

15th CIRP Conference on Modelling of Machining Operations 2015

(15th CMMO)

Procedia CIRP Volume 31

Karlsruhe, Germany
11-12 June 2015

Editor:

Volker Schulze

ISBN: 978-1-5108-0585-9

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© by Elsevier B.V.
All rights reserved.

Printed by Curran Associates, Inc. (2015)

For permission requests, please contact Elsevier B.V.
at the address below.

Elsevier B.V.
Radarweg 29
Amsterdam 1043 NX
The Netherlands

Phone: +31 20 485 3911
Fax: +31 20 485 2457

<http://www.elsevierpublishingsolutions.com/contact.asp>

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

SURFACE INTEGRITY 1

Surface Layer Modification by Cryogenic Burnishing of Al 7050-T7451 Alloy and Validation with FEM-based Burnishing Model.....	1
<i>B. Huang, Y. Kaynak, Y. Sun, I.S. Jawahir</i>	
Influence of the Cutting Tool Compliance on the Workpiece Surface Shape in Face Milling of Workpiece Compounds	7
<i>B. Denkena, E. Hasselberg</i>	
Mold Manufacturing Optimization: A Global Approach of Milling and Polishing Processes	13
<i>L. Grandguillaume, S. Lavernhe, Y. Quinsat, C. Tournier</i>	
Prediction of Residual Stresses after Laser-assisted Machining of Inconel 718 Using SPH.....	19
<i>M.A. Balbaa, Mohamed N.A. Nasr</i>	
Springback in Metal Cutting with High Cutting Speeds	24
<i>N. Schaaf, F. Kuster, K. Wegener</i>	

OPTIMIZATION OF MACHINING PROCESSES

Analysis of Feature Extracting Ability for Cutting State Monitoring Using Deep Belief Networks.....	29
<i>Yang Fu, Yun Zhang, Haiyu Qiao, Degun Li, Huamin Zhou, Jürgen Leopold</i>	
Experimental Validation of a Physics-based Simulation Approach for Pneumatic Components for Production Systems in the Automotive Industry	35
<i>Felix Damrath, Anton Strahilov, Thomas Bär, Michael Vielhaber</i>	
Finite Element Simulation for Quality Dependent Lifetime Analysis of Micro Gears	41
<i>B. Haefner, M. Quiring, J. Gullasch, G. Glaser, T. Dmytryk, G. Lanza</i>	
Ontology-based Determination of Alternative CNC Machines for a Flexible Resource Allocation	47
<i>Gerald Rehage, Jürgen Gausemeier</i>	
Universal Concept for the Optimization of Step Sizes in Manufacturing Processes	53
<i>Melanie Senn, Frank Schweizer, Wulf Pfeiffer</i>	

DYNAMICS AND STABILITY OF MACHINING 1

Variable Compliance-related Aspects of Chatter in Turning Thin-walled Tubular Parts.....	58
<i>Artem Gerasimenko, Mikhail Guskov, Jérôme Duchemin, Philippe Lorong, Alexander Gouskov</i>	
Integrated Simulation System for 5-axis Milling Cycles.....	64
<i>Tunc L. Taner, Sulitka Matej, Kopacka Jan</i>	
High Performance Machining Enabled by Adaptive Machine Components	70
<i>J. Burtscher, S.-F. Koch, J. Bauer, H. Wagner, J. Fleischer</i>	
Hardware-in-the-Loop Machine Simulation for Modular Machine Tools	76
<i>Marco Witt, Philipp Klimant</i>	
The Concept of Active Elimination of Vibrations in Milling Process.....	82
<i>Andrzej Weremczuk, Rafał Rusinek, Jerzy Warminski</i>	

MODELLING OF MATERIAL BEHAVIOUR 1

Novel Approach for 3D Simulation of a Cutting Process with Adaptive Remeshing Technique	88
<i>Frederik Zanger, Nikolay Boev, Volker Schulze</i>	
Machining Process Simulations with Smoothed Particle Hydrodynamics.....	94
<i>Fabian Spreng, Peter Eberhard</i>	
An Elastoplastic Constitutive Damage Model to Simulate the Chip Formation Process and Workpiece Subsurface Defects when Machining CFRP Composites.....	100
<i>S. Zenia, L. Ben Ayed, M. Nouari, A. Delamézière</i>	
Influence of Kinematic Hardening During machining of ARMCO Iron	106
<i>Frederik Zanger, Andreas Fellmeth, Michael Gerstenmeyer, Volker Schulze</i>	
On the Selection of Johnson-cook Constitutive Model Parameters for Ti-6Al-4V Using Three Types of Numerical Models of Orthogonal Cutting	112
<i>Yancheng Zhang, J.C. Outeiro, Tarek Mabrouki</i>	

SURFACE INTEGRITY 2

Effects of Sequential Cuts on Residual Stresses when Orthogonal Cutting Steel AISI 1045.....	118
<i>Mohamed N.A. Nasr</i>	
Finite Element Prediction of the Tool Wear Influence in Ti6Al4V Machining.....	124
<i>François Ducobu, Pedro-José Arrazola, Edouard Rivière-Lorphèvre, Enrico Filippi</i>	
Numerical Simulation of Surface Modification During Machining of Nickel-based Superalloy	130
<i>Serafino Caruso, Stano Imbrogno, Giovanna Rotella, Mikel Imaz Ciaran, Pedro J. Arrazola, Luigino Filice, Domenico Umbrello</i>	
Surface Roughness Modelling in Face Milling.....	136
<i>Csaba Felho, Bernhard Karpuschewski, János Kundrák</i>	

THERMAL EFFECTS IN MACHINING PROCESSES 1

Considering the Influence of Minimum Quantity Lubrication for Modelling Changes in Temperature, Forces and Phase Transformations during Machining	142
<i>Patrick Bollig, Carsten Faltin, Robert Schießl, Johannes Schneider, Ulrich Maas, Volker Schulze</i>	
Simulation of MQL Deep Hole Drilling for Predicting Thermally Induced Workpiece Deformations.....	148
<i>Dirk Biermann, Heribert Blum, Jörg Frohne, Ivan Iovkov, Andreas Rademacher, Korinna Rosin</i>	
Analysis of the Thermal Impact on Gamma Titanium Aluminide by Grinding with Internal Coolant Supply Based on Experimental Investigation and Transient Thermal Simulation	154
<i>A. Fritzsche, F. Bleicher</i>	
Cryogenic Milling of Aluminium-lithium Alloys: Thermo-mechanical Modelling towards Fine-tuning of Part Surface Residual Stress	160
<i>Xiaoming Zhang, Haikuo Mu, Xinda Huang, Zhongtao Fu, Dahu Zhu, Han Ding</i>	

HIGH PERFORMANCE MACHINING 1

Effect of Rake Angle on Strain Field During Orthogonal Cutting of Hardened Steel with c-BN Tools.....	166
<i>Thomas Baizeau, Sébastien Campocasso, Guillaume Fromentin, Frédéric Rossi, Gérard Poulachon</i>	
Influences of Micro Mechanical Property and Microstructure on Performance of Machining High Chromium White Cast Iron with cBN Tools.....	172
<i>Ling Chen, Jinming Zhou, Volodymyr Bushlya, Jan-Eric Stahl</i>	
A Solid Modeler Based Engagement Model for 5-axis Ball End Milling	179
<i>I.E. Yigit, S. Ehsan Layegh K., Ismail Lazoglu</i>	
Analysis and Modelling of the Contact Radius Effect on the Cutting Forces in Cylindrical and Face Turning of Ti6Al4V Titanium Alloy	185
<i>Théo Dorlin, Guillaume Fromentin, Jean-Philippe Costes</i>	

NON-CONVENTIONAL MACHINING

Energy-based Approaches for Multi-scale Modelling of Material Loadings During Electric Discharge Machining (EDM).....	191
<i>Fritz Klocke, Sebastian Schneider, Simon Harst, David Welling, Andreas Klink</i>	
Multiphysics Simulation of the Material Removal in Jet Electrochemical Machining	197
<i>Matthias Hackert-Oschätzchen, Raphael Paul, Michael Kowalick, André Martin, Gunnar Meichsner, Andreas Schubert</i>	
A Contribution on the Modelling of Wire Electrical Discharge Machining of a γ-TiAl Alloy	203
<i>Giovanna Gautier, Paolo C. Priarone, Stefania Rizzuti, Luca Settinieri, Vincenzo Tebaldo</i>	
CFD Simulation of the Abrasive Flow Machining Process	209
<i>E. Uhlmann, C. Schmiedel, J. Wendler</i>	

SURFACE INTEGRITY 3

Evaluating Residual Stresses Induced by Drilling of Ti-6Al-4V Alloy by Using an Experimental-numerical Methodology	215
<i>J.P. Nobre, J.C. Outeiro</i>	
Prediction of the 3D Surface Topography after Ball End Milling and its Influence on Aerodynamics	221
<i>B. Denkena, V. Böß, D. Nespor, P. Gilge, S. Hohenstein, J. Seume</i>	
Experimental Study and Modeling of Machining with Dry Compressed Air, Flood and Minimum Quantity Cutting Fluid Cooling Techniques	228
<i>M. Ravi Sankar, S.K. Choudhury</i>	

THERMAL EFFECTS IN MACHINING PROCESSES 2

Experimental Study and Modeling of Steady State Temperature Distributions in Coated Cemented Carbide Tools in Turning.....	234
<i>Amol Thakare, Anders Nordgren</i>	
An Analytical Model of the Temperature Distribution in the Chip Breakage Location of Metal Cutting Operations.....	240
<i>F. Klocke, D. Lung, D. Veselovac, S. Buchkremer</i>	
The Mechanics of Cutting: In-situ Measurement and Modelling.....	246
<i>Mustapha Abouridouane, Fritz Klocke, Dieter Lung, Dražen Veselovac</i>	

HIGH PERFORMANCE MACHINING 2

Cutting Simulation of Titanium Alloy Drilling with Energy Analysis and FEM	252
<i>Takashi Matsumura, Shoichi Tamura</i>	
Analytical Modelling of Milling Forces for Helical End Milling Based on a Predictive Machining Theory.....	258
<i>Zhongtao Fu, Wenyu Yang, Xuelin Wang, Jürgen Leopold</i>	
Sensitivity Analysis of Cryogenic Cooling on Machining of Magnesium Alloy AZ31B-O.....	264
<i>Mohamed N.A. Nasr, J.C. Outeiro</i>	

MICRO MACHINING PROCESSES

Tool Temperatures and Wear in Micro-machining Cu-Ni Alloys with Diamond Tools: Models, Simulations and Experiments	270
<i>T.H.C. Childs, C.J. Evans, E.C. Browy, J.R. Troutman, E. Paul</i>	
Least-squares Based Parameter Identification for a Function-related Surface Optimisation in Micro Ball-end Milling	276
<i>J. Vehmeyer, I. Piotrowska-Kurczewski, F. Bohmermann, O. Riemer, P. Maafß</i>	
Modelling of Grain Motion for Three-body Abrasion.....	282
<i>I. Loesch, O. Riemer</i>	

WEAR AND BUILT UP EDGES

An Analytical Model of Residual Stress for Flank Milling of Ti-6Al-4V	287
<i>Xinda Huang, Xiaoming Zhang, Han Ding</i>	
Characterization and Modelling of the Rough Turning Process of Large-scale Parts: Tribological Behaviour and Tool Wear Analyses.....	293
<i>B. Haddag, H. Makich, M. Nouari, J. Dhers</i>	
A New Procedure to Increase the Orthogonal Cutting Machining Time Simulated.....	299
<i>M. Guediche, T. Mabrouki, C. Donnet, J.M. Bergheau, H. Hamdi</i>	
A Combined Empirical and Numerical Approach for Tool Wear Prediction in Machining	304
<i>Keyvan Hosseinkhani, E. Ng</i>	
Influence of the Built-up Edge on the Stress State in the Chip Formation Zone During Orthogonal Cutting of AISI1045.....	310
<i>Eckart Uhlmann, Steffen Henze, Katrin Brömmelhoff</i>	
Comparative Analysis of PCD Drill Designs During Drilling of CFRP Laminates.....	316
<i>Y. Karpat, O. Bahtiyar</i>	

THERMAL EFFECTS IN MACHINING PROCESSES 3

Determination of the Thermal Load Distribution in Internal Traverse Grinding using a Geometric-Kinematic Simulation	322
<i>S. Schumann, T. Siebrecht, P. Kersting, D. Biermann, R. Holtermann, A. Menzel</i>	
Parameter Identification for Finite Element Based Models in Dry Machining Applications.....	328
<i>H. Wernsing, C. Büskens</i>	
Heat Flux in Cutting: Importance, Simulation and Validation	334
<i>M. Putz, G. Schmidt, U. Semmler, M. Dix, M. Bräunig, M. Brockmann, S. Gierlings</i>	
Prediction of Temperature Induced Shape Deviations in dry Milling	340
<i>B. Denkena, A. Schmidt, P. Maafß, D. Niederwestberg, C. Niebuhr, J. Vehmeyer</i>	
Development and Validation of a Hybrid Model for the Prediction of Shape Deviations in dry Machining Processes.....	346
<i>M. Gulpak, J. Sölter</i>	

Analytical Modelling Methods for Temperature Fields in Metal Cutting Based on Panel Method of Fluid Mechanics	352
<i>F. Klocke, M. Brockmann, S. Gierlings, D. Veselovac, D. Kever, B. Roidl, G. Schmidt, U. Semmler</i>	

GRINDING

A Meta-model Framework for Grinding Simulation.....	357
<i>Marco Leonesio, Majid Sarhangi, Giacomo Bianchi, Paolo Parenti, Alberto Cassinari</i>	
The Development of Dislodgement Free Diamond Electroplated Wheel for Engineering Ceramic Grinding Processes	363
<i>Geng Zhi, Xuekun Li, Sebastian Wolf, Yiming (Kevin) Rong</i>	
Discrete Element Modelling of Drag Finishing	369
<i>Eckart Uhlmann, Alexander Eulitz, Arne Dethlefs</i>	
Predictive Modeling of Surface Roughness in Grinding.....	375
<i>Sanchit Kumar Khare, Sanjay Agarwal</i>	
Analysis of Measured and Predicted Residual Stresses Induced by Finish Cylindrical Grinding of High Speed Steel with CBN Wheel.....	381
<i>Haifa Sallem, Hédi Hamdi</i>	
Analysis of Process Forces for the Precision Honing of Small Bores.....	387
<i>Uwe Moos, Dirk Bähre</i>	

MODELLING OF MATERIAL BEHAVIOUR 2

Modelling of Vibration Assisted Machining f.c.c Single Crystal	393
<i>S. Abolfazl Zahedi, Anish Roy, Vadim V. Silberschmidt</i>	
A New Method to Determine Material Parameters from Machining Simulations Using Inverse Identification	399
<i>Martin Bäker</i>	
Inverse Determination of Constitutive Equations and Cutting Force Modelling for Complex Tools Using Oxley's Predictive Machining Theory	405
<i>B. Denkena, T. Grove, M.A. Dittrich, D. Niederwestberg, M. Lahres</i>	
Characterization of the Cutting Forces Generated During the Gear Hobbing Process: Spur Gear	411
<i>N. Sabkhi, C. Pelaingre, C. Barlier, A. Moufki, M. Nouari</i>	
On the Analytical Representation of Chip Area and Tool Geometry when Oblique Turning with Round Tools. Part 1: Chip Area Parameters Under Variation of Side and Back Rake Angle	417
<i>V. Bushlya, F. Schultheiss, O. Gutnichenko, J.M. Zhou, J.-E. Stähle</i>	
On the Analytical Representation of Chip Area and Tool Geometry when Oblique Turning with Round Tools. Part 2: Variation of Tool Geometry Along the Edge Line	423
<i>V. Bushlya, F. Schultheiss, O. Gutnichenko, J.M. Zhou, J.-E. Stähle</i>	

MONITORING AND DIAGNOSTICS

Orthogonal Cutting Process Modelling Considering Tool-workpiece Frictional Effect	429
<i>Rafal Rusinek, Marian Wiercigroch, Pankaj Wahi</i>	
Mechanistic Model for Prediction of Cutting Forces in Turning of Non-axisymmetric Parts	435
<i>Itxaso Cascón, Jon Ander Sarasua</i>	
Development of a Discrete Event Model for Energy and Resource Efficient Milling	441
<i>Rüdiger Rentsch, Carsten Heinzel</i>	
Modelling of Part Distortion Due to Residual Stresses Relaxation: An aeronautical Case Study	447
<i>L. D'Alvise, D. Chantzis, B. Schoinochoritis, K. Salomitis</i>	
Predictive Modelling and Optimization of Machining Parameters to Minimize Surface Roughness using Artificial Neural Network Coupled with Genetic Algorithm	453
<i>Girish Kant, Kuldeep Singh Sangwan</i>	
Multipoint Recursive Sequential Three-point Method for On-machine Roundness Measurement	459
<i>Haifeng Ma, Chungang Zhuang, Zhenhua Xiong</i>	

THERMAL EFFECTS IN MACHINING PROCESSES 4

Experimental and Analytical Investigation of Workpiece Thermal Load During External Cylindrical Grinding	465
<i>Stepan Jermolajev, Carsten Heinzel, Ekkard Brinksmeier</i>	

A Novel Finite Element Approach to Modeling Hard Turning in Due Consideration of the Viscoplastic Asymmetry Effect.....	471
<i>Eckart Uhlmann, Rolf Mahnken, Ivan Mitkov Ivanov, Chun Cheng</i>	
Enhanced Machinability of Ti-5553 Alloy from Cryogenic Machining: Comparison with MQL and Flood-cooled Machining and Modeling.....	477
<i>Y. Sun, B. Huang, D.A. Puleo, I.S. Jawahir</i>	
A Novel Simulation Approach to Determine Thermally Induced Geometric Deviations in Dry Gear Hobbing	483
<i>I. Kadashevich, M. Beutner, B. Karpuschewski, T. Halle</i>	
Modelling and Experimental Investigation of Cutting Temperature when Rough Turning Hardened Tool Steel with PCBN Tools.....	489
<i>V. Kryzhanivskyy, V. Bushlya, O. Gutnichenko, I.A. Petrusha, J.-E. Ståhl</i>	
 DYNAMICS AND STABILITY OF MACHINING 2	
Computerized Simulation of Interference in Thread Milling of Non-Symmetric Thread Profiles.....	496
<i>Guillaume Fromentin, Benjamin Döbbeler, Dieter Lung</i>	
A Method for Identification of Machine-tool Dynamics under Machining	502
<i>Hui Cai, Bo Luo, Xinyong Mao, Lin Gui, Bao Song, Bin Li, Fangyu Peng</i>	
Axis Position Dependent Dynamics of Multi-axis Milling Machines	508
<i>C. Brecher, H. Altstädter, M. Daniels</i>	
Analysis of Cutting Stability in Vibration Assisted Machining Using Ananalytical Predictive Force Model	515
<i>Yuan Gao, Ronglei Sun, Jürgen Leopold</i>	
Modeling and Cutting Path Optimization of Shallow Shell Considering its Varying Dynamics During Machining.....	521
<i>Yilong Liu, Baohai Wu, Ming Luo, Dinghua Zhang</i>	
3D Finite Element Modeling of Holder-Tool Assembly for Stability Prediction in Milling.....	527
<i>Niccolò Grossi, Filippo Montevercchi, Antonio Scippa, Gianni Campatelli</i>	
 MODELLING OF MATERIAL BEHAVIOUR 3	
Numerical Model of Machining Considering the Effect of MnS Inclusions in an Austenitic Stainless Steel.....	533
<i>G.M.P. Chagas, I.F. Machado</i>	
A Finite Element Simulation for Orthogonal Cutting of UD-CFRP Incorporating a Novel Fibre-matrix Interface Model	539
<i>Alessandro Abena, Sein Leung Soo, Khamis Essa</i>	
Multi-physics Modelling in Machining OFHC Copper – Coupling of Microstructure-based Flow Stress and Grain Refinement Models.....	545
<i>Z. Atmani, B. Haddag, M. Nouari, M. Zenasni</i>	
Finite Element Simulation of Semi-finishing Turning of Electron Beam Melted Ti6Al4V Under Dry and Cryogenic Cooling	551
<i>A. Bordin, S. Imbrogno, G. Rotella, S. Bruschi, A. Ghiootti, D. Umbrello</i>	
Modeling and Simulation of Machining-induced Surface Integrity Characteristicsof NiTi Alloy.....	557
<i>Y. Kaynak, S. Manchiraju, I.S. Jawahir</i>	
Predictive Modelling of Cutting Force and its Influence on Surface Accuracy in Ultra-high Precision Machining of Contact Lenses.....	563
<i>O.A. Olufayo, K. Abou-El-Hossein</i>	
Author Index	