Kick of Meeting of CEEPUS Network on Modeling, Simulation and CAD in Engineering and Management

UBT SIM - Center for Modelling and Simulation

Case Study: SIMULATION AND OPTIMISATION
for Complex Production Systems

Edmond Hajrizi

Sofia, October 2016

Edmond Hajrizi

- Education Background: **Mechatronics and Intelligent Systems, Computer Science and Management**
- Research Area: **Systems Design and Management** (Education, Business, Entrepreneurship and Innovation, Regional Development, Quality and Process Management, Information Systems, Mechatronics and Robotics)
- Professions: **Entrepreneur, Teacher, Researcher, Innovator, Trainer, Consulter/ Adviser / Expert, Assessor, Publisher, Member of dif. Professional and Scientific Councils**
- Founder, Owner and President of **UBT**, IEME, KASIM, KA-CASE, Quality Kosova, IPC
- Academic Staff of Vienna University of Technology
- Academic Staff of Danube University Krems
- Research Follower at City University London
- Visiting Scholar at Warsaw University
- World Bank Expert for Research and Innovation
- Accredited First IPMA Assessor for Project Management (A, B, C, D)
- Accredited EOQ/QA Examiner and Trainer for Quality
- Accredited Assessor for Excellence based on EFQM … ILEP
- Member of GA of IFAC, EUROSIM, IPMA, EOQ, AESOP, IEEE, etc., representing Kosovo
- Team Member of Experts for Bologna Membership Process
- National Contact Point for Horizon 2020 ICT and FET
- Board Member of Kosova Agency for Statistics, PTK
- Editor of International Journal of Business and Technology
- Member in different scientific and professional bodies (SC, TC, RB)

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PART 1

UBT – University for Business and Technology

License and Accreditation

- UBT Starts up at 2001 as Institute for Enterprise Management and Engineering (IEME)
- IEME - UBT is licensed by the Ministry of Education, Science and Technology in Higher Education Institution sector, since 2003.
- UBT is accredited at institutional and programme levels by the Kosovo Accreditation Agency, sience begining
- UBT is certified according ISO 9001, since 2007
- UBT is certified with Recognized for Excellence, 4*, according EFQM Business Excellence, 2014

Facts and Figures

- Objectives: The most innovative and leadership Institution in Higher Education in Kosovo
- Organization: EFQM Recognised for Excellence 4*, ISO 9001:2015 , ISO 17024
- Academic Development: 15 Faculties, 25 Accredited Study Programs, 77 Accredited Majors, 3 MBAs, 10 Joint International Study Programs, 200 Open University Courses, 5 Postgraduate, 5 Higher Professional Education, 200 Personal Certification, 25% of total courses are taught in English and other Foreign Languages, 50 Spin Offs,
- Infrastructure: 5 innovation Campuses, 40 Research Labs, 20 Support Service Centres and Offices, 20 Research and Education Centres, 250000 Libraries holdings, 40 Service Units, Budget: 30% in R&D, Incubation and Innovation Centres, 30 Digital and Smart Application supporting Univ. Virtualisation
- Students: 17000 registered, 80% Bachelor, 20% master, 50% Female Students, 100 Foreign visiting Students per year
- Alumni: 2000 Alumni, 98% jobs in the first year
- Staff: 500 Employees & 300 Visiting Foreigners, 35% Female
- Research: 250 Scholars, 70 Research Topics, 7 Institutes, 1000 publications per year, 200 research and development grants, 20 % National Grants, 20% of European Grants in Kosovo,
- International: 240 Foreign Partners, International Individual Membership, Institutional Membership, National Membership, International Relations Offices and Represents
- Success Stories: 1st Place NASA Challenges, 1st Place European Championship in Robot Soccer, Largest Computer Science and Engineering School in Western Balkan,
- Strategy – 2016 - 2025
- Development – 15 Years Experience, Established in 2001, Founded and Designed by Edmond Hajrizi

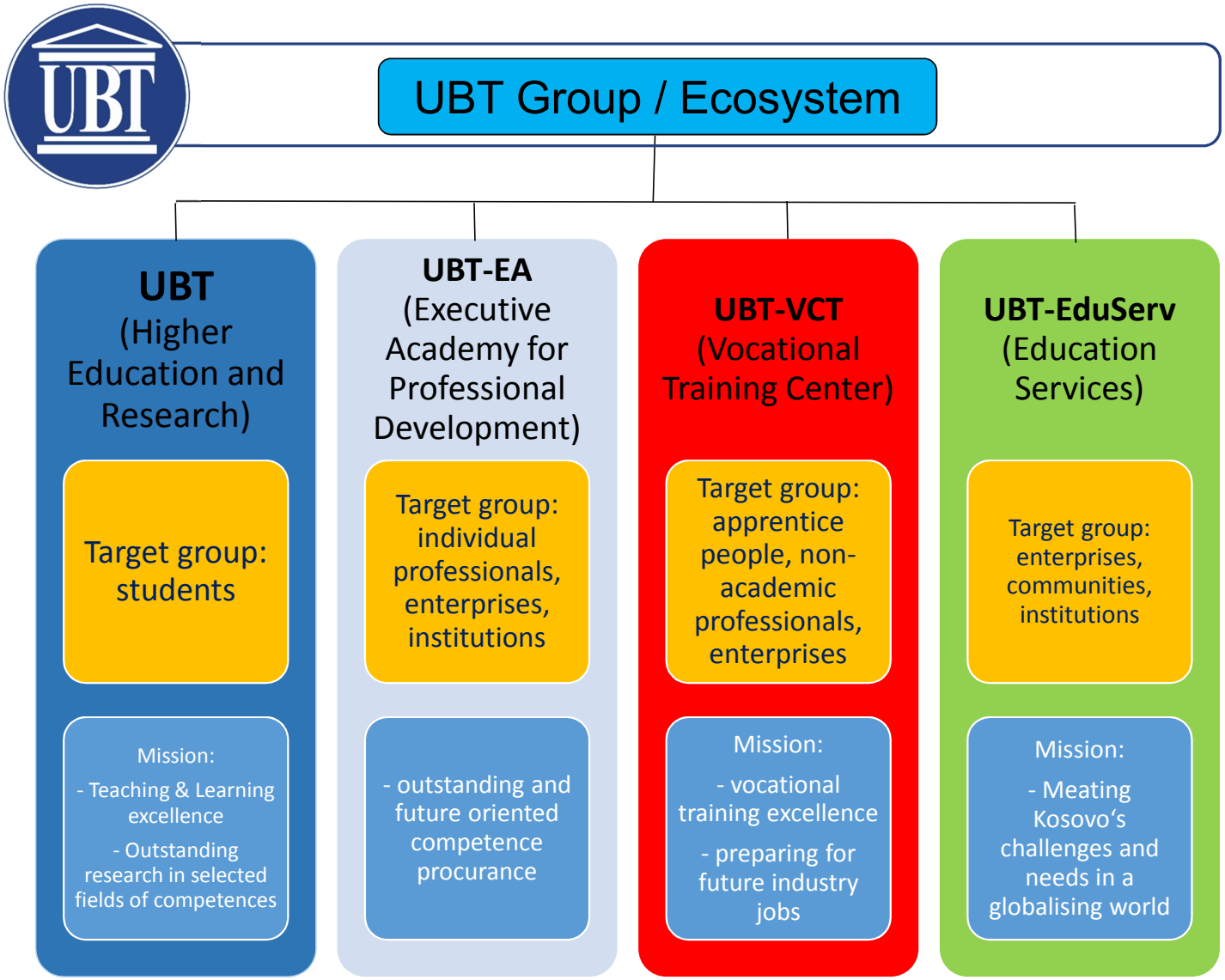
Objectives

Focus: Technology, Business, Life Sciences, Law and Social Sciences

- Transdisciplinarity
- Leadership and Innovation
- Small Scale Ecosystem and Growth

UBT has identified five Strategic Goals:

- Achieving Academic Excellence
- Maintaining and increasing Internationalization and regional partnerships
- Creating Positive Working and Learning Environment
- Partnership with the Community
- Developing Research, Innovation and Social Responsibility


UBT Group / Ecosystem
UBT
(Higher Education and Research)
Target group: students
Mission:
- Teaching & Learning excellence
- Outstanding research in selected fields of competences
UBT-EA
(Executive Academy for Professional Development)
Target group: individual professionals, enterprises, institutions
- outstanding and future oriented competence procurance
UBT-VCT
(Vocational Training Center)
Target group: apprentice people, non-academic professionals, enterprises
Mission:
- vocational training excellence
- preparing for future industry jobs
UBT-EduServ
(Education Services)
Target group: enterprises, communities, institutions
Mission:
- Meating Kosovo‘s challenges and needs in a globalising world

Growing Organization

SCHOOLS:

- MBE – Management Business and Economics
- LS – Law
- PS - Political Science and Diplomacy
- MM - Media and Communication
- IS – Information Systems
- CSE – Computer Science and Engineering
- MM – Mechatronics Management
- EE – Energy Engineering
- ASP – Architecture and Spatial Planning
- IND – Integrated Design
- INI - Civil Engineering and Infrastructure
- HST – Health Science and Technology
- FST – Food Science and Technology
- PDLLL - Professional Development and LLL

INSTITUTES:

- Institute of Research and Development (IEME)
- Institute for System Design and Management
- Institute for Development of Education and Academic Affairs (IDEAA)
- Institute of Foreign Languages and Intercultural Competence (I
- Institute for Spatial Planning, Sustainable Development and Engineering

Centers of Expertise:

- Center for Tourism and Hospitality
- Center for Career Development and Internship
- Center for Statistics, Data Processing and Forecasting
- Center for Public Opinion Research
- Center for Modelling and Simulation
- Center for Software Development and Innovation
- Center for Digitalization and Smart Solutions
- Center for Incubation and Start Ups
- Center for Arts, Multimedia and Culture
- Center for Cyber Security and Privacy
- Center for Professional Development and LLL
- Center for IPR and Legal Supports
- Center for Knowledge Management and Library
- Center of UBT SAP University Alliance
- Center for International Studies
- Center for Health Science and technology
- Center for Food Science and Technology

OFFICESS:

- Office for International Relations
- Office for Quality Assurance
- Office for Students Services, etc.

Academic Affairs

- UBT Campuses
  - Prishtina
  - Lipjan
  - Prizren
  - Ferizai
  - Gjilan - office
- UBT Library
- UBT Modeling and Simulation Lab
- UBT Computer Programming Labs
- UBT Intelligent Systems and Robotics Lab
- Mechatronics and Robotics Labs
- UBT Energy Lab
- UBT Industrial Production Lab
- UBT SAP Lab
- UBT Printing Lab
- UBT Economics Lab
- UBT Software System Design and Innovation Lab
- UBT Networking and Communication Lab
- UBT Operation Systems Lab
- UBT Certification Center

- UBT Energy Lab
- UBT Material Science Lab
- UBT Industrial Production Lab
- UBT Workshops Tool Lab
- UBT Clinical Skills Lab
- UBT Microbiology Lab

- UBT Chemistry lab
- UBT Physics Lab
- UBT Biochemistry Lab
- UBT Anatomy Lab
- UBT Physiotherapy Lab
- UBT Physiology Lab
- UBT Food Technology Lab
- UBT Creative and Studio Design Lab
- UBT Space Makers Lab
- UBT Electronics Lab
- UBT Textile and Fashion Design Lab
- UBT Fine Arts Lab

- UBT Architecture Design Lab
- UBT Entrepreneurship Corner Lab
- UBT Computer Architecture Lab
- UBT SAP Lab
- UBT Printing Lab
- UBT Economics Lab
- UBT Media: Radio, Newspaper, Portal, Labs
- UBT Software System Design and Innovation Lab

Spin Offs

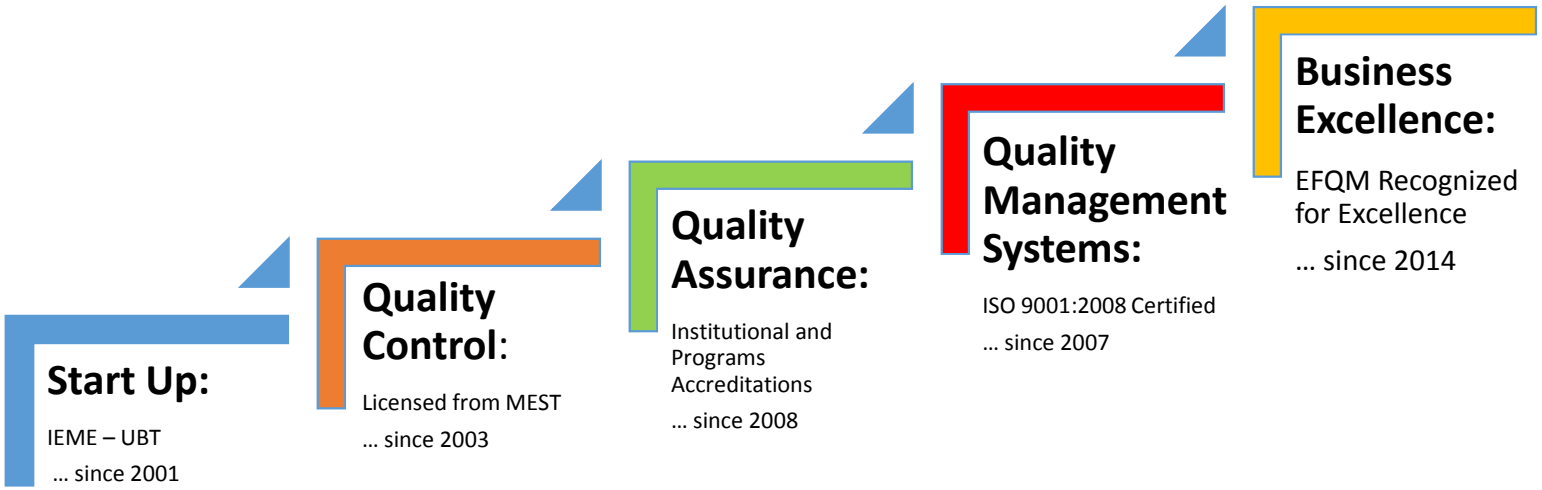
- Quality Kosova - Kosovo Association for Management: Member of International Project Management Association and European Organization for Quality
- **CA – CASE - Kosovo Association for Control, Automation and Systems Engineering : Member of International Federation of Automatic and Control**
- **KA-SIM – Kosova Association for Modeling and Simulation: Member of EUROSIM (European Federation of Simulation Associations)**
- KAAAF – Kosova Association for Accounting, Auditing and Finance
- IES – Intellectual Excellence Service
- UBT Academic and Development Regional Centers
- IPC – International Professional Certification and Evaluation
- Students and Staff Spinn Off ….

Summer Academies and Annual Days

SUMMER ACADEMIES and ANNUAL DAYS:

- Academy of Entrepreneurship and Innovation
- Academy of Information and Communication Technology
- Academy of Robotics and Advanced Technology
- Academy of Sustainable and Integrated Design
- Academy of Energy Efficiency
- Modelling and Simulation Academy
- Life Sciences Academy
- Academy of European Studies and International Relations
- Academy of FDI and Regional Development
- Consumer Protection Day,
- Innovation Day,
- Entrepreneurships Day
- Project Day,
- Quality Day,
- ICT Day, etc

15 Years: Founding, Growth and Quality



Succeed with Quality

EFQM
Recognised for excellence
4 star

Recognised for Excellence 4 Star

is awarded to

UBT - University Education for Business and Technology

September 2014

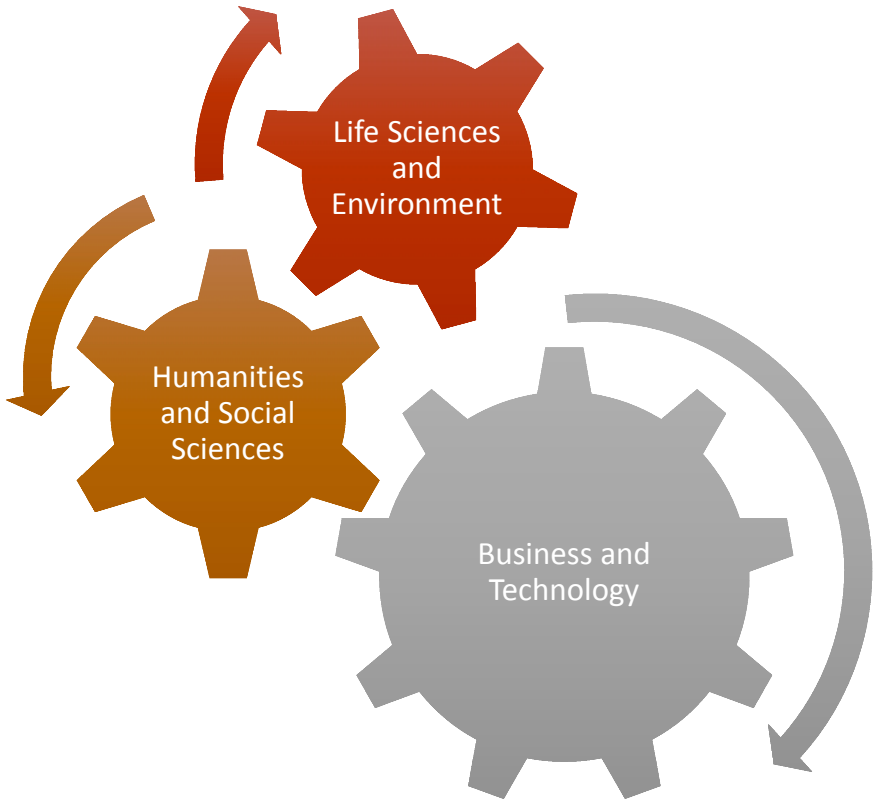
issued by EFQM

Marc Amblard, CEO

UBT - Science and Innovation Campus.

Member of IASP International Association of Science Parks and Areas of Innovation

ACADEMIC PROFILE



Academic Programs

- Management, Business and Economics
  - Finance, Banking and Accounting (B, M)
  - Management and Entrepreneurship (B, M)
  - Marketing and Sales (B, M)
  - International Business (B)
  - Public Procurement Management and Law (M)
  - Tourism Management (M)
  - Health Care Management
  - International Engineering Management M/ VUT & OU
  - Professional Master of Business Administration /DUK
- Information Systems (Business and IT)
  - Information Systems (Bachelor)
  - Information Systems (Master) / WIT
  - GIS
- Computer Science and Engineering (B, M) / CUL
  - Software and Systems Engineering
  - Information and Data Bases
  - Computer Networking and Telecommunication
  - Multimedia Computer Graphics and Design
  - Mechatronics (Intelligent) Systems and Robotics
- Mechatronics Management
  - Mechatronics Management (B, M)
- Energy Engineering
  - Energy Engineering
  - Energy Efficiency Engineering (B, PE)
- Architecture, Civil Engineering and Spatial Planning
  - Architecture (B)
  - Architecture, Spatial Planning and Project Management (M) / VUT
  - Architecture and Spatial Planning (M)
- Civil Engineering and Infrastructure (B,M)
  - Building Engineering and Infrastructure
- Law
  - Law (LLB / LLM))
- Political Science and Diplomacy
  - European Integration (B)
  - International Relations and Diplomacy (B)
  - Public Administration (B,)
  - Security Studies (B)
  - International Relations, Diplomacy and Intercultural Competence (M) / DA & ENA
  - European Integration and Law (M)/ CIFE
  - International Relations (B/M … Warsaw)
  - Multiple Join Master Degree in Political Sciences
- Media and Communication
  - Media and Communication (Bachelor, Master)
- Public Policy and Management (Master)
- Nursing
- Food Science and Technology
- Integrated Design

Joint Double Degree Programs

- Warsaw University, BA / MA International Relations
- Vienna University of Technology on Mechatronics Management and Engineering Management
- Parthenope University of Naples, BA on Business and Economics
- Danube University Krems on Professional MBAs
- CIFE, Nice , France in European and International Studies
- Semmelweis University, Budapest, Hungary, Nursing
- University of Salzburg … Erasmus + Capacity Building .. Multiple Joint Master Degree in Political Sciences
- CEEPUS … Joint Program
- etc.

Research and Development

- Research and Development Strategy
- Research
  - Individual, Supervised and Research Groups
  - Commissioned research Projects for World Bank, Kosova Government, Regional Development, EC, etc.
- Journals
  - International Journal of Business and Technology, ISSN: Bib ID (66488)
- Conferences:
  - **International Conferences: IC MBE, IC SCE, IC MM, IC ASP, IFAC T.C. 9.5 – ISTC – SWIIS, etc. , PM** Forum, European Quality Days in Kosova, etc.
  - UBT Summer University (annually) / Sumer Academies …. International Summer University 2014
  - UBT Students Summer and Winter Conference (annually)
- Professional Development / Services:
  - Professional Training, Consulting and Developing Projects
  - Certification (Personal and Systems) according ISO Standards, IPMA, EOQ, CISCO, Microsoft, etc)
  - Supervision, University Incubator / Entrepreneurship and Management in all schools.

R & D in 2015

- Kosova Database for Research and Development Publication
- UBT Stats – the DATA Center for Data Processing and Statistics
- UBT Business Transformation through Digitalization (Virtualization) and Smart Solutions: 30 Applications self (in house) developed to support UBT Digitalization

Internationalization

- International cooperation with more than 240 Institutions world wide (EU, UK, USA, Asia, SEEC)
- Double Degrees, Joint degree and Certifications
- Study visits of students, Staff, Businesses and Government's people.
- EU Higher Education Projects:
  - 5 Tempus Projects, since 2004 incl. Energy Efficiency
  - 4 Erasmus Mundus Projects incl. SIGMA
  - Erasmus +, KA1 Mobility Grants, Capacity Building – EURPS, CEEPUSs
  - Capacity Building Support for successfully application and Networking in FP7 / National Contact Point for Horizon 2020 for ICT and FET
- Different Projects with International and National Organizations and Donors: European Commission, World Bank, EBRD, UNHABITAT, UNICEF, USAID, GIZ, ADA, Check Republic, Switzerland, Norway , etc.

International Recognitions

- **Professional and Scientific Membership of Kosova:**

IFAC, IEEE, IPMA, EOQ, **EUROSIM**, FIRA EU Chapter, AESOP, PLAN, EFQM, QA, IASP, EURAM, SAP University Charter …

Professional and Scientific Country Recognitions

International Mobility

- Erasmus Mundus
- Erasmus Plus
- **CEEPUS**
- Biletareral Cooperation
- Academic Exchange Progress

Stories to remember:

2015 SPACE APPS AWARD WINNERS

2015 SPACE APPS AWARD WINNERS

NatEv Explorer

NatEv Explorer encourages crowdsourcing to discover and "tag" interesting, natural events and potential threats to humans through the real-time earth observatory data provided by NASA.

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PART 2

UBT – SIM

Modelling, Simulation, Control and Optimisation

UBT SIM

Modelling, Simulation, Control and Optimisation

Competence Centre @
University for Business and Technology

Design the Future … Feel the future …

UBT Departments: Trans/Interdisciplinary Approach

- Mechatronics and Robotics
- Information Systems
- Computer Science and Engineering
- Energy Engineering
- Management, Business and Economics
- Architecture and Spatial Planning
- Building and Infrastructure Engineering
- Media and Communication
- Health Science and Technology
- Food Science and Technology
- Political Sciences
- Law

The Process Flow …. Support Process

UBT STATS … UBT DATA CENTER

- Data Collection
- Data Processing
- Statistics

UBT SIM

- Modelling
- Simulation
- Optimisation

UBT Visualisation

Impact … Forecasting … Value Add … Decision Making … Analysis

Modelling and Simulation @UBT

- Education
  - Main focus in STEM … Business and Technology: Modelling, Simulation, Optimisation, ….
- Research
  - Individual approach
  - Group Approach
- Development:
  - Focus on Complexity System Engineering and Management

Partners and Networking

- Vienna University for Technology …. MMT / E-Learning
- University of Tirana … Departamenti of Statistics and Applied Informatics KA – SIM member of EUROSIM
- KA – CASE member of IFAC … TECIS – Technology, Culture and International Stability, Durres 2016
- UBT SAP University Alliance Center … Business Simulation

and now

- CEEPUS Network for Modelling, Simulation and CAD in Engineering and Management …

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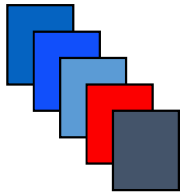
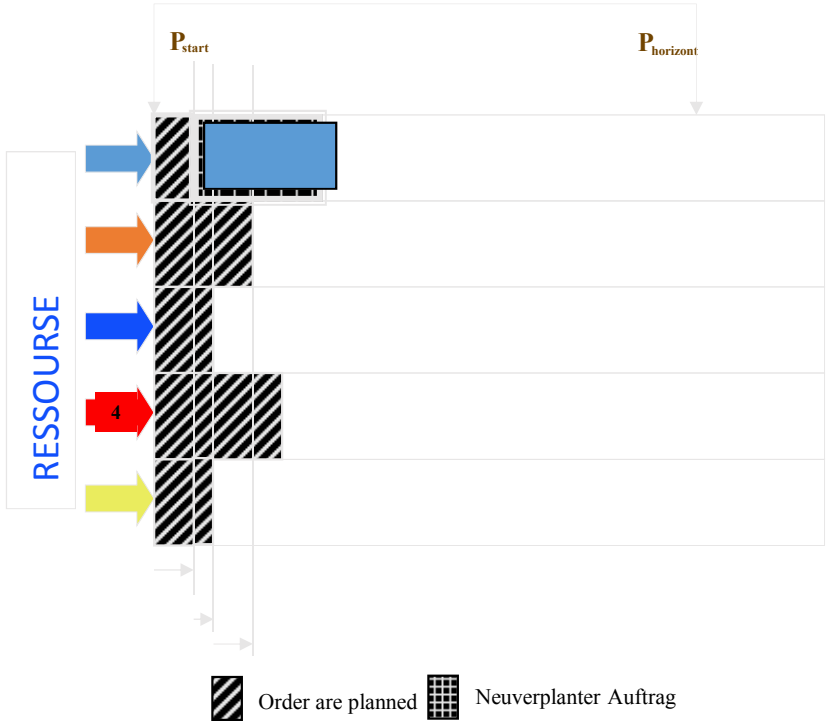
Sofia, October 2016

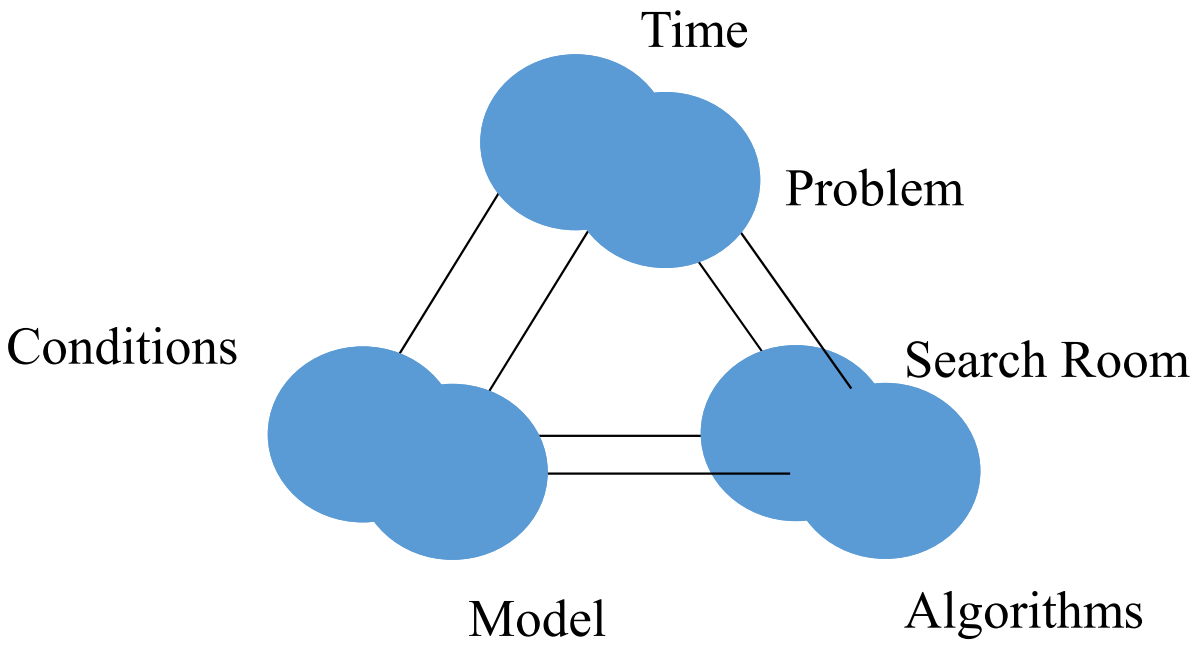
The queues / The Scheduling





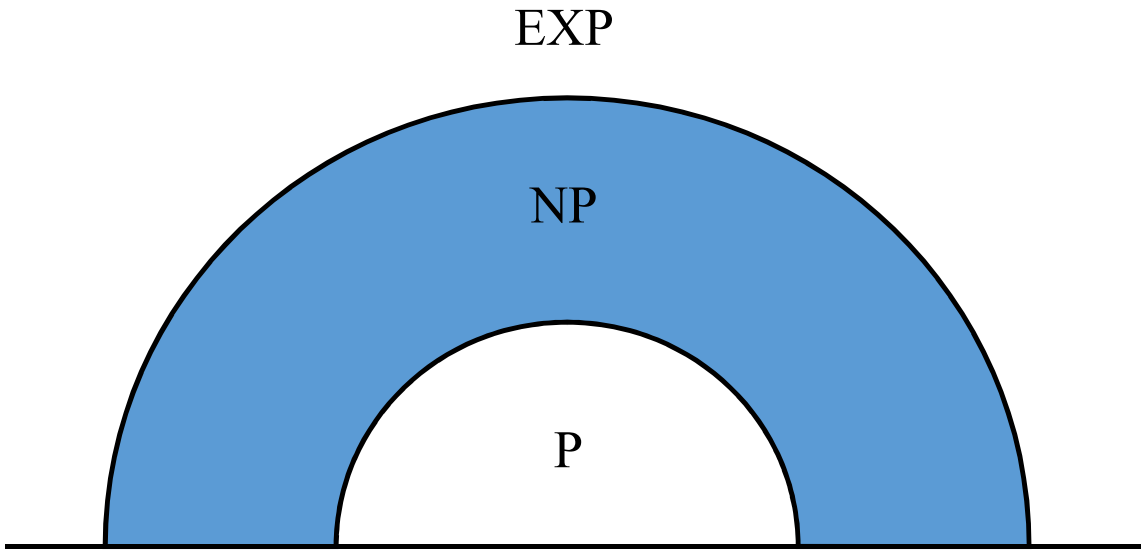
Complexity

- Time
- Variables

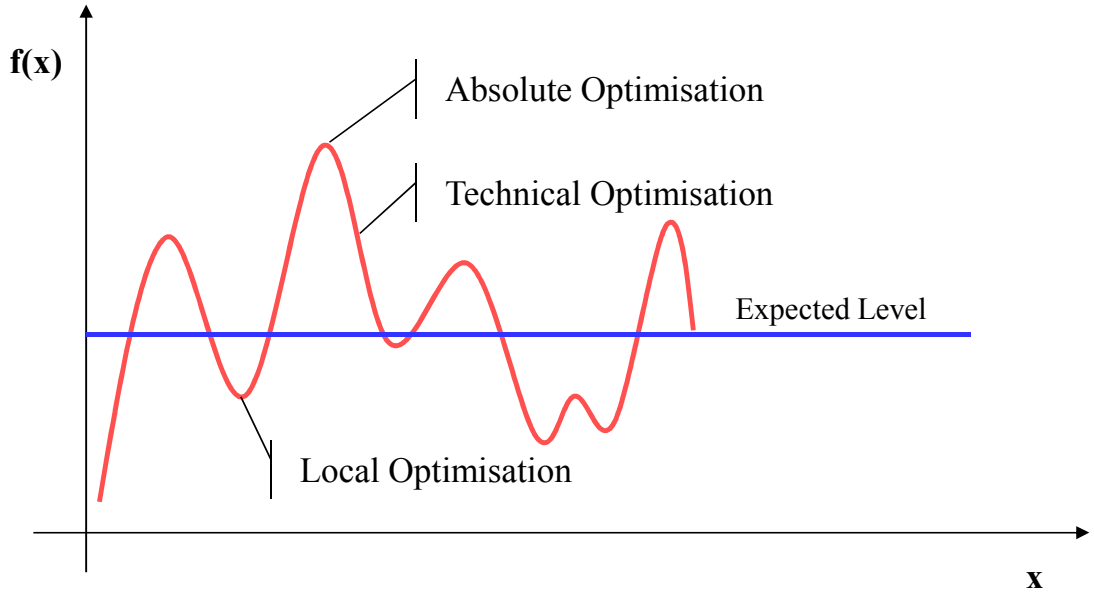


Probleme - Complexity

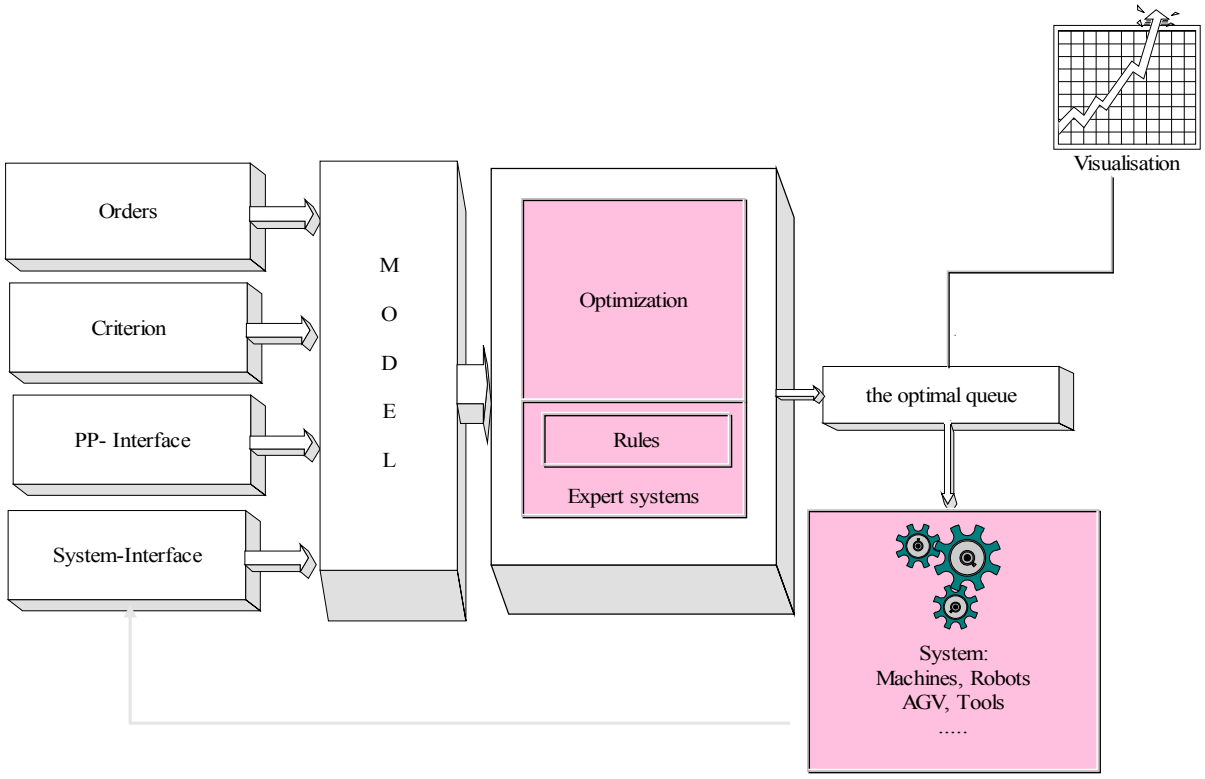
- P, NP, EXP,...



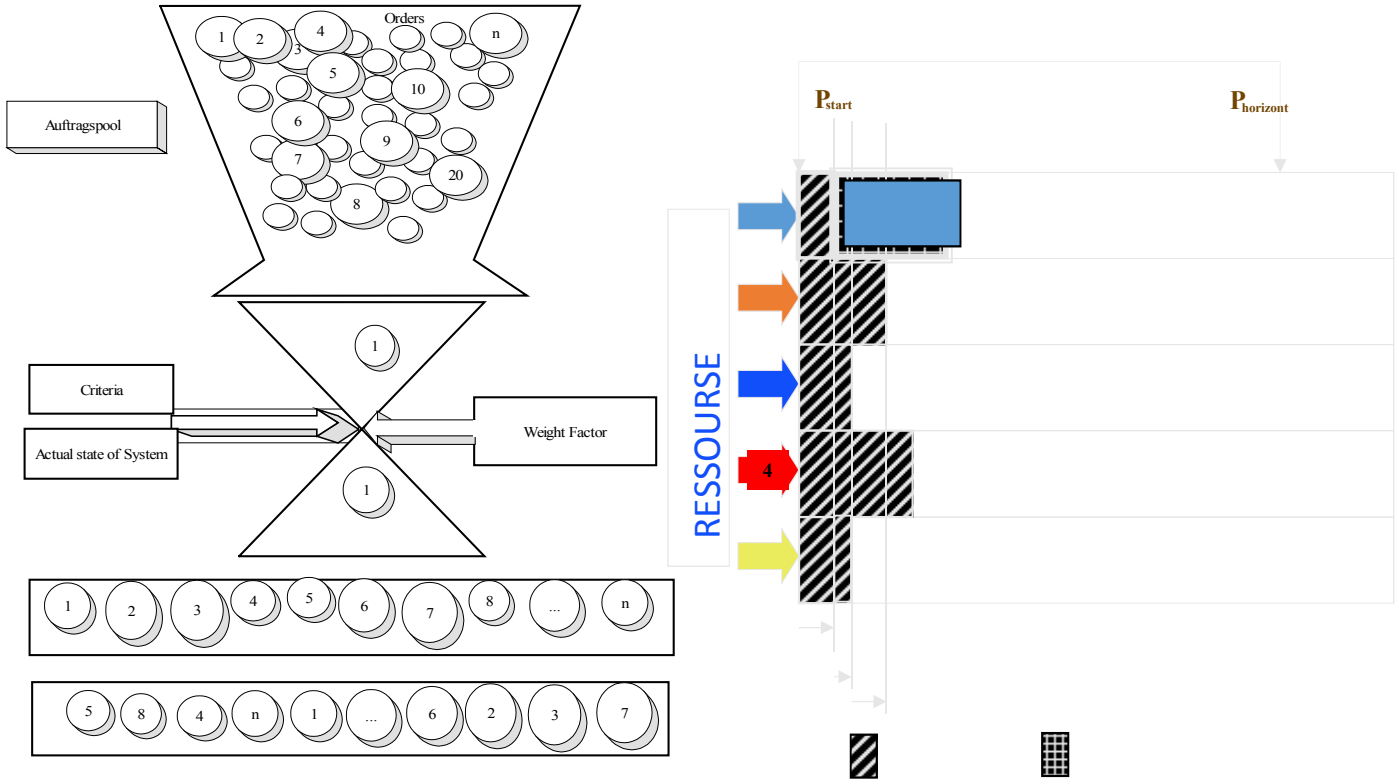
Optimisation



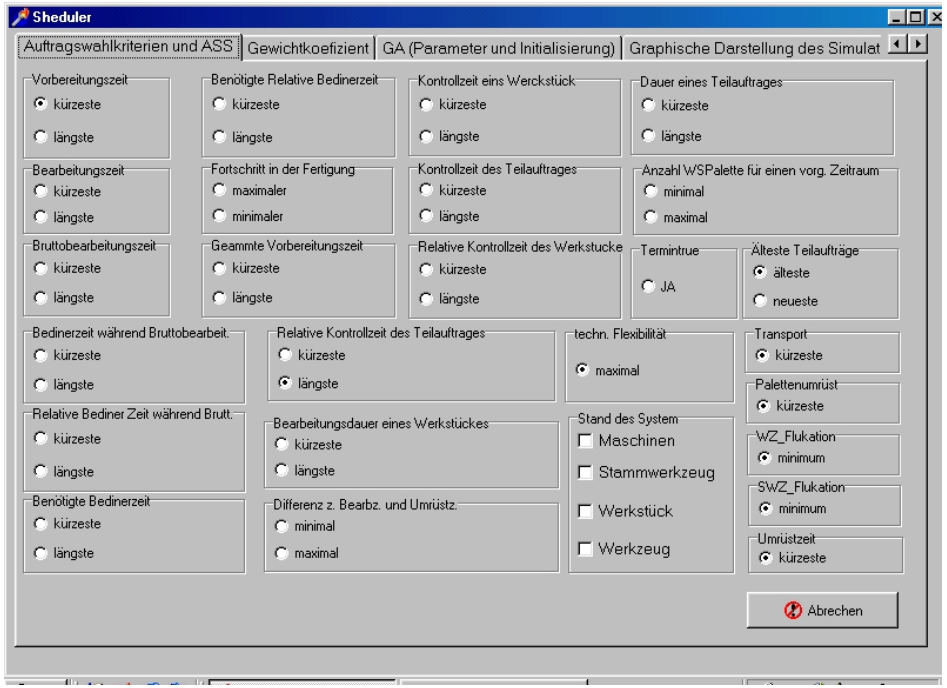
CASE STUDIES: INTSCHED



Working scenario in INTSCHED



Multi Criteria Desicion Making



INTSCHED


Auftragspool
Fertigungsablauf
Maschinenstand
Gantt Diagramm
INTSCHED

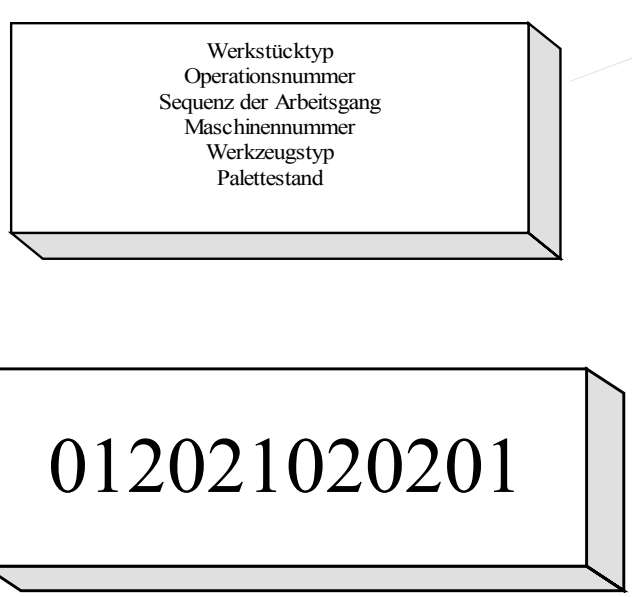
Fitneß Funktionen (Modell)

/* Hier werden zwei Fitneß Funktionen verwenden werden */

- The **first fitness** function is a **weighted total evolution** where a lot of simple criteria (priority, setup time, process time, start date, duo date, actual state of FS, minimizing flow tools, minimizing AGV routs, etc) are included. **There are implemented 47 different criteria**. The criteria can be applied as single citerion or in combination; depending on the state of the FS, whereby an expert operator will design the best strategy for scheduling.

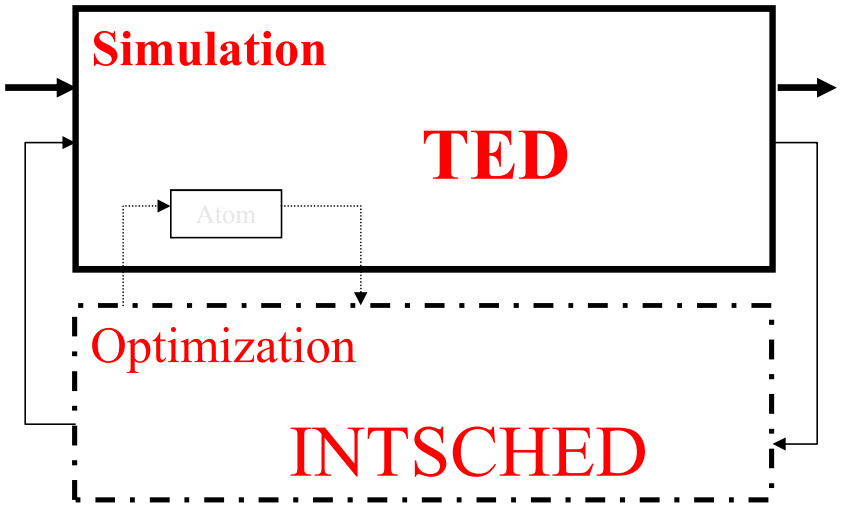
- The **second fitness** function can be used as a **objective function.**
Here there are a lot of objective functions which can be used as fitness functions: **balancing machines, minimizing flow times, minimizing total number of reject, minimizing makespan** (completion time for the last job), **minimizing total processing cost, etc.**

Gen Code

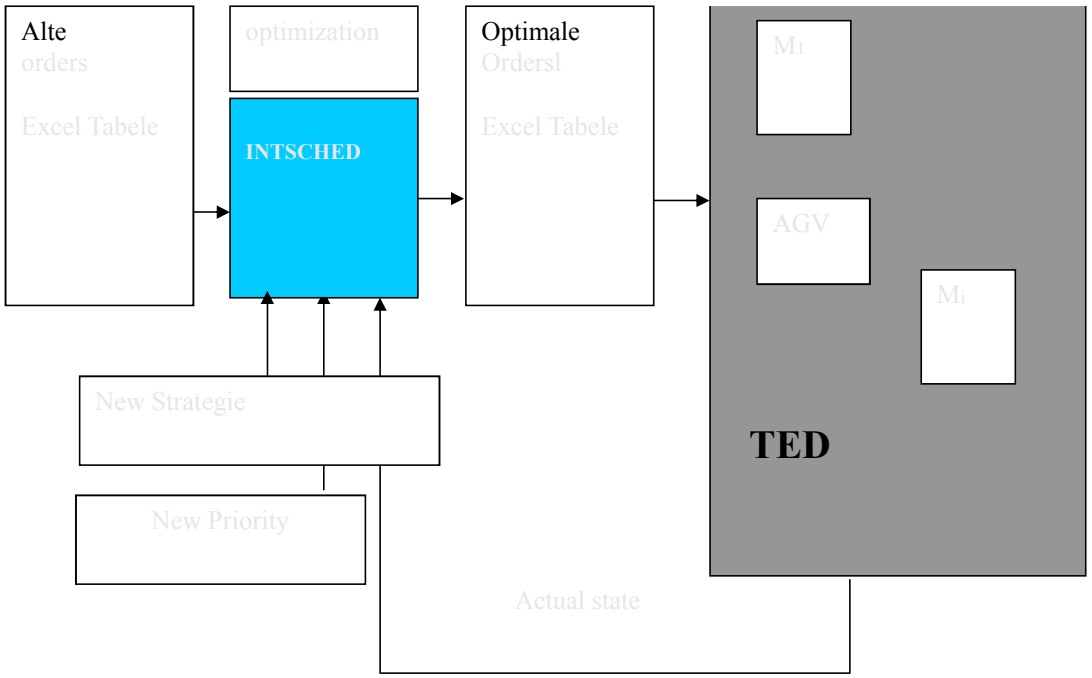

Repräsentation des Gens
Werkstücktyp
Operationsnummer
Sequenz der Arbeitsgang
Maschinennummer
Werkzeugstyp
Palettestand
012021020201

The Integration between Simulation and Optimization

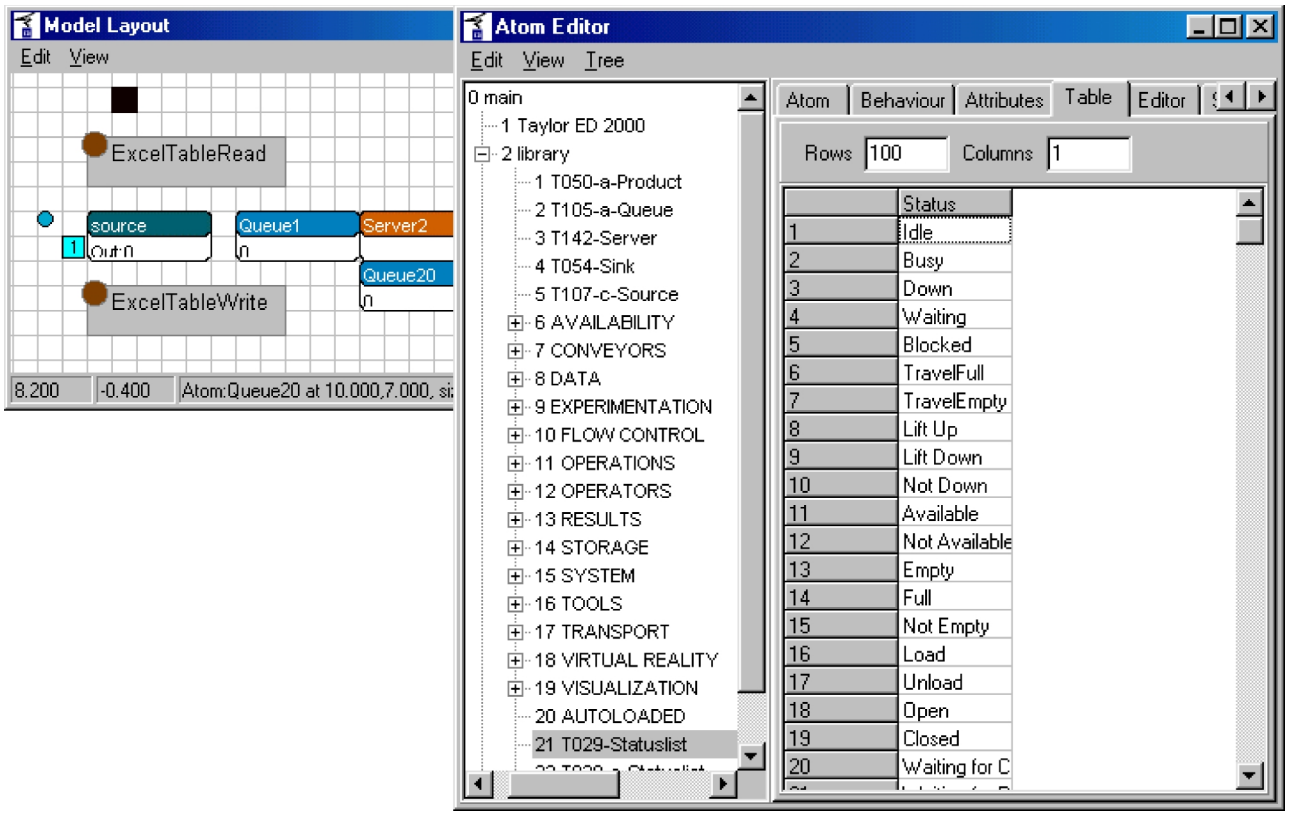
(TAYLOR ED AND INTSCHED)



The Architecture of the Integration between Simulation und Optimierung



TED ... ED


Model Layout
Edit View
ExcelTableRead
source
Out:0
Queue1
0
Server2
Queue20
0
ExcelTableWrite
8.200
-0.400
Atom:Queue20 at 10.000,7.000,
Atom Editor
Edit View Tree
0 main
1 Taylor ED 2000
2 library
1 T050-a-Product
2 T105-a-Queue
3 T142-Server
4 T054-Sink
5 T107-c-Source
6 AVAILABILITY
7 CONVEYORS
8 DATA
9 EXPERIMENTATION
10 FLOW CONTROL
11 OPERATIONS
12 OPERATORS
13 RESULTS
14 STORAGE
15 SYSTEM
16 TOOLS
17 TRANSPORT
18 VIRTUAL REALITY
19 VISUALIZATION
20 AUTOLOADED
21 T029-Statuslist
Atom
Behaviour
Attributes
Table
Editor
Rows 100
Columns 1
Status
1 Idle
2 Busy
3 Down
4 Waiting
5 Blocked
6 TravelFull
7 TravelEmpty
8 Lift Up
9 Lift Down
10 Not Down
11 Available
12 Not Available
13 Empty
14 Full
15 Not Empty
16 Load
17 Unload
18 Open
19 Closed
20 Waiting for C

Conclusion

The implementation of INTSCHED has the following advantages:

- it can generate good results for scheduling … different optimizations techniques are implemented
- it is very flexible to connected with ERP or other IMS like SAP and productions planning with scheduling can be integrated
- over special interfaces it can in real time directly get the real state of each FS subsystem so it can be used as real-time optimizer of complex FS dynamic scheduling.
- INTSCHED is verified on the three flexible systems: flexible manufacturing system, flexible assembly systems and flexible transport system

Further Research and Development Work

- Using INTESCHED Model for different Industry 4.0 Applications
- Integrated Approach between Data Processing, Modelling, Simulation, Optimization, Visualization and Analytics
- Trans disciplinary Approach of Modeling and Simulation within the CEEPUS Partners
- Create Joint Research Supervision for the new PhD Candidate

THANK YOU
VERY MUCH FOR YOUR ATTENTION!