

COST 526 - 'Automatic Process Optimization in Materials Technology' – (APOMAT)  
**Final Report – 31 July 2005**  
**Summary sheet**

Project Code	<b>SI 2</b>
Title	<i>Optimization of Fatigue Resistance of Cold Forging Tools by Considering Damage Mechanisms at Micro Scale</i>
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**Funding Situation** (for the whole project)

Amount of money received specifically for COST	12 kEuros
Other resources partially used for the project	0 kEuros

**International Collaboration** (mention group and type of work done in collaboration during the whole project)

Rockfield Software, Swansea, discussion and improvement of the direct interface between the optimization shell and the simulation programme "Elfen" (final definition of the core part, clean-up).

ENS-LMT Cachan, preparation of the software background for the multi-scale example (implementation in FEAP, parallelization of micro-level simulations, setting up computational environment).

Université de Technologie de Compiègne – shape parameterization & function approximation

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

Iskra-Avtoelektrika, Slovenia. Analysis of service life of tooling systems, test cases, definition of meaningful quality functions.

**Meetings, visits, exchange of scientists, short**

<b>term scientific missions</b> (mention main events during the whole project)	Location, date
Rockfield Software, direct interface between the optimization shell and the simulation programme "Elfen"	Ljubljana, 1902
Université de Technologie de Compiègne, shape parameterization	Compiègne, July 2003
ENS-LMT Cachan, multi-scale example (optimisation of inclusion shape of inhomogeneous material)	Cachan, April 2004
Project meetings	

## Main Outcome of the project (mention only the major points)

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A methodology for inter-disciplinary approach to automatic optimization problems as a part of process design has been developed, including serviceable approaches to shape parameterization, solution environment integration and optimization of noisy response.

## Publications, related to this project

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### Published

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- [1] Optimisation Shell Inverse, electronic document at <http://www.c3m.si/inverse/> , maintained by the Centre for Computational Continuum Mechanics, Ljubljana.
- [2] Rodic T and Gresovnik. I. A computer system for solving inverse and optimisation problems. Eng. Comput., 1998, vol. 15, no. 7: 893-907.
- [3] Gresovnik I. A General Purpose Computational Shell for Solving Inverse and Optimisation Problems - Applications to Metal Forming Processes. Ph.D. thesis, University of Wales Swansea, 2000. Available on the Internet at <http://www.c3m.si/inverse/doc/phd/index.html>
- [4] Gresovnik I. Quick Introduction to Optimization Shell Inverse. Electronic document at <http://www.c3m.si/inverse/doc/other/> .
- [5] I. Gresovnik, T. Rodic, D. Jelovsek. Simple two stage transforms designed for optimisation of shape in forming processes. In Proceedings of The 4th ESAFORM Conference on Material Forming, Liege, Belgium, April 23-25, 2001.
- [6] I. Gresovnik, T. Rodic, Practical considerations regarding optimisation of shape in forming processes, In Proceedings of The 5th International ESAFORM Conference on Material Forming, Akademia Góeniczo-Hutnicza Kraków, 2002.
- [7] I. Gresovnik. Spline Interpolation with Sensitivities. Internal report, C3M, 2003.
- [8] I. Gresovnik, D. Markovic, T. Rodic, A. Ibrahimbegovic. Optimization of Inclusion Shape in Inhomogeneous Structural Elements. Proceedings of NATO-ARW advanced workshop on Multi-physics and Multi-scale Computer Models in Non-linear Analysis and Optimal Design of Engineering Structures Under Extreme Conditions, Bled, Slovenia, June 13 - 17, 2004.
- [9] I. Gresovnik, S. Hartman and T. Rodic. Development of Optimization Methodology for Reduction of Defect Risk at Blow Forming. Proceedings of the 6th World Congress on Structural and Multidisciplinary Optimization, Rio, 2005.
- [10] I. Grešovnik, " ioptlib home", electronic document at <http://www.c3m.si/igor/ioptlib/>

### Submitted for publication

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- [11] T. Rodic, D. Cukjati and I. Gresovnik. Optimal design of preform geometry and tribological conditions in can forming. Accepted for publication in Engineering Computations.
- [12] A. Ibrahimbegovic, I. Gresovnik, D. Markovic, S. Melnyk and T. Rodic Shape optimization of two-phase material with microstructure. Accepted for publication in Engineering Computations.

### In preparation

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Will you continue the actual cooperation with your partners after the end of the action?

X  
Yes

No

Would you participate in a possible "spin-off" action continuing the present one?

X  
Yes

No

Will you continue your present work/collaboration with another European action?

Yes

X  
No