## Table of Contents

Preface, Committees and Sponsors

### Chapter 1: Mechanism and Technology of High Speed Machining

<table>
<thead>
<tr>
<th>Title</th>
<th>Page</th>
</tr>
</thead>
<tbody>
<tr>
<td>Application of Different Cooling Strategies in Drilling of Metal Matrix Composite (MMC)</td>
<td>3</td>
</tr>
<tr>
<td>M.I. Sadik and G. Grenmyr</td>
<td></td>
</tr>
<tr>
<td>Effect of Spindle Speeds on 3D Topography of Ball-End Milled Surfaces Using Wavelet Analysis Method</td>
<td>13</td>
</tr>
<tr>
<td>S. Liu, J. Zhao, W.Z. Qin and J.M. Pang</td>
<td></td>
</tr>
<tr>
<td>Experimental Investigation of Mechanical-Thermal Characteristics in High Efficiency Turning Titanium Alloy Ti6Al4V</td>
<td>20</td>
</tr>
<tr>
<td>L.M. Shi, Y. Cheng and Q.J. Li</td>
<td></td>
</tr>
<tr>
<td>Experimental Investigations into Machining of FRP Material</td>
<td>29</td>
</tr>
<tr>
<td>P. Zeman, P. Kolar and P. Masek</td>
<td></td>
</tr>
<tr>
<td>Experimental Research of Milling Force and Cutting Temperature of TB2 Titanium Alloy in Liquid Nitrogen Cooling</td>
<td>36</td>
</tr>
<tr>
<td>J.J. Liu, C. Chen, Y.F. Yang, L. Li and W. Zhao</td>
<td></td>
</tr>
<tr>
<td>Study on the Shear Angles in High Speed Machining of Powder Metallurgy Superalloy</td>
<td>43</td>
</tr>
<tr>
<td>Y. Qiao, X.L. Fu and Y.Z. Pan</td>
<td></td>
</tr>
<tr>
<td>Increasing Productivity and Process Stability in Turning of Aerospace Materials with High Pressure Lubricant Supply</td>
<td>48</td>
</tr>
<tr>
<td>F. Klocke, T. Cayli and D. Veselovac</td>
<td></td>
</tr>
<tr>
<td>Time Dependent Behavior Analysis of Inconel 718 in High Speed Grinding Process</td>
<td>56</td>
</tr>
<tr>
<td>G. Zhi, X.K. Li and Y.M. Rong</td>
<td></td>
</tr>
<tr>
<td>The Machinability Evaluation of Hardened Steel 7Cr5SiMnMoV</td>
<td>64</td>
</tr>
<tr>
<td>X.M. Feng, S.M. Zhang, J.S. Hu, X. Song and F. Liu</td>
<td></td>
</tr>
<tr>
<td>Experimental Study on Prestressed Cutting of Alloy Ring Parts</td>
<td>71</td>
</tr>
<tr>
<td>R.T. Peng, Y.G. Li, X.Z. Tang and Z. Zhou</td>
<td></td>
</tr>
<tr>
<td>Chip Formation of S790 Hardened Steel under High Speed Dry Milling Condition</td>
<td>77</td>
</tr>
<tr>
<td>D.H. Yu, H. Wang, C.Y. Wang, Y.H. Yuan and F. Ding</td>
<td></td>
</tr>
<tr>
<td>Experimental Study on Cutting Force and Cutting Power in High Feed Milling of Ti5Al5Mo5VCrFe</td>
<td>88</td>
</tr>
<tr>
<td>H. Sun, H. Xiao and L. Li</td>
<td></td>
</tr>
<tr>
<td>Time Domain Simulation of Milling Chatter Stability</td>
<td>94</td>
</tr>
<tr>
<td>Y.C. Ma, M. Wan and W.H. Zhang</td>
<td></td>
</tr>
<tr>
<td>Q.Y. Wu, L. He, H. Xiao and L. Li</td>
<td></td>
</tr>
<tr>
<td>Study on the Machinability Characteristics of Ti3AlNb Based Alloy in Turning with Coated Cemented Carbide Tools</td>
<td>106</td>
</tr>
<tr>
<td>Identification of Cutting Shear Stress, Shear and Friction Angles Using Flat End Milling Tests</td>
<td>112</td>
</tr>
<tr>
<td>M. Wan, W.J. Pan and W.H. Zhang</td>
<td></td>
</tr>
<tr>
<td>Discrete Element Simulation of Machining Cracks in Brittle Materials during High Speed Cutting</td>
<td>117</td>
</tr>
<tr>
<td>Y. He, J. Zhang, Y.F. Jiang, H.G. Liu and W.H. Zhao</td>
<td></td>
</tr>
<tr>
<td>Friction Modeling and Experimental Research of Tool-Chip in Turning Titanium Alloy Ti6Al4V</td>
<td>126</td>
</tr>
<tr>
<td>Z. Li, E.L. Liu, T.D. Wang, N. Zhao and L.C. Min</td>
<td></td>
</tr>
<tr>
<td>Effect of Tool Wear on Surface Qualities in Milling of TC4</td>
<td>132</td>
</tr>
<tr>
<td>S.C. Yang, X.Y. Cui, Y.H. Zhang and Z.W. Wang</td>
<td></td>
</tr>
<tr>
<td>The Influence of the Grinding Wheel Parameters on the Spiral Groove Parameters of the End Mill</td>
<td>139</td>
</tr>
<tr>
<td>X.F. Zhao, H.Y. Shi and L. He</td>
<td></td>
</tr>
</tbody>
</table>
Chapter 2: Micro-Machining and Non-Traditional Machining Technologies

Comparison between EBM and DMLS Ti6Al4V Machinability Characteristics under Dry Micro-Milling Conditions
Z. Rysava and S. Bruschi 177

Experimental Study on Micro Milling of Carbon Fiber Reinforced Plastics
X. Wu, L. Li, N. He and X.Q. Hao 185

Optimization of Cutting Parameters and Burrs Control with PMMA Coating in Micro-Milling Titanium Alloys

Influence of Drill Geometry Parameters on Helical Point Micro Drilling Performance

The Grinding and Test of Annular Milling Cutter with Double-Circular-Arc

Chapter 3: Recent Developments in High Speed Machine Tools and Cutting Tools

Study on Oxidation Resistance of Tool Materials for Machining Superalloy
T.D. Wang, E.L. Liu and Z. Li 215

A Novel Evaluation Method on the Precision of Linear Motor Feed System in High-Speed Machine Tools
X.J. Yang, Y. Li, C.F. Ma, D. Lv, J. Zhang and W.H. Zhao 220

Effect of Corner Radius on the Vibration Amplitude in PCBN Tool Cutting Hardened Steel Process

Microstructures and Mechanical Properties of CrN Coatings Deposited by HIPIMS
L.S. Fu, W. Dai, Q.M. Wang and K. Zeng 234

Diffusion Wear and Oxidation Wear of PCBN Tool when Cutting Materials Difficult-to-Cut Based on Thermodynamics Solubility
F. Shao, Y.T. Wang and J.H. Li 242

Influence of Cutting Tool Edge Preparation on Cutting Force and Surface Integrity
X.F. Zhao, L. He, W. Liu and W.J. Zheng 250

Tool Life Prediction Model Based on GA-BP Neural Network
Z. Zhang, L. Li and W. Zhao 256

Experimental Research on Chemical Mechanical Sharpening of CVD Diamond Micro Tool
Y. Xia, X.Q. Hao, L. Li and N. He 263

An Evaluation Method Based on Grey Relational Grade for Cutting Tool Performance in the Milling of Titanium Aircraft Components
Y.P. Jia, W. Zhao and L. Li 270

Tool Material Selection Based on Analytic Hierarchy Process Method in Machining Al-Si Piston Alloy
A.H. Li, Y.M. Wu, J. Zhao and Z.C. Gong 277
2D Barcode Identification Technology Application in Tool Management System for Workshop
W.P. Du, L. Li and W. Zhao 283

Effect of Optimizing PID Parameters and Spindle Speeds on Processing Performance of KDP Micro-Defect Mitigation Machine Tool
M.J. Chen, W.J. Ma and Y. Xiao 290

Experimental Analysis of Damping Fixture for Thin-Walled Workpiece Milling
D.S. Liu, M. Luo and D.H. Zhang 296

Vibration Control of HSM of Thin-Wall Titanium Alloy Components Based on Finite Element Simulation
K. Zhao, H.H. Su, L.J. He and Y.Z. Liu 304

Zoom Synchrosqueezing Transform for Instantaneous Speed Estimation of High Speed Spindle
S.T. Xi, H.R. Cao and X.F. Chen 310

Research on the Tool Wear Mechanism of Cemented Carbide Ball End Mill Machining Titanium Alloy
Y.H. Zhang, S.C. Yang and C. Feng 318

Lightweight Design of the Welded Beam of Machining Center Based on Topology Optimization
Q. Sun, Z.L. Li, H. Yu, Y. Liu and J.S. Zhang 326

Growth Time Optimization of Fine Grained Diamond Coated Drills for Machining CFRP
X.C. Wang, X.T. Shen, T.Q. Zhao, F.H. Sun and B. Shen 333

Next Generation Insert for Forced Coolant Application in Machining of Inconel 718
N. Tamil Alagan, T. Beno and A. Wretland 340

Dynamic Characteristics Analysis for the Headstock of a Vertical Machining Center

Optimal Design Analysis of the Thickness of Shrink-Fit Holder

Chapter 4: CAD/CAM/CAE Technologies in Modeling and Simulation of Processes in High Speed Machining

Thermal Deformation Impact Analysis on the Workbench of Large Size Hydrostatic Bearing Plate Structure

Simulation of Meso-Scale Machining of AISI1045 Based on Multiphase Model
T.Y. Shang, L.J. Xie, X.L. Chen, Y. Qin and T. Fu 374

Parameter Analysis of Placement Function for the Rectangular Packing Problem Based on GA
Y.H. Zhu 381

Unbalance Response of HSK Hydraulic Chuck Tooling System for High-Speed Machining

Thermal Characteristics Analysis of Hardened Steel Die Transition Region in Machining Process
W. Zhang, H.L. Liu, T. Wu, X.Y. Cui and F.S. He 394

Simulation of Tool Wear in Prestressed Cutting Superalloys
R.T. Peng, J. Li, X.Z. Tang and Z. Zhou 402

A Unified Cutting Force Model for Flat End Mills Based on Cutter Geometry and Material Properties
X.D. Zhang, C. Han, D.H. Zhang and M. Luo 408

NC Machining Program Simulation and Experiments for Pelton Runner
Y. Wang, J.X. Guo, B.T. Wang and Y.S. Zhai 417

Study on Plunge Milling Cutter Design with Finite Element Analysis
Y.S. Zhai, H.L. Song and J.S. Hu 425

Heat Transfer Model for Pulse Laser Assisted Machining of ZrO2
H. Lu, S.L. Wang, N. He, L. Li and X.Q. Hao 430

Research on Overall Aluminum Alloy Flange Machining Deformation
Finite Element Simulation of High Speed Machining of Ti6Al4V Alloy and the Corresponding Experimental Study
L.H. Meng 444

Finite Element Simulation of Ultrasonic Incremental Forming
P.Y. Li, Q. Liu, W.R. An and S.J. Li 452

Microstructural Effect on Crack Propagation Behavior of Ceramic Tool Materials via Cohesive Zone Modeling
Z.L. Li, J. Zhao, F.Z. Wang, A.H. Li and X.H. Tian 462

Orthogonal Variable Thickness Cutting Modeling of Surface Milling and Physical Fields Simulation
W. Zhang, C.J. Du, X.L. Cheng and F.S. He 468

Rapid Modeling of BTA Deep-Hole Drill Based on Customized Development of NX
X.F. Wu, W. Luo and S.C. Yang 476

Research on the High Temperature Constitutive Model of 300M Ultrahigh Strength Steel
H.P. Zhang, N. Zhao, X. Shi, X.L. Zhang and Y. Ren 484

Study on the High Speed Cutting Experiment of Micro Deformation Zone Based on the Theory of Dislocation
X.L. Fu, Z.H. An, Y.A. Pan, W.X. Lin and Y. Qiao 493

Kinematical Smoothing of Rotary Axis near Singularity Point
L. Grandguillaume, S. Lavernhe and C. Tournier 501

Grain Refinement and Thermal Stability of AISI1020 Strips Prepared by Large Strain Extrusion Machining
J.Y. Zhang, B.L. Li, Z.J. Zou, T. Zou and W.J. Deng 509

Dynamic Characteristic Analysis of CNC Turret Punch Servo Beam
Y.J. Guo 522

Instantaneous Dynamics of Multi-Axis Milling Thin-Walled Workpiece with Complex Curved Surface
G.G. Ju, Q.H. Song, Z.Q. Liu, J.H. Shi, Y. Wan and X. Ai 529

Design of Typical Aviation Titanium Alloy Benchmark
P.F. Ma, S.Z. Wang and W. Zhao 536

Chapter 5: Testing, Measuring and Monitoring in Machining Processes

Dynamic Grinding Hub Monitoring during a High Performance Grinding Process with Ceramic CBN on Cold Work Steel
A. Fritsche and F. Bleicher 545

The Design of Automatic System for the Calibration of Testing Temperature Cutter with Thin Film Thermocouple
Y.X. Cui, Y. Qi, L.M. Guo, Q.X. Zhang and Y. Jia 552

The Adaptive Machining of the Leading and Trailing Edges of Precision Forging Blades Based on the On-Machine Measurement
J. Gao, B.H. Wu and Y. Zhang 562

Spectral Properties of Milling and Machined Surface
G. Stepan, M. Toth, D. Bachrathy and S. Ganeriwala 570

Cutting Parameters Optimization Based on Cutting Force Spectrum when Ball Milling A880 Gas Turbine Blade Profiles
X.D. He, C.D. Wang, Z.K. Wang and M. Chen 578

The Analysis and Optimization of Machining Precision Based on Electromechanical Matching in High-Speed Machine Tools
X.J. Yang, C.F. Ma, Y. Li, D. Lv, J. Zhang and W.H. Zhao 584

Measurement of Micro-Drill Breakage during PCB Drilling
X. Huang, Z.S. Chen, C.Y. Wang, L.J. Zheng and Y.X. Song 592

Vibration Monitoring and Analysis of Thin-Walled Casing Milling
Y.H. Yao, B.H. Wu and M. Luo 600