



**COST 526**  
**“Automatic Process Optimization in Materials Technology”**  
**(APOMAT)**

**Half-Yearly Report**

To be sent to **V.Tesch@access.rwth-aachen.de** until **August 31, 2002**

|                             |  |
|-----------------------------|--|
| <b>1. Reporting Period</b>  | <b>1.1.2002 – 30.6.2002</b>  |
| Project title               | Distributed simulation-based Optimization in Sheet Metal Forming   |
| Project leader              | Prof. Dr.-Ing. Manfred Grauer  |
| Organization                | University of Siegen<br>Dept. of Information Systems   |
| Main collaborators involved | Fischer & Kauffmann GmbH & Co KG,<br>Finnentrop, Germany<br>INPRO GmbH, Berlin, Germany<br>Linde+Wiemann Profiltechnik GmbH, Dillenburg, Germany |

**2. Funding Situation**

|  |        |
|--|--------|
| Amount of money received specifically for COST | kEuros |
| Other resources partially used for the project | kEuros |

**3. International Collaboration**

(mention group and type of work done in collaboration during the reporting period)

Participation in the Working Group Meeting in Saint-Dié des Vosges + project progress report  
 YES

Working group 1:

- Contact with Dr. C. Knopf-Lenoire about exchange of doctoral students between the Universite de Technologie de Compiegne and the University of Siegen

Working group 4:

- Contact with Dr. J. Wendt (VTT Manufacturing Technology, Finland) and discussion about cooperation in the field of distributed simulation-based Optimization as soon as a funding is available.

Prof. H. Nakayama, Konan University, Kobe/Japan, Dept. of Information Systems and Systems Engineering, Workshop about optimization approaches for virtual product design (21.3.- 23.3.2002, Kyoto and Kobe)

**4. Industry participation**

(mention name of companies and work done in collaboration during the whole project)

With Fischer & Kauffmann:

- analysis of multi-stage optimization problems from industrial practice in sheet metal forming with focus on stability
- further validation of INPRO's simulation system INDEED's accuracy

With Linde + Wiemann:

- analysis of multi-stage optimization problems from industrial practice in sheet metal forming with focus on optimal surface quality with minimal wrinkling as a part of the objective function or the constraints
- further analysis of INDEED's output data for the automatic detection of wrinkling as a constraint of the optimization problem as a part of the objective function or the constraints

With INPRO:

- preparation for installation and application of the FETI (Finite Element Tearing and Interconnection)-version of INPRO's simulation system INDEED in a network of workstation or a cluster environment respectively

| <b>5. Meetings, visits, exchange of scientists, short-term scientific missions</b>   | <b>Location, date</b>  |
|--|--|
| Talk at the IFIP Working Group 7.6 Workshop on Virtual Environments for Advanced Modeling, title "Virtual Product and Process Optimisation – the ViPrO Project"  | Japan Advanced Institute of Science and Technology (JAIST), March 25-27, 2002, Ishikawa, Japan     |
| Talk at the 16th JISR-IIASA Workshop on Methodologies and Tools for Complex System Modeling and Integrated Policy Assessment, title "Performance Analysis of Distributed Solution Approaches in Simulation-based Optimization" | International Institute for Applied Systems Analysis (IIASA), July 15-17, 2002, Laxenburg, Austria |
| Workshop with regional industrial partners: Product-Data-Management-Systems for small and medium enterprises.  | University of Siegen, 19.3.2002  |



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**6. Progress within the reporting period**

(Not exceeding 3 pages, including tables and figures)

- research on optimization algorithms for multi-stage sheet metal forming processes with a variable number of stages
- research on industrial optimization problems to be solved and feasibility studies using INPRO's INDEED
- studies and comparison of simulation results to actually manufactured parts to evaluate INDEED's accuracy for 2D and 3D models
- preparation and submission of a proposal for a 128-node/256 CPU cluster to the DFG, Deutsche Forschungsgemeinschaft
- studies on the use of the CATIA V5 Component Application Architecture (CAA) for the automatic generation of 2D and 3D FE-models as input for INDEED in the automatic optimization
- evaluation of INDEED's simulation output data for the retrieval of values of the constraints and the objective function

**7. List of publications**

a) Published

T. Barth, M. Grauer, Grid Computing-approaches for distributed virtual prototyping, (in german) D. Schoder, K. Fischbach, R. Teichmann (eds.), Peer-to-Peer (P2P), Springer, 2002, pp.153-172.

O. Arndt, T. Barth, B. Freisleben, M. Gerdes, M. Grauer, A Neural Network Approach to the Solution of Optimization Problems in Computational Engineering, in: Arabnia, H.R., Mun, Y. (eds.), Proc. of the 2002 International Conference on Artificial Intelligence (IC-AI'02), pp. 154-160, 2002

b) Submitted for publications

M. Gerdes, T. Barth, M. Grauer, About Performance-Models for the Distributed Solution of Simulation-Based Optimizations in Engineering, accepted for publication in the Proc. of the International Conference on Computational and Mathematical Models in Science and Engineering (CMMSE'02), 20-25 September 2002, Alicante/ Spain.

O. Arndt, T. Barth, B. Freisleben, M. Gerdes, M. Grauer, A Combined Global and Local Search Approach Using Prediction in Simulation-Based Optimization, accepted for publication in the Proc. of the 2002 IEEE International Conference on Systems, Man and Cybernetics (SMC'02), 6-9 October 2002, Hammamet/Tunisia.

c) In preparation

G. Stuff, T. Barth, M. Grauer, “Automatic simulation-based optimization of sheet-metal-forming processes”, in preparation for the Journal of Material Processing Technology, Elsevier

