

Table of Contents

Preface, Organisation and Acknowledgements

Keynotes

Gear Hobbing – Research Activities and State of the Art B. Karpuschewski, M. Beutner, M. Köchig and M. Wengler	3
--	---

Chapter 1: Assembly

Analysis and Visualisation of the Positioning Accuracy and Underlying Effects of Industrial Robots M. Ulrich, G. Lux and T. Piprek	15
Worker Information Systems Including Dynamic Visualisation: A Perspective for Minimising the Conflict of Objectives between a Resource-Efficient Use of Inspection Equipment and the Cognitive Load of the Worker M. Lušić, K. Schmutzer Braz, S. Wittmann, C. Fischer, R. Hornfeck and J. Franke	23
An Ultrasonic Non-Contact Handling Device from Quartz Glass for Middle and High Temperature Applications E. Locmelis	31
Spatial Programming for Industrial Robots: Efficient, Effective and User-Optimised through Natural Communication and Augmented Reality J. Lambrecht and J. Krüger	39
Structural Mechanics Process Simulation of Linear Coil Winding J. Bönig, B. Bickel, M. Ebenhöch, M. Spahr, C. Fischer and J. Franke	47

Chapter 2: Cutting and Grinding

A Simulation Model for Analysis of Roll Tensioning of Circular Saw Blade U. Heisel, T. Stehle and H. Ghassemi	57
Advanced Machining Processes for CFRP I. Rieck and E. Uhlmann	67
Analogy Studies of the Effect of Finishing on the Tribological Running-In Behaviour of Engine Components Using the Example of the Cylinder Running Surface B. Karpuschewski, F. Welzel and K. Risse	75
Analysing Internal Material Loads in Manufacturing Processes S. Kuschel, J. Sölter and E. Brinksmeier	83
Analysis and Simulation of Surface Topographies in Grinding of Thermally Sprayed Coatings S. Rausch, T. Siebrecht, P. Kersting and D. Biermann	91
Analytical Model Approach for Tool Temperature Prediction in Broaching Nickel-Based Alloys S. Gierlings and M. Brockmann	99
Binderless-cBN as Cutting Material for Ultra-Precision Machining of Stainless Steel J. Polte, M. Polte, D. Lorenz, D. Oberschmidt, H. Sturm and E. Uhlmann	107
Dry and Residue-Free Cutting with High-Pressure CO₂-Blasting M. Bilz and E. Uhlmann	115
Dry Ice Blasting as a Pre-Treatment Process for Electroplating E.M. Baira, M. Kretschmar, R. Hollan, F. Heitmüller and E. Uhlmann	123
Enzymatic Degradation of Epoxy Resins: An Approach for the Recycling of Carbon Fiber Reinforced Polymers K. Moeser	131
Force Requirements in Shear Cutting of Metal-Polymer-Metal Composites D. Übelacker, J. Hohmann and P. Groche	137

Interaction of Load and Residual Stresses in Sintered 1.3344 High Speed Steel B. Denkena, T. Grove and H. Lucas	145
Investigations on Cryogenic Turning to Achieve Surface Hardening of Metastable Austenitic Steel AISI 347 P. Mayer, B. Kirsch and J.C. Aurich	153
Material Behaviour of Armco-Iron and AISI 4140 at High Speed Deformation during Machining F. Zanger and M. Gerstenmeyer	161
Micromachining of Silicon - Study on the Material Removal Mechanism M. Carrella and J.C. Aurich	167
Robot-Assisted Vibration Polishing of NiCo Retroreflector Moulds F. Elsner-Dörge, O. Riemer and E. Brinksmeier	175
Modelling of Tool Engagement and FEM-Simulation of Chip Formation for Drilling Processes M. Tiffe and D. Biermann	183
A New Approach for the Prediction of Surface and Subsurface Properties after Grinding S. Jermolajev and E. Brinksmeier	189

Chapter 3: Forming

A New Method to Enhance the Accuracy of the Buckling Test Using Modified Yoshida Sample F. Han and M. Liewald	199
Adjusting of Roller Levellers by Finite Element Simulations Including a Closed-Loop Control M. Grüber, M. Oligschläger and G. Hirt	207
An Improvement of the Time Dependent Method Based on the Coefficient of Correlation for the Determination of the Forming Limit Curve M. Merklein, A. Kuppert and E. Affronti	215
Composite Hot Extrusion of Functional Elements M. Schwane, C. Dahnke, M. Haase, N. Ben Khalifa and A.E. Tekkaya	223
Considering Anisotropic Material Behaviour of Sheet Metals for Ductile Fracture Prediction A. Sabathil, I. Heinle, A. Lipp, J. Meinhardt and M. Merklein	229
Design of an Electromagnetic System to Avoid Horizontal Ram Displacement M. Gröne, V. Salfeld and R. Krimm	237
Development of a Pneumatic Bulge Test for High Temperatures and Controlled Strain Rates A. Braun, J. Storz, M. Bambach and G. Hirt	245
Effect of Surface Enlargement and of Viscosity of Lubricants on Friction Behaviour of Advanced High Strength Steel Material during Deep Drawing M. Singer and M. Liewald	253
Experimental and Numerical Analysis of Dry Shearing of Aluminum 6082 F. Steinbach, L. Chen, A. Güner and A.E. Tekkaya	261
Influence of Manufacturing Process on the Fatigue Strength of Gears A. Reiß and U. Engel	269
Decrease of Springback by Geometrical Modification of the Sheet Metal Part A. Weinschenk and W. Volk	277
Process Chains for Fibre Metal Laminates R. Neugebauer, V. Kräusel and A. Graf	285
Reproducibility of Wear Tests and the Effect of Load on Tool Life in Sheet Metal Forming M. Christiany and P. Groche	293
Bending of Tailored Blanks Using Elastic Tools A. Weinrich, C. Becker, F. Maevus, S. Chatti and A.E. Tekkaya	301
Smart FE-Based Tool Design in Cold Forging K. Andreas, C. Kiener, U. Engel and M. Merklein	309

Wear Analysis of Tool Surfaces Structured by Machine Hammer Peening for Foil-Free Forming of Stainless Steel	
F. Klocke, D. Trauth, M. Terhorst and P. Mattfeld	317
Numerical Approach to Determine Natural Strain of Spherical Preforms in Open Die Upsetting	
H. Brüning and F. Vollertsen	325
A Novel Tool Design Strategy for Electromagnetic Forming	
R. Neugebauer, V. Psyk and C. Scheffler	333
Wear Prediction for Hot Forging Dies under Consideration of Structure Modification in the Surface Layer	
A. Klassen, A. Bouguecha and B.A. Behrens	341

Chapter 4: Machines

Adaptive Friction Bearing for Reduction of Stick-Slip Effects	
T. Engel, A. Lechler and A. Verl	351
Avoiding Collision Damage of Motor Spindles through an Innovative Overload Protection System	
M. Berger and D. Korff	357
Determination of the Technical Energy Flexibility of Production Systems	
R.S.H. Popp and M.F. Zaeh	365
Evaluating Mobile Machine Tool Dynamics by Substructure Synthesis	
M. Law, H. Rentzsch and S. Ihlenfeldt	373
FE-Simulation for a Safe Design of Machine Tool Safety Guards	
F. Meister and E. Uhlmann	381
Integration of Carbon Fibre Reinforced Structures in Machine Tools Using the Example of a Swivel Arm	
A. Bretz, A. Landmann and R. Rost	387
Methodology for the Efficient Analysis of Thermal and Thermo-Elastic Behaviour of Machine Tools	
K. Großmann, A. Galant, M. Merx and M. Riedel	395
Methods to Design the Adjustment of Parameters for Thermal Machine-Tool Models	
B. Kauschinger and S. Schroeder	403
Modular Control Integrated Correction of Thermoelastic Errors of Machine Tools Based on the Thermoelastic Functional Chain	
X. Thiem, K. Großmann and A. Mühl	411
Parameter Identification of NC-Axes during Regular Operation of a Machine Tool	
A. Hellmich, K. Hipp, H. Schlegel and R. Neugebauer	419
Square Foot Manufacturing - Concept and Design of an Electrorheological Inchworm Feed Drive	
A. Breitfeld, H. Freyer and P. Conflant	427
The Printed Machine Tool for Micro Machining	
C. Batke, K.H. Wurst, A. Lechler and A. Verl	433
3D Printing of Inorganic Sand Moulds for Casting Applications	
R. Ramakrishnan, B. Griebel, W. Volk, D. Günther and J. Günther	441
A Robust Algorithm for Autotuning Controllers in Mechatronic Modules	
C. Friedrich, A. Stanicki, M. Bröcker, A. Lechler and A. Verl	451

Chapter 5: Organisation

An Approach towards Improving the Robustness of Production Systems	
N. Stricker and G. Lanza	461
Approach to Assess and Compare the Performances of Production Structures	
G. Schuh, T. Potente, C. Thomas, T. Nuyken, C. Hausberg and S. Dany	469
Cognitive Self-Optimization for Quality Control Loops – Potentials and Future Challenges in Research	
R.H. Schmitt, E. Permin and M. Fuhrmann	477

Identification and Improvement of Communication in Factories S. Tschöpe and C. Reinema	485
Dimensional <i>In Situ</i> Shape and Surface Inspection of Metallic Micro Components in Micro Bulk Manufacturing D. Weimer, S. Huferath von Luepke, A. Tausendfreund, R.B. Bergmann, G. Goch and B. Scholz-Reiter	493
Energy KPI's, Challenges for Sustainable Manufacturing Strategies, Analysis of Existing Rules and Indicators in an Industrial Environment in Relation to the Establishment of Energy Benchmark S. Kreitlein, T. Rackow and J. Franke	501
Lean Production Systems in the Context of Social Trends: Job Satisfaction the Key Factor to Success T. Stock	509
Learning Factories for Sustainable Manufacturing - A Generic Design Approach R. Helm, C. Reise and D. Röble	517
Mechanical Properties of Large Three-Dimensional Specimens Build through Direct Powder Deposition P. Khazan, M. Stroth, H. Freiße and H. Köhler	525
Model Based Optimization of Forging Process Chains under the Consideration of Penalty Functions M. Dannenberg, A. Georgiadis and B.A. Behrens	533
Model-Based Development Process of Cybertronic Products and Production Systems H. Meissner, M. Cadet, N. Stephan and C. Bohr	539
Reference Model for the Description of Digital Engineering Tools Based on Mechatronic Principles and Concepts B. Drescher and G. Reinhart	547
Scenario-Based Determination of Alternative Product Architecture Designs G. Schuh, M. Schiffer and C. Ortlieb	555
Product-Quality Based Scheduling of Automated Food Processing M. Wagner, T. Schleimer, T. Seeberger and G. Reinhart	563
Scientific Management 2.0 – A Design Model for Experimental Research in Production Management G. Schuh, T. Gartzén and F. Basse	571
Simulation-Based Sequencing Algorithm for MRO Operations of Train Couplings A. Georgiadis	581
Target-Based Evaluation of Disturbances in Production Systems K. Knüppel and I. Nikitin	589
An Analytical Model Describing the Lateness Distribution of Storage Processes M. Grigutsch, J. Nywlt and S. Bertsch	597
An Approach to Analyse the Volume Flexibility of Production Systems J. Busch, M. Görke and D. Krämer	605