Digital Factory

»Grid Engineering for Manufacturing«

Department: Digital Factory
Team leader: Dr.-Ing. Carmen Constantinescu MBA
Joint Research:
Fraunhofer Institute for Manufacturing Engineering and Automation (IPA)
Institute for Industrial Manufacturing and Management (IFF), Stuttgart University
Graduate School of Excellence for advanced Manufacturing Engineering (GSaME), Stuttgart University
Digital Factory

Overview

• The Research Group: Digital Factory
• Field of Research
• Today's approach: Grid Engineering for Manufacturing
• Concept Implementation: »GEMLab 2.0«
• Further Activities
Leading position in the field of “Digital Production” through excellent research and the appliance of digital methods and tools through the whole factory lifecycle.
The Research Group: Digital Factory (II)

Hüsamettin Karatas  
Researcher, IFF

Jens Jäger  
Researcher, IFF

Thomas Adolf  
Researcher, IPA

Axel Bruns  
Researcher, IFF

Günther Riexinger  
Researcher, IPA

Johannes Volkamann  
Researcher, IFF

Michael Neumann  
PhD student, GSaME

Dr. Carmen Constantinescu  
Team Leader, IPA

Dominik Lucke  
Researcher, IFF

Omar Abdul Rahman  
Researcher, IFF

Martin Landherr  
PhD student, GSaME

Andreas Kluth  
Researcher, IFF
Networked, digital and knowledge-based manufacturing

Factory Lifecycle Management

Factory Data Management

Digital Engineering Tools
Today's approach: Grid Engineering for Manufacturing

Continuously integrated product design, factory and process planning as well as factory operation and maintenance:

- Modelling, simulation, optimization and visualization of products, factories and processes
- Networking and distribution of data, models, tools and computer resources with the support of grid technologies

Benefits:
- Reduction of time
- Lowering of costs
- Increase of throughput and quality

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Grid Engineering for Manufacturing Laboratory – »GEMLab 2.0«

1. Product development
   - PLM: Product Lifecycle Management
   - Product-DBMS

2. Investment and performance planning
   - Specialized application, FEM
   - Product functionality simulation

3. Site and network planning
   - Product function simulation
   - Factory performance simulation

4. Buildings, infrastructure and media planning
   - System simulation

5. Internal logistics and layout planning
   - Process simulation

6. Process, equipment and workplace planning

7. Ramp-up and project management
   - Factory operation and manufacturing execution

8. Planning workflows
   - Factory operation and manufacturing execution

Simulation techniques

- Product: Specialized application, FEM
- System: Product functionality simulation
- Process: Factory performance simulation

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PLM: Product Lifecycle Management
FLM: Factory Lifecycle Management
DBMS: Data Base Management System
## Digital Factory

### Concept Implementation: »GEMLab 2.0« (II)

#### Hardware

<table>
<thead>
<tr>
<th>1. GEMLab, FhG IPA</th>
</tr>
</thead>
<tbody>
<tr>
<td>Stereoscopic 3D-Projektion-Wall&lt;sup&gt;8&lt;/sup&gt;</td>
</tr>
<tr>
<td>• 10 dedicated PC Workstations</td>
</tr>
<tr>
<td>• 12 High-End-PCs for 3D-Cube System</td>
</tr>
<tr>
<td>• 14 further PCs as additional Workstations</td>
</tr>
</tbody>
</table>

Cooperative Planning Table

VR-Systems:
- SpaceMouse
- Nintendo Wii Control and Balance Board

#### Software

<table>
<thead>
<tr>
<th>Planning Phase</th>
<th>Tools</th>
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<tbody>
<tr>
<td>Product development</td>
<td>NX&lt;sup&gt;3&lt;/sup&gt;, Pro/Engineer&lt;sup&gt;4&lt;/sup&gt;, AutoCAD&lt;sup&gt;10&lt;/sup&gt;, Inventor&lt;sup&gt;10&lt;/sup&gt;</td>
</tr>
<tr>
<td>Product life cycle management</td>
<td>Windchill&lt;sup&gt;4&lt;/sup&gt;</td>
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<tr>
<td>Investment and performance planning</td>
<td>FLIP&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>Site and network planning</td>
<td>vProNet&lt;sup&gt;1&lt;/sup&gt;</td>
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<tr>
<td>Process, equipment and workplace planning</td>
<td>Process Designer / Process Simulate&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Process simulation</td>
<td>Plant Simulation&lt;sup&gt;3&lt;/sup&gt;</td>
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<tr>
<td>Layout planning</td>
<td>Cooperative Planning Table&lt;sup&gt;1&lt;/sup&gt;, Process Designer&lt;sup&gt;3&lt;/sup&gt;, FactoryCAD&lt;sup&gt;3&lt;/sup&gt;, SBFP&lt;sup&gt;9&lt;/sup&gt;</td>
</tr>
<tr>
<td>Internal logistics</td>
<td>FactoryCAD&lt;sup&gt;3&lt;/sup&gt;, FactoryFlow&lt;sup&gt;3&lt;/sup&gt;, Plant Simulation&lt;sup&gt;3&lt;/sup&gt;, Order Management System&lt;sup&gt;1,2&lt;/sup&gt;</td>
</tr>
<tr>
<td>3D visualization</td>
<td>GEM Factory Immersion&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Factory operation</td>
<td>Failure Management System&lt;sup&gt;1,5&lt;/sup&gt;, Order Management System&lt;sup&gt;1,2&lt;/sup&gt;, Factory Cockpit&lt;sup&gt;1,2&lt;/sup&gt;, DataEngine&lt;sup&gt;1,2&lt;/sup&gt;, ProVis.Agent&lt;sup&gt;7&lt;/sup&gt;, ProVis.APS&lt;sup&gt;7&lt;/sup&gt;, ProVis.Visu&lt;sup&gt;7&lt;/sup&gt;, Total Energy Efficiency Management&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>Factory life cycle management</td>
<td>Teamcenter Manufacturing&lt;sup&gt;3&lt;/sup&gt;</td>
</tr>
<tr>
<td>Planning workflow</td>
<td>GEMFlow (workflow system)&lt;sup&gt;1&lt;/sup&gt;</td>
</tr>
<tr>
<td>System integration</td>
<td>Globus Toolkit&lt;sup&gt;6&lt;/sup&gt;</td>
</tr>
</tbody>
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1) Fraunhofer IPA
2) IFF Universität Stuttgart
3) Siemens Industry Software
4) Parametric Technology Corporation (PTC)
5) Sikom Solvtec
6) GlobusAlliance
7) Fraunhofer IOSB
8) Eyevis
9) University of Malta
10) Autodesk
1. Fraunhofer Academy
   Certified Continuing Education Courses:
   • “Digital Engineering of Factories and Processes”
   • “Virtual Reality for Factory and Process Planning”

2. Memberships
   • Association of German Engineers (VDI)
     • VDI Guideline Committee
       “Data Management and System Architecture”
     • VDI Technical Committee
       FA204 “Modelling and Simulation”
   • PLM User Group e.V.

3. University / Academic Activities
   • Lecture: “Knowledge and Information Management in the Production II”
   • Other training courses: “Knowledge and Information Management in the Production”

4. Miscellaneous
   International PhD student exchange
Digital Factory

GEMLab 2.0

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Universität Stuttgart IF
Institut für Industrielle Fertigung und Fabrikbetrieb