

Table of Contents

Preface, Committee and Acknowledgements

Chapter 1: Keynote

Optical 3D Metrology for Optimization of Sheet Metal Forming Processes K. Galanulis, S. Adolf and H. Friebe	3
Use of FE Simulation and Servo Press Capabilities in Forming of AHSS and Aluminum Alloys A. Fallahiazoodar, L. Ju and T. Altan	13
Stamping Plant 4.0 – Basics for the Application of Data Mining Methods in Manufacturing Car Body Parts S. Purr, J. Meinhardt, A. Lipp, A. Werner, M. Ostermair and B. Glück	21

Chapter 2: Forming

Evaluation of Drawing Force and Thickness Distribution in the Deep-Drawing Process with Variable Blank-Holding L. Lazarescu, I. Nicodim and D. Banabic	33
Flexible Manufacturing of Double-Curved Sheet Metal Panels for the Realization of Self-Supporting Freeform Structures D. Bailly, M. Bambach, G. Hirt, T. Pofahl, G. Della Puppa and M. Trautz	41
Formability of AA6060 Tubes in Hot Metal Gas Forming at High Temperatures F. Michieletto, A. Ghiotti and S. Bruschi	49
Friction Adjustment within Dry Deep Drawing by Locally Laser Textured Tool Surfaces T. Häfner, J. Heberle, M. Dobler, M. Gränitz, I. Alexeev and M. Schmidt	57
Internal Flow-Turning - An Innovative Technology for the Manufacture of Tailored Tubes W. Homberg, T. Rostek and E. Wiens	65
Laser Forming of Steel Dome-Shaped Parts Using a Flower Pattern M. Loh-Mousavi, M. Rostami and M. Farzin	71
Lightweight Design in Architecture – Forming of Stainless Steel Composites for Modern Facades M. Tulke, J. Watzke, A. Brosius and M. Schomäcker	77
On the Friction Effect on the Characteristics of Hydroformed Tube in a Square Section Die: Analytical, Numerical and Experimental Approaches A. Abdelkefi, N. Boudeau, P. Malecot, G. Michel and N. Guermazi	83
Study of Earing Defect during Deep Drawing Process with Finite Element Simulation R. Patel, H.K. Dave and H. Raval	91
Embossing of Metal Inserts for Subsequent Assembly Injection Moulding of Media Tight Electronic Systems P. Frey, M. Heinle, C. Leisen, D. Drummer and M. Merklein	99
The Influence of Strain Rate on the Springback of Commercially Pure Titanium in a Stretch Forming Operation A.G. Leacock, S. Quinn, G. Volk, D. McCracken and D. Brown	107
Goal Driven Optimization of Process Parameters for Maximum Efficiency in Laser Bending of Advanced High Strength Steels J. Griffiths, M.J.W. Riley, G. Sheikholeslami, S.P. Edwardson and G. Dearden	115
Investigation of the Portevin-Le Chatelier Effect in AlMgSi-Tailored Heat Treated Blanks A. Kahrimanidis, D. Wortberg and M. Merklein	123
Development of a New Method for Producing Plane Expanded Metal by Laser Cutting and Forming of Metal Plates under Uniaxial Tension M. Merklein, D. Junker, A. Schaub, A. Kretschmer and M. Lechner	131

Chapter 3: Bending

The Effect of Punch Radius on the Deformation of Ultra-High Strength Steel in Bending A.M. Arola, V. Kesti and R. Ruoppa	139
Experimental and Numerical Determination of the Required Initial Sheet Width in Die Bending T. Traub and P. Groche	147
On the Identification of a Loading Scheme in Large Radius Air Bending V. Vorkov, R. Aerens, D. Vandepitte and J.R. Duflou	155
Simulative Winding of Roll Formed Profile in Carcass Production for Flexible Pipes P.S. Nielsen, C.A. Ormstrup, B.A.K. Hartz, M.S. Nielsen and N. Bay	163

Chapter 4: Incremental Forming

Negative Bulge Formation in High Speed Incremental Forming H. Vanhove and J.R. Duflou	173
Accuracy and Material Properties in Incremental Forming for a Multi-Step Expanding Approach J. Brüninghaus, A. Oster and B. Kuhlenkötter	179
Experimental Testing of an Analytical Model for Membrane Strains in Single Point Incremental Forming D. Adams, T. McAnulty and M. Doolan	187
Formability Enhancement in Incremental Forming for an Automotive Aluminium Alloy Using Laser Assisted Incremental Forming A. Mohammadi, H. Vanhove, A. Van Bael, D. Weise and J.R. Duflou	195

Chapter 5: Hot Stamping

Local Prevention of Hardening for Punching of Hot-Stamped Parts K. Mori, T. Maeno and T. Suganami	205
Numerical Analysis and Experimental Validation of the Thermo-Mechanical Flow Behaviour of the Hot Stamping Steel MBW[®] 1500 B. Potdar, S. Graff and B. Kiefer	213
Tribological Behaviour of Lubricants in Hot Stamping of AA6016 F. Medea, A. Ghiotti and S. Bruschi	221
Design of Press Tools to Investigate the Hot Stamping Behaviour of Alternative Coatings for Press-Hardened Steel Parts D. Close, P. Feuser and R. Lallement	227
Investigation of Weld Seam Structures of Tailor Welded Blanks for Hot Stamping R. Kolleck, R. Vollmer, C. Both and A. Breuer	235
Improvement of the Ductility of Press-Hardened Plane Sheets through a Modified Heat Treatment T. Konrad and P. Feuser	243

Chapter 6: Sheet-Bulk Metal Forming

Experimental Verification of a Benchmark Forming Simulation P. Landkammer, A. Loderer, E. Krebs, B. Söhngen, P. Steinmann, T. Hausotte, P. Kersting, D. Biermann and K. Willner	251
Flexible Rolling of Process Adapted Semi-Finished Parts and its Application in a Sheet-Bulk Metal Forming Process P. Hildenbrand, T. Schneider and M. Merklein	259
Locally Adapted Tribological Conditions as a Method for Influencing the Material Flow in Sheet-Bulk Metal Forming Processes M. Loeffler, T. Schneider, U. Vierzigmann, U. Engel and M. Merklein	267

Influence of Surface Modifications on Friction, Using High-Feed Milling and Wear Resistant PVD-Coating for Sheet-Metal Forming Tools	
D. Biermann, D. Freiburg, R. Hense, W. Tillmann and D. Stangier	275
Experimental and Simulative Investigations of Tribology in Sheet-Bulk Metal Forming	
F. Beyer, H. Blum, D. Kumor, A. Rademacher, K. Willner and T. Schneider	283
Measuring Systems for Sheet-Bulk Metal Forming	
A. Loderer, M. Timmermann, S. Matthias, M. Kästner, T. Schneider, T. Hausotte and E. Reithmeier	291

Chapter 7: Materials Testing

Formability Characteristics of Hot Stamped Ti6Al4V Sheets Electro-Chemically Modified on Surface for Biomedical Applications	
B. Valoppi, S. Bruschi and A. Ghiotti	301
Modeling of the Plastic Characteristics of AA6082 for the Friction Stir Welding Process	
S. Pellegrino, L. Fratini, M. Merklein, W. Böhm and H. Nguyen	309
Novel Punch Design for Nonlinear Strain Path Generation and Evaluation Methods	
M. Liewald and K. Drotleff	317
Structural and Frictional Performance of Fused Deposition Modelled Acrylonitrile Butadiene Styrene (P430) with a View to Use as Rapid Tooling Material in Sheet Metal Forming	
A.G. Leacock, G. Cowan, M. Cosby, G. Volk, D. McCracken and D. Brown	325
A New Approach to the Evaluation of Forming Limits in Sheet Metal Forming	
M. Merklein, A. Maier, D. Kinnstätter, C. Jaremenko and E. Affronti	333
Analysis of Tensile Test of Titanium EBW Sheet	
J. Adamus and M. Motyka	339
Effect of Pre-Compressive Strain on Work-Hardening Behavior upon Two-Step Loading in a Magnesium Alloy Sheet	
T. Hama, Y. Tanaka, M. Uratani, T. Tanaka, H. Fujimoto and H. Takuda	347
Cold Formability of Automotive Sheet Metals: Anisotropy, Localization, Damage and Ductile Fracture	
J.H. Lian, D.C. Ahn, D.C. Chae, S. Münstermann and W. Bleck	353
Investigation on the Strain Behaviour of a Precipitation-Hardenable Aluminium Alloy through a Temperature Gradient Based Heat Treatment	
G. di Michele, P. Guglielmi, G. Palumbo and D. Sorgente	361
Identification of Plasticity Model Parameters of the Heat-Affected Zone in Resistance Spot Welded Martensitic Boron Steel	
T. Eller, L. Greve, M. Andres, M. Medricky, T. Meinders and T. van den Boogaard	369
Influence of Stress Relaxation after Uniaxial Pre-Straining on Subsequent Plastic Yielding in the Uniaxial Tensile Test of Sheet Metal	
S. Suttner and M. Merklein	377
Validation of Kinematic Hardening Parameters from Different Stress States and Levels of Plastic Strain with the Use of the Cyclic Bending Test	
M. Rosenschon, S. Suttner and M. Merklein	385

Chapter 8: Modelling

Analysis and Optimization for the Production Process of an Automotive Alternator Using FEM and Experiments	
A. D'Annibale, A. di Ilio, M. Trozzi and L. Bonaventura	395
Experimental and Numerical Investigation on a Pressure Dependent Friction Model	
F. Zöller, V. Sturm and M. Merklein	403
A Constitutive Model for the Simulation of the Deformation Behavior of TWIP Steels	
A. Haufe, A. Erhart and A. Butz	411
Numerical Prediction of Failure within Small Curvature Bending of Advanced High Strength Steels	
I. Tsoupris and M. Merklein	419

Enhancement of Lemaitre Model to Predict Cracks at Low and Negative Triaxialities in Sheet Metal Forming	
K. Isik, M. Doig, H. Richter, T. Clausmeyer and A.E. Tekkaya	427
A Modified Shell Element Model Combined with Yld91 Yield Function in Simulating Aluminum Alloy Applied Hydroforming	
F.F. Zhang, J. Chen, J.S. Chen, X.H. Zhu and S.J. Yuan	435
Creep Behaviour of AA6016 during Automotive Paint Drying Processes	
J. Regensburger, L. Mendes de Lima, C. Albiez, P. Weigel and W.G. Drossel	443
Design of Numerical Simulations of Linear Friction Welding Processes: Issues and Difficulties	
A. Ducato, D. Campanella, G. Buffa and L. Fratini	451
New Approach for Wrinkle Prediction in Deep Drawing Process	
F. Han and R. Radonjic	459

Chapter 9: Cutting and Joining

Development of a Testing Method for the Identification of Friction Coefficients for Numerical Modeling of the Shear-Clinching Process	
M. Müller, U. Vierzigmann, R. Hörhold, G. Meschut and M. Merklein	469
Notch Shear Cutting of Press Hardened Steels	
M. Feistle, M. Krinninger, R. Golle and W. Volk	477
On the Solid Bonding Phenomena in Linear Friction Welding and Accumulative Roll Bonding Processes: Numerical Simulation Insights	
D. Campanella, G. Buffa, L. Fratini and M. Merklein	485
Solid State Recycling of Aluminium Sheet Scrap by Means of Spark Plasma Sintering	
D. Paraskevas, K. Vanmeensel, J. Vleugels, W. Dewulf and J.R. Duflou	493

Chapter 10: Planning

Selection, Modeling and Prediction of Life of Stripper of Compound Die	
S. Kashid, S. Kumar and H.M. Hussein	501
New Diagnostic Techniques for an Automated Hemming Validation of Hang-On Parts	
C. Kaiser, M. Zubeil, K. Roll and W. Volk	509
Sheet Metal Laser Cutting Tool Path Generation: Dealing with Overlooked Problem Aspects	
R. Dewil, P. Vansteenwegen and D. Cattrysse	517
Minimization of Energy Consumptions by Means of an Intelligent Production Scheduling	
E. Mariano, F. Nucci, A. Del Prete and A. Grieco	525

Chapter 11: MatProFuture

Cranial Reconstruction Using Double Side Incremental Forming	
B. Lu, D.K. Xu, R.Z. Liu, H.A. Ou, H. Long and J. Chen	535
Fracture Prediction in Sheet Metal Stamping Based on a Modified Ductile Fracture Criterion	
R. Zeng, L. Huang and J.J. Li	543
Finite Element Analysis on Plastic Deformation Behaviors of Ti-3Al-2.5V Tubes under Axial Compression	
T. Huang, M. Zhan, J.Q. Tan, J. Guo and H. Yang	551
Numerical Study on the Comparison of Deformation Characteristics during the Fine Blanking Process of Spur Gears and Helical Gear	
W.T. Xia, H.J. Mao, L. Hua and Y.X. Liu	559