that the students have some basic knowledge in modeling, programming, and statistics.

Learning Outcomes

After participating in the summer school, the student will be able to:

- identify the research landscape on control interfaces,
- explain and apply the core ideas of network flow optimization, big data analytics, control theory, and heuristics,
- identify limitations and assumptions of distributed control,
- clarify performance criteria for control interfaces and select evaluation criteria,
- judge whether central or decentral coordination is appropriate,
- verify and discuss whether one of these methods is an applicable solution approach for agiven scenario, and
- analyze conflicting objectives and constraints with respect to the performance of a control interface.

In the midterm, students will utilize this knowledge within their own projects to:

- classify their research project in the topic landscape of the summer school,
- sharpen the understanding of the working principles and realize the interdependencies between different levels and components of the systems,
- improve communication and to increase understanding and exchange between the involved scientific disciplines.

Finally, the summer school strives to generate a network of young researchers within the field of logistics. The aim of the network is to foster ideas from the various discipline and give rise to opportunities for joint research. To support this process, the summer school is accompanied by classical social elements such as get-together, dinner and guided tour, but also comprises new features such as research speed dating for scientific purpose and group lab sessions.

Program Summer School 2016

Monday, February 29th, 2016	
9:00 - 13:00	**Control Theoritic Modeling of Logistic System** Prof. Neil Duffie, PhD, University of Madison-Wisconsin, USA (BIBA Conference Rooms 1020-1030)
13:00 - 14:00	**Lunch** (Mensa)
14:00 - 18:00	**Control Lab** Prof. Neil Duffie, PhD, University of Madison-Wisconsin, USA (IPS-Lab 1)
18:00 - End	**Get Together** (BIBA Halle)

Tuesday, March 1st, 2016	
9:00 - 13:00	**Excursion to ArcelorMittal Bremen**
13:00 - 14:00	**Lunch** (Mensa)
14:00 - 18:00	**Speed Dating for Scientific Purpose** Dr.-Ing. Ingrid Rügge, LogDynamics-IGS, University of Bremen, Germany (BIBA Auditorium)
19:00 - End	**Grünkohl Dinner** Schüttinger Gasthausbrauerei, Hinter dem Schütting 12/13, 28195 Bremen

Wednesday, March 2nd, 2016	
09:00 - 13:00	**Industry 4.0** Prof. Dr. Michael Henke, Technical University of Dortmund, Germany (BIBA Conference Rooms 1020-1040)
13:00 - 14:00	**Lunch** (Mensa)
14:00 - 17:30	**Industry 4.0 Lab** Prof. Dr. Michael Henke, Technical University of Dortmund, Germany (IPS-Lab 1)
18:00 - End	**Guided Tour to Bremen**

Thursday, March 3rd, 2016	
09:00 - 13:00	**Complex Networks in Logistics** Dr. Olivia Woolley, ETH Zurich, Switzerland (BIBA Conference Rooms, 1020-1030)
13:00 - 14:00	**Lunch** (Mensa)
14:00 - 18:00	**Network Lab** Dr. Olivia Woolley, ETH Zurich, Switzerland (IPS-Lab 1)
18:00 - End	**Common Dinner**

Friday, March 4nd, 2016	
09:00 - 13:00	**Process Analysis using Machine Learning** Prof. Christopher Irgens, PhD, University of Strathclyde, UK (BIBA Conference Rooms, 1020-1030)
13:00 - 14:00	**Lunch** (Mensa)
14:00 - 18:00	**Process Analysis Lab** Prof. Christopher Irgens, PhD, University of Strathclyde, UK (IPS-Lab 1)
18:00 - End	**Closing**

Abstract and Short Profile

Monday, February 29th, 2016

Control Theoretic Modeling of Logistic Systems

Prof. Neil Duffie, PhD
University of Madison-Wisconsin, USA

As markets continue to become increasingly more dynamic and turbulent, new types of logistic systems and networks will be required that are agile, changeable and robust in the presence of turbulence. At the same time, information and computing technologies enabling future cyber-physical systems and Industry 4.0 will improve support for strategies such as joint use of resources by different companies, flexible capacity and active countermeasures against low due date reliability. To accomplish this, powerful tools are needed for designing, modeling, analyzing and understanding the dynamic behavior of logistic systems and networks.

The tools of control systems engineering offer a wide spectrum of potential contributions to understanding this dynamic behavior. However, for many reasons including the nature of operational decision-making and a lack of data and suitable dynamic models, relatively few examples are available outside the field of supply chain dynamics as to how classical control theory, much less advanced control theory, can be applied.

The main focus points of this lecture include:

- Opportunities for applying classical control theoretical modeling and analysis of the transient behavior and fundamental dynamics of logistic systems and networks including scheduling, sequencing, loading and controlling.
- The basic theory and history of work in this research area will be reviewed, especially research related to production systems and networks, and several recent examples of progress will be discussed.
- These will illustrate the potential that exists and obstacles that need to be overcome in applying tools from the field of control systems engineering and the kinds of approaches that may be required in the future as the need for dynamic modeling and analysis of logistic systems and networks continues to grow.

Note: Some basic material on control theory and the Matlab/Simulink control systems toolbox will be presented during the lecture to enable progress to be made during the lab.

Short Profile

Neil A. Duffie received his PhD in Mechanical Engineering in 1980, M.S. in Engineering in 1976, and B.S. in Computer Science in 1974, all from the University of Wisconsin-Madison, Madison, Wisconsin, USA. He is an Emeritus Professor and past Chair of the Department of Mechanical Engineering of the University of Wisconsin-Madison.

His main research interests are distributed system control and manufacturing process automation. He is the acting Director of the Manufacturing System Engineering Program at the University of Wisconsin-Madison. Professor Duffie is a Fellow of ASME, CIRP and SME. He is a member of the CIRP Editorial Committee, and is past chair of its Scientific Technical Committee for Production Systems and Organizations. He is a Past President of the Society of Manufacturing Engineers (2008). In 2008 he was Mercator Guest Professor at the University of Bremen, Germany. He also has been a visiting researcher at the University of Stuttgart, Jacobs University, Cranfield University, James Cook University, and the AIST Mechanical Engineering Laboratory in Japan.

In 2012 he received the SME Frederick W. Taylor Research Medal for publishing significant seminal research findings based on the application of modern control theory to manufacturing operations leading to a better understanding of processes, equipment and facilities. Since 2014 he has been the Editor-In-Chief of the SME Journal of Manufacturing Systems.

Tuesday, March 1st, 2016

SpeedDating for Scientific Purpose

Dr.-Ing. Ingrid Rügge
Log*Dynamics*-IGS, University of Bremen, Germany

It is a challenge to get across the point of a PhD topic quickly. Project managers or sales people often use the metaphor of the „elevator pitch“ to explain that one has to be able to actually not only say what s/he is doing but do it in a way that is interesting. The International Graduate School for Dynamics in Logistics (IGS) employs the metaphor of speed dating to make a lot of people know each other and their research topics in a very short time and to bridge the disciplinary and cultural gap as well.

Each participant has two tasks:

- to introduce her/himself and her/his research topic with a few words to someone from a different discipline and with an unknown cultural background and
- to listen and identify common research interests or a mutual basis for further cooperation.

Short Profile

Dr.-Ing. Ingrid Rügge studied computer sciences at the Carl von Ossietzky University in Oldenburg and at the University of Bremen and obtained the diploma degree in 1995. In 1996 she started to work as researcher at the Artificial Intelligence Laboratory at the University of Hamburg (LKI) on the project „MIMIC – Medical Intelligent Monitoring in Intensive Care“. From 1995 to 2000 she held the position of a guest scientist at University of Bremen, working on gender-related topics. From 1999 to 2007 Dr.-Ing. Ingrid Rügge was researcher at the Faculty of Mathematics and Computer Science at the University of Bremen within the Center of Computing Technologies (TZI) in different positions.

In 2004 she co-initiated the project ‚wearIT@work - Empowering the mobile worker by wearable computing‘ and further research projects within the upraising field of wearable computing. She developed a novel concept for the close co-operation of science and business on the topic ‚mobile solutions‘ under the label Mobile Solution Center Bremen (2004).

In 2006 she received her PhD (Dr.-Ing.) from the Department of Computer Science at the University of Bremen. Since June 2007 Dr.-Ing. Ingrid Rügge has been the managing director of the International Graduate School of Dynamics in Logistics (IGS) within the ‚Bremen Research Cluster for Dynamics in Logistics - LogDynamics‘ of the University of Bremen. The IGS is the research training programme of LogDynamics. She is the local co-ordinator of three ERASMUS MUNDUS exchange projects, cLINK, FUSION and gLINK.

Currently, she focusses on career development of Ph.D. students i.e. methods for cross-cultural communication in a heterogeneous international research cluster; motivating inter-disciplinary research co-operation, curriculum development for soft skill and transferable skill courses, and supervising the contributing external lecturers, particularly lecturers from different disciplines (e.g. language teacher, speech therapist, choir conductor, opera director) and other countries.

Wednesday, March 2nd, 2016

Management of Industry 4.0 - Challenges and areas of activities for the successful management of companies

Prof. Dr. Michael Henke

Technical University of Dortmund, Germany

Everybody is talking about Industry 4.0. - but what does it really mean? In short: Everything is linked, everything is autonomous. It is about the Internet of Things and Internet of Services. The following issues relate to challenges and areas of activities for the successful management of companies and will be discussed in the course:

- Fitness program for the company

A challenging task to implement Industry 4.0. is not only to make the production fit, for example with the implementation of cyber-physical systems, but the most important thing is the organization and management of implementation of Industry 4.0.

- A private analogy

Through Social Networks and Social Media, we share a huge amount of information in real-time, which was uncommon before. This is the perfect analogy to the Smart Factory of Industry 4.0, in which everything is linked. The main challenges of the management 4.0 is to properly organize exchange of unlimited information and technical data, e.g. from different machines, systems, etc. as well as communication of different functions in the company.

- Wasted advantages

If the management does not do their job, many opportunities of Industry 4.0 will be wasted. In order to achieve the transformation of the organizations, some tools like the Change Management should be implemented.

- Reserved Small-Medium Enterprises

Until now the Small-medium enterprises (SMEs) react rather carefully or reserved concerning Industry 4.0. Research and Identification on which area of Industry 4.0 fits best to each type of SMEs should be performed both by scientists and practitioners.

- New business models

Industry 4.0 is strongly based on Big Data. New business opportunities quickly develop from the previously unknown big amount of data. With the implementation of these new business opportunities, different functions are emerged and changed accordingly. New management system is therefore needed.

- Measurement and Control

Another important discussion topic of Industry 4.0 is the measuring and control models: „You can't manage what you can't measure". What will be the costs of implementation of Industry 4.0 for my company? What would be the benefits for my company? Only by answering these questions, we can make reasonable decision.

Short Profile

Prof. Dr. Michael Henke is director of the Enterprise Logistics at Fraunhofer IML and he also holds the chair of Enterprise Logistics at the faculty of Mechanical Engineering at TU Dortmund University. His research focuses lie among others on the area of e.g. management of the Industry 4.0, purchasing and supply management, supply chain risk management and financial supply chain management.

Michael Henke began his career studying Brewing and Beverage Technology at the Technical University of Munich (Dipl.-Ing.). He gained his doctorate and habilitation in Business and Economics at the Technical University of Munich. During the last year of his habilitation Michael Henke was also working as senior consultant for the Supply Management Group SMG in St. Gallen, Switzerland.

Since 2007 he was teaching and researching as professor at the EBS European Business School in Wiesbaden, he started his new career at Fraunhofer IML at the beginning of September 2013.

Thursday, March 3rd, 2016

Complex networks: From structure to dynamics

Dr. Olivia Woolley
ETH Zurich, Switzerland

In this course we will study the basic mathematical and computational methods used in the study of complex networks.

We will first discuss basic measures used to characterize network structure and the role of individual components in networks. This will include different centrality measures and community detection algorithms. We will then review standard network models and how their properties relate to real world networks, such as transportation, social and information networks. We will continue onto basic network optimization problems, such as shortest-path and searching algorithms.

Our main focus will be on exploring the connection between network structure and 1) network resilience, 2) dynamics on networks (focusing on spreading processes). We will also discuss the problem of inferring networks from available data. Finally Students will carry out a small project, visualizing and analyzing the properties of real networks to become familiar with some of the basic tools for network analysis.

Short Profile

Education:

- Northwestern University, Evanston, IL, USA
  Ph.D. in Engineering Science and Applied Mathematics (ESAM), 2013
  M.S. in Engineering Science and Applied Mathematics, 2007
- Stanford University, Stanford, CA, USA
  B.S. in Mathematical and Computational Science (Minor in Civil & Environmental Engineering), 2004

Research experience:

- ETH, Zürich, Switzerland
  Postdoctoral Research Fellow, Professorship of Computational Social Science 6/2013-present
- Northwestern University, Evanston, IL, USA
  PhD Researcher, ESAM and Northwestern Institute on Complex Systems 9/2007-5/2013
- International Water Management Institute (IWMI), Colombo, Sri Lanka
  Research and Analyst Consultant 5/2005-7/2006

Friday, March 4th, 2016

Is it possible to get sense from „Big Data“?

Prof. Christopher Irgens, PhD
University of Strathclyde, UK

The use of current supervised and unsupervised machine learning methods and tools carry a promise of bringing ‚cosmos‘ to ‚chaos‘. This seminar is based upon experience from the past 5 - 6 years with ‚big data‘ from two different application domains, namely aerospace manufacturing and financial investment market. In hindsight with varying results.

The methods and associated tools are both supervised and unsupervised, such as Support Vector Machine and Cluster Analysis. These have been used both as single tools and complementary tools with varying results. The theoretical background to these methods and tools is both simple and ‚common sense‘. This will be ‚explored‘ during both the lecture part and practical part of the seminar. The main focus will be on SVM (Support Vector Machine) and Cluster Analysis. The themes of the seminar will be taken from the above mentioned applications, as will data where possible without breaking confidentiality which is current.

Data-mining will invariably involve considerable effort in the pre-processing of the data, the experience of this will be addressed as will the data volume which brings with it both limitations and opportunities. The theoretical backgrounds of SVM and Cluster Analysis will be introduced and this will be followed by both synthetic and actual cases from completed work.

The practical work will aim at introductory use of available software on prepared data scenarios, so that participants may get some initial understanding of the potential as well as limitations of machine learning.

Short Profile

Educated in Norway and England. University of Liverpool from 1966 to 1972 in BEng(HONS) in Mechanical Engineering and MSC in Numerical Analysis and Electronic Computation.

Worked in:

- Avionics in British defence industry
- Early implementations of the POP-2 compiler for Artificial Intelligence use
- Professor and Visiting Professor at British, Norwegian, Swiss, Chzech and Egyptian universities.

Retired, Visiting Professor at University of Strathclyde, Glasgow, United Kingdom.

Summer School Location

The Summer School 2016 will be held in BIBA, next to the tram stop (H) „Klagenfurter Straße“ of the line no. 6. This tram connects the university with the main railway station, the city and the airport. The universities canteen (Mensa) can be reached by a short walk of five minutes.

BIBA Address: Hochschulring 20, 28359 Bremen

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