

Table of Contents

Preface

Chapter 1: Plenary Lectures

Material Forming Digital Twins: The Alliance between Physics-Based and Data-Driven Models

F. Chinesta, E. Cueto and S. Guevelou 3

Machining of Additive Manufactured Metal Alloys

S. Bruschi, R. Bertolini and A. Ghiotti 15

Chapter 2: Additive Manufacturing

Characterization of Surface and Bulk Features of SLM Parts

C. Bruni, D. Ciccarelli, T. Mancía, M. Peralisi and L. Greco 27

From Theory to Practice: Development and Calibration of Micro Pellet Extruder for Additive Manufacturing

A. Curmi and A. Rochman 34

A Comprehensive Analysis of AISI 316L Samples Printed via FDM: Structural and Mechanical Characterization

M. Carminati, M. Quarto, G. D'Urso, C. Giardini and C. Borriello 46

Study of Bonding Mechanisms in Cold Spray of Metal-to-Polymer through a Numerical Approach

A. Viscusi, M. Bruno, L. Carrino, R. Della Gatta, G. Iandolo and A.S. Perna 56

Laser Metal Deposition with Coaxial Wire Feeding for the Automated and Reliable Build-Up of Solid Metal Parts

C. Bernauer, T. Merk, A. Zapata and M.F. Zaeh 65

Material Characterization of Hybrid Components Manufactured by Laser-Based Directed Energy Deposition on Sheet Metal Substrates

M. Kreß, D. Bartels, M. Schmidt and M. Merklein 80

Optimization of Laser Metal Deposition Process for 2205 Duplex Stainless Steel

S.M. Arbo, A. Saai, S.H. Sørli, C. Dybdahl, M. Onsøien and M. Nedreberg 90

Comparison of Scan Strategies for Side Roughness Optimization of Al6061-Zr Alloy Produced by Laser Powder Bed Fusion (L-PBF), Benefits and Drawbacks on Different Part Profiles

M. Beal 103

Influence of Geometric Parameters on Buckling Behavior of 3D Printed Anisogrid Structures

S. Gentili, L. Greco, T. Mancía and M. Simoncini 115

Cold Sprayed Metallic Coatings on Fibre-Reinforced Composites: A Machine Learning Approach for the Optimization of the Process

A.S. Perna, L. Carrino, R. Della Gatta and A. Viscusi 122

On the Influence of Cross-Section Size on Measured Strength of SLM-Produced AlSi10Mg-Alloy

D. Vysochinskiy and N. Akhtar 132

Experimental Setup for Fatigue Testing of Additively Manufactured Specimens

E. Manco, F. Scherillo, A. El Hassanin, D. Borrelli, A. Caraviello and A. Squillace 141

Selective Laser Melting of Ti-6Al-4V Lattices: Case Study on a Spinal Cage Prosthesis

F. Cantaboni, P. Ginestra, M. Tocci, E. Ceretti, G. De Sio, X. Cao, L.N. Carter, V.M. Villapán, M. Lowther, S. Louth and S.C. Cox 147

Maximizing the Resolution Range of Additive-Manufactured Miniature-Scale Force-Sensing Devices for Biomedical Applications

L. Quagliato, S.Y. Kim and S.C. Ryu 159

Acoustic Performances of Polymers Hierarchical Structure Produced with Material Jetting Technology E. Levi, E.A. Piana and L. Giorleo	168
Efficient Build-Up of High-Strength Aluminum Structures Using Friction Stir Additive Manufacturing M.E. Sigl, P. Danninger, C. Bernauer, R. Hartl and M.F. Zaeh	176
Experimental Investigation of Efficiency and Deposit Process Temperature during Multi-Layer Friction Surfacing Z. Kallien, A. Roos and B. Klusemann	187
18Ni300 Maraging Steel Produced via Direct Energy Deposition on H13 Tool Steel and DIN CK45 J. Gil, R. Seca, R. Amaral, O. Emadinia, A. Reis and A. de Jesus	194
Exploring Potentialities of Direct Laser Deposition: Thin-Walled Structures A.T. Silvestri, M. Perini, P. Bosetti and A. Squillace	206
<i>In Silico</i> Finite Element Approach on Mechanical Behavior in Superelastic Nitinol J.C. Chekotu and D. Brabazon	213
Silver Nano-Colloid Characterization for Printing Application S.P. Sreenilayam, É. McCarthy, L. McKeon, O. Ronan, K. Fleischer, V. Nicolosi and D. Brabazon	220
Selective Laser Melting of Ti6Al4V: Effects of Heat Accumulation Phenomena due to Building Orientation D. Palmeri, G. Buffa, G. Pollara and L. Fratini	226
Investigating the Melt-Pool Temperature Evolution in Laser-Powder Bed Fusion by Means of Infra-Red Light: A Review M.A. Obeidi, I. Ul Ahad and D. Brabazon	235
Laser Powder Bed Fusion of Aluminium Alloy 6061 for Ultra-High Vacuum Applications R. McCann, C. Hughes and D. Brabazon	242
The Analysis of Small-Scale Notches on the Fatigue Performance of SLM Ti-6Al-4V; A Theory of Critical Distances Approach B. Gillham, A. Yankin, H. Shipley, F. McNamara, C. Tomonto, G. O'Donnell, D. Trimble, S. Yin, D. Taylor and R. Lupoi	250
Flexible and High-Precision Integration of Inserts by Combining Subtractive and Non-Planar Additive Manufacturing of Polymers M. Springmann, N. Matkovic, A. Schäfer, M. Waldhof, T. Schlotthauer, M. Friedmann, P. Middendorf, J. Fleischer and N. Parspour	268
Laser-Powder Bed Fusion of Inconel 718 Alloy: Effect of the Contour Strategy on Surface Quality and Sub-Surface Density A. El Hassanin, F. Napolitano, C. Trimarco, E. Manco, F. Scherillo, D. Borrelli, A. Caraviello, A. Squillace and A. Astarita	280
Metamaterial Mechanical Performances: A Single Cell Analysis G. Ranzini, L. Giorleo and E. Ceretti	288
Discontinuous Galerkin FEM with Hot Element Addition for the Thermal Simulation of Additive Manufacturing B. Nijhuis, B. Geijselaers, J. Havinga and T. van den Boogaard	297
Prediction of Solid-State Phase Transformations for the Ti-6Al-4V Alloy C.M. Andrade, D.M. Neto and M.C. Oliveira	305
Assessing the Accuracy of Different Remapping Methods in Adaptive Mesh Refinement B.M. Marques, D.M. Neto and J.L. Alves	316
Uncertainty Quantification in the Directed Energy Deposition Process Using Deep Learning-Based Probabilistic Approach T.Q.D. Pham, T.V. Hoang, X.V. Tran, S. Fetni, L. Duchêne, H.S. Tran and A.M. Habraken	323
Thermal Modeling of Laser Powder Bed Fusion during Printing on Temperature-Unstable Materials Considering Local Sintering F. Frölich and L. Kärger	331
Effect of Finite Element Mesh Size and Time-Increment on Predicting Part-Scale Temperature for Powder Bed Fusion Process R. Ullah, J.H. Lian, J.J. Wu and E. Niemi	341
3D Modeling of Polymer Selective Laser Sintering Process: Laser-Polymer Interaction Modeling L. Zhang, M. Boutaous and S.H. Xin	349

Porosity Prediction in AM Using PBF-LB Employing Time-Series Classification V. Mahato, D. Brabazon and A. Caputo	358
Modelling Thermoplastic Filaments' Sintering by Level Set Method L. Chaunier, S. Belhabib, S. Guessasma, A. Reguerre and E. Leroy	365
Ultrasonic Monitoring of Part's Height and Layer Thickness in Powder Bed Fusion M. Raffestin, A. Domashenkov, P. Faverjon, P. Bertrand and C. Courbon	373

Chapter 3: Extrusion and Drawing

Metal Forming-Induced Residual Stresses and Rule of Mixtures' Prediction of Tensile Behavior of Bimetallic Wires A. Dashti, A. Guillet, C. Keller and B. Vieille	381
Process Stability and Reproducibility of the Dieless Drawing Process for AZ31 Magnesium Wires M. Braatz, J. Bohlen and N. Ben Khalifa	389
Characteristics of the Combined Rolling and Extrusion Process C. Heinzl and S. Müller	401
Effect of Temperature on Surface Cracking Defects in AA7075 Hot Extrusion T. Funazuka, K. Dohda, N. Takatsuji, K. Takano and N. Sukunthakan	409
Modeling Friction in HyperXtrude for Hot Forward Extrusion Simulation of EN AW 6060 and EN AW 6082 Alloys S.E. Hoque, S. Hovden, S. Culic, J.A. Nietsch, J. Kronsteiner and D. Horwatitsch	416
Simulation of Coarse Grain Evolution during Hot Extrusion of Al-Mg-Si Alloy J. Kronsteiner, S. Hovden, A. Arnoldt and J. Österreicher	426
Material Flow Visualization for Metal Extrusion on near Industrial Scale D. Horwatitsch, J. Herr and A. Hinterer	436
Towards Multi-Scale Modeling of Zirconium Alloys Recrystallization and Application to Thermo-Mechanical Processes Optimization A. Gaillac, V. Grand, A. Arsen, Q. Gaillard and M. Bernacki	443
FEM Analysis of the Skin Contamination Behavior in the Extrusion of a AA6082 Profile M. Negrozio, R. Pelaccia, L. Donati and B. Reggiani	452
Assessment of the Optimization Strategy for Nitrogen Cooling Channel Design in Extrusion Dies R. Pelaccia, M. Negrozio, B. Reggiani and L. Donati	460
Comparison of Friction Extrusion Processing From Bulk and Chips of Aluminum-Copper Alloys L. Rath, U.F.H. Suhuddin and B. Klusemann	471
A Model for Roll-Drawing of Full Sections with Experimental Verification R. Braun, I.Z. Ananta, G.B. Buono, C. Overhagen and M. Uddin	481
Copper Wire Multi-Pass Drawing: Process Modeling and Optimization S. Di Donato, L. Donati and M. Negrozio	499
Possibility of Deformation of Billet with Various Internal Structure in KOBEX Extrusion M. Zwolak, R.E. Śliwa, B. Pawłowska and A. Wędrychowicz	511
Extrusion of Lightweight Aluminum and Magnesium Alloys Structures for Aviation Applications R.E. Śliwa, B. Pawłowska, T. Balawender and M. Zwolak	523
Prediction of Underfilling Defect in Aluminium Profile Extrusion Based on ALE Simulation I. Kniazkin	537

Chapter 4: Forging and Rolling

Methodology to Investigate the Transformation Plasticity for Numerical Modelling of Hot Forging Processes B.A. Behrens, K. Brunotte, H. Wester and C. Kock	547
Numerical Investigations on Stresses and Temperature Development of Tool Dies during Hot Forging B.A. Behrens, D. Rosenbusch, H. Wester and J. Siring	559

FEM Modelling of Weld Damage in Continuous Cold Rolling of MIG/MAG Butt-Welded Stainless Steel Strips L. Demoulin, Z. Zahar, A. El Mekkaoui, A. Reignier, K. Mocellin, P. Montmitonnet and P.E. Leger	569
Elaboration of Parameters of Large-Size Rings Production Process Taking into Account the Evolution of Material Relative Density Ł. Lisiecki, A. Łukaszek-Solek, J. Majta, S. Kajpust, S. Misiowiec and K. Muszka	580
Data-Driven Roll Pass Design of Wire Rod Mills C. Overhagen and K. Fu	589
Effects of Tool-Workpiece Friction Condition on Energy Consumption during Piercing Phase of Seamless Tube Production H. Aghajani Derazkola, E. Garcia and A. Murillo-Marrodán	602
Impact of a Splined Mandrel Geometry on Die Filling in a Cold Forging Process with Adjustable Deformation Zone A. Weiss, M. Arny and M. Liewald	612
Performance Analysis of Work-Roll Wear Models on Hot Rolling N. Souto, E. Marchand, A. Gay, Z. Koont and N. Legrand	621

Chapter 5: Incremental and Sheet Metal Forming

Process Window Definition to Predict Mechanical Properties of Press Hardened Parts of Boron Steel with Tailored Properties M.E. Palmieri and L. Tricarico	635
Influence of Conformal Cooling Channel Parameters on Hot Stamping Tool and Press-Hardening Process M.E. Palmieri and L. Tricarico	645
Setting Residual Stresses in Tensile Stress-Superposed Incremental Sheet Forming F. Maaß, M. Hahn and A.E. Tekkaya	655
Hot Spinning of Cutting Blades for Food Industry D. Engemann and W. Homberg	663
Multistage Deep-Drawing with Alternating Blank Draw-in for Springback Reduction in Transfer and Progressive Dies D. Briesenick and M. Liewald	674
Manufacture of Defined Residual Stress Distributions in the Friction-Spinning Process: Driven Tool and Subsequent Flow-Forming F. Dahms and W. Homberg	683
Evaluation of Cold Roll Forming Strategies for the Production of a High-Strength Aluminum Hat Profile T. Suckow and P. Groche	690
Hybrid Forming - A Method for Simultaneous Forming of High Strength Metal Sheet and Long Fiber Reinforced Plastic X.F. Fang, T. Kloska and D. Heidrich	700
Preliminary Study on the Onset of Necking Detection Using DIT in Tensile Tests D. Palomo, A.J. Martínez-Donaire, J.A. López Fernández, M. Borrego and C. Vallellano	710
Increasing the Forming Limits in Hole Flanging of Dual-Phase (DP) 1000 Steel Using Punch Rotation L.I. Besong, J. Buhl, S. Härtel and M. Bambach	717
Analysis of the Part Quality and Process Stability when Producing Metallic Micro Parts by Multi-Stage Bulk Forming from Sheet Metal M. Kraus and M. Merklein	724
Analysis of Side-Wall Wrinkling in Deep Drawing Processes S.R. Dal and H. Darendeliler	732
A Materials Science-Based Approach to Finite Element Simulation of Warm-Forming of Al-Mg-Zn Alloys F. Grabner and J. Österreicher	744
Numerical Study to Promote the Residual Stresses Development during ISF Process with Improvement in Two Point Incremental Die Forming M.J. Afzal and J. Buhl	752

Influence of Macro-Structured Tools on the Formability of Aluminum Alloys in the Cryogenic Temperature Range M. Tulke, A. Wolf, R. Lafarge, F. Grunow and A. Brosius	760
Numerical Modelling of Conventional and Incremental Forming of Thin-Walled Tube C. Suntaxi, G. Centeno, A. Rosa-Sainz, D. Morales-Palma and C. Vallellano	768
Relevance of Symmetry Assumptions in the 3D Numerical Modeling of a Flowformability Test N.M.R. Kauta, P. Bouchard and K. Mocellin	776
Effects of Temperature on Deep Drawing of an Aluminum Alloy for Different Yield Criteria and Hardening Models R.H. Demirkol and H. Darendeliler	784
Analysis of the Possibility of Forming Stiffening Ribs in Litecor Metal-Plastic Composite Using the Single Point Incremental Forming Method A. Kubit, M. Korzeniowski, M. Bobusia, K. Ochalek and J. Slota	802
Prediction of Forming Forces for Incremental Micro-Forming Using Finite Element Analysis A. Bansal, R. Cheng, M. Banu, A. Taub and J. Ni	815
Design of Single Point Incremental Forming for a Motorcycle Headlight Fairing Manufacture O. Wiessler and H. Long	822
Identification of Influencing Factors in Machine Hammer Peening with Consideration of Lubricant Influences L. Uhlmann, R. Mannens, I.F. Weiser, T. Herrig and T. Bergs	834
Imprinting of Micro-/Nano-Textures onto Metals and Alloys with Use of the Laser-Printed DLC-Die T. Aizawa and T. Inohara	843
In Process Measurement Techniques Based on Available Sensors in the Stamping Machines for the Automotive Industry I. Peinado-Asensi, N. Montes and E. García	853
Innovative Online Measurement and Modelling Approach for Property-Controlled Flow Forming Processes L. Kersting, B. Arian, J.R. Vasquez, A. Trächtler, W. Homberg and F. Walther	862
Analysis of Thickness Distributions Calculated from Surface Strains Obtained through Digital Image Correlation for Incremental Sheet Forming M. Vanhulst, H. Vanhove, Y. Carette, S. Waumans and J.R. Duflou	875

Chapter 6: Formability of Metallic Materials

Prediction of Forming Limit Diagram Using the Marciniak-Kuczynski Method for Ti-6Al-4V Using Different Material Models C. Lonardi, L. Corallo and P. Verleysen	885
Modeling of Deep Rolling as a Distortion Compensation Strategy during Profile Grinding C. Schieber, M. Hettig, M.F. Zaeh and C. Heinzl	897
Failure Prediction of Automotive Components Utilizing a Path Independent Forming Limit Criterion A. Barlo, M. Sigvant, N. Manopulo, M.S. Islam and J. Pilthammar	906
Local Formability of Different Advanced High Strength Steels F.H. Shen, H.S. Wang, H. Xu, W.Q. Liu, S. Münstermann and J.H. Lian	917
Work-Hardening Behavior of a ZX10 Magnesium Alloy Sheet under Monotonic and Reverse Loadings T. Hama, K. Higuchi, H. Yoshida and Y. Jono	926
Drawing Capability of High Formable Packaging Steel: Comparison of Limiting Drawing Ratio and Forming Limit Curve F. Knieps, M. Köhl and M. Merklein	933
Effect of Temperature and Strain Rate on Formability of Titanium Alloy KS1.2ASN R. Sikhamov, V. Ventzke, F. Dorn, B. Klusemann, N. Ben Khalifa and N. Kashaev	939
Determination of Forming Limit Curves - Strain Path and Failure Analysis D. Kohl and M. Merklein	947

Investigation of the Influence by Size Effects on the Material Characterization of the Uniaxial Compression Stress State P. Hetz, M. Kraus and M. Merklein	955
Application of the DIC System to Build a Forming Limit Diagram (FLD) of Multilayer Materials P. Lisiecka-Graca, M. Kwiecień, Ł. Madej, J. Majta and K. Muszka	963
On the Anisotropic Mechanical Response of Ti6Al4V Sheet at High Strain Rates L. Corallo and P. Verleysen	970
Surface Quality and Mechanical Properties in Drawn Stainless Steel Profile Wires Caused by Process Parameters M. Kwiecień, J. Majta, M. Rumiński, J. Kawalko and K. Muszka	980
Material Parameters Sensitivity on Springback Modelling of Simple Bending Process G.J. Béres, Z. Lukács and M. Tisza	992
DIC Strain Monitoring during Fatigue of Cold-Formed High Strength Steel S. Gothivarekar, A. Van Bael, R. Talemi and S. Coppieters	1000
Influence of the Anisotropic Behavior on Equibiaxial Paths F.F. Salles, M.C. Oliveira, D.M. Neto, J.L. Alves, L.F. Menezes and J.V. Fernandes	1007
Experimental Investigation of Factors Influencing the Determination of the Onset of Yielding by Temperature Measurement S. Vitzthum, M. Gruber, J. Rebelo-Kornmeier, M. Hofmann and W. Volk	1021
Investigation of the Plane Strain Behaviour of a Laser-Heat Treated Aluminium Alloy A. Piccininni, A. Lattanzi, M. Rossi and G. Palumbo	1030
A Novel Method for the Determination of High Temperature FLCs of ECAP-Processed Aluminum AA5083 Sheet Metal M. Gruber, P. Leitner, M. Auer, C. Illgen, P. Frint, M.F.X. Wagner and W. Volk	1039
A Critical Evaluation of Forming Limit Curves Regarding Layout of Bending Processes P. Frohn-Sörensen, D. Nebeling, J. Reuter and B. Engel	1051
Bulging of Isotropic Materials H. Godoy, B. Revil-Baudard and O. Cazacu	1061
Finite Element Analysis of AA 6016-T4 Sheet Metal Forming Operations Using a New Polycrystalline Model B. Revil-Baudard, O. Cazacu and N. Chandola	1067
Deep-Drawing of Commercially-Pure Niobium Sheet K. Chen, M. Kim, P. Carriere, J. Penney, N. Gopal Matavalam, S. Kutsaev and Y.P. Korkolis	1075
Investigation of the Tube Expansion Test with Elastomer Using Locally Overaged AA6063 Tubes A. Piccininni, M.B. Silva and G. Palumbo	1083
Characterization of Yield Surface Evolution of AZ31 from Shear to Equibiaxial Tension Y.S. Lou, J. Zhang, C. Zhang and J.W. Yoon	1093
Study on the Effect of Anisotropy on Plastic Flow Localization of Third Generation Advanced High Strength Steel M. Butuc, G. Vincze, R. Santos, A. Pereira, A. dos Santos and R. Amaral	1100
On the Effect of the Tension-Compression Ratio on Forming of Isotropic Materials M.C. Oliveira, I. Prcela, V. Cvitanić, D.M. Neto, J.L. Alves and L.F. Menezes	1108
Fine Blanking Limits of Manganese-Boron-Steel in Fine Blanking Compared to Tempered Steel with Variation of Sheet Metal Temperature I.F. Weiser, T. Herrig and T. Bergs	1122

Chapter 7: Friction and Wear in Forming Processes

Application of Calcium Carbonate as Green Lubricant Additive in Sheet Metal Forming Ú. Arinbjarnar, M. Moghadam and C.V. Nielsen	1133
Near-Net Forging of Titanium and Titanium Alloys by the Plasma Carburized SKD11 Dies T. Aizawa, S. Ishiguro, T. Shiratori and T. Yoshino	1143
Method for the Estimation of Wear Resistance Curves in Sheet Metal Forming with Uncoated Tools Y.T. Wu, R.Z. Li and P. Groche	1151

FEA Approach for Wear and Damage Prediction of Tools for the Progressive Die Stamping of Steel Washers E. Kaya, D. Farioli and M. Strano	1168
Load-Adapted Surface Modifications to Increase Lifetime of Forging Dies H. Paschke, M. Weber, K. Brunotte, M. Rothgänger, T. Petersen, M. Siegmund and J. Peddinghaus	1178
Non-Uniform Effect of the Contact Conditions on the Earing Profile in Cylindrical Cups of Anisotropic Materials D.M. Neto, M.C. Oliveira, R.E. Dick, J.L. Alves and L.F. Menezes	1188
Performance Evaluation of Lubricants with Swift Cup Drawing N. Demazel, A. Kacem, S. Thuillier, H. Laurent, P. Briend and J. Masse	1195
Slider on Sheet Tester Development for Characterizing Galling J. Venema, F. Korver and T. Chezan	1204
<i>In Situ</i> Wear Measurement of Hot Forging Dies Using Robot Aided Endoscopic Fringe Projection P. Middendorf, M. Rothgänger, J. Peddinghaus, K. Brunotte, J. Uhe, B.A. Behrens, L. Quentin, M. Kästner and E. Reithmeier	1211

Chapter 8: Composites Forming Processes

A Hypoelastic Approach for Simulating the Independent Bending Behavior of Textile Composite within the Stress Resultant Shell B. Chen, P. Boisse, J. Colmars and N. Naouar	1223
The Influence of the Sample Size of Bias Extension Tests on the Results of Forming Simulations of Fiber-Reinforced Thermoplastics J. Graef and B. Engel	1234
A Crystallization Kinetic Model for Long Fiber-Based Composite with Thermoplastic Semicrystalline Polymer Matrix N. Bigot, M. Boutaous, S.H. Xin and N. Hamila	1240
Simulation of Wrinkling during Forming of Binder Stabilized UD-NCF Preforms in Wind Turbine Blade Manufacturing P.H. Broberg, C. Krogh, E. Lindgaard and B.L.V. Bak	1248
Comprehending the Bending: A Comparison of Different Test Setups for Measuring the Out-of-Plane Flexural Rigidity of a UD Fabric C. Krogh, P.H. Broberg, J. Kepler and J. Jakobsen	1257
Numerical Evaluation of Press Forming Parameters and Mould Geometry in Wood Plastic Composite (WPC) Products S. Matthews, P. Tanninen, A. Toghyani, V. Leminen and J. Varis	1268
On the Effect of Release Agent and Heating Time on Tool-Ply Friction of Thermoplastic Composite in Melt E.R. Pierik, J.L.G. Liddiard, W.J.B. Grouve, S. Wijskamp and R. Akkerman	1276
Evaluation of the Patternability of Fibre-Based Materials with Converting Experiments P. Tanninen, V. Leminen, S. Matthews, M. Merabtene and J. Varis	1284
Cold Spray Metallization of Hybrid Thermoplastic - Thermoset Fiber Reinforced Composite H. Parmar, R. Della Gatta, A. Viscusi, F. Tucci, A. Astarita and P. Carlone	1293
Robotic-Assisted Measurement of Fabrics for the Characterization of the Shear Tension Coupling K.R. Langat, E. De Luycker, F. Noureddine and M. Rakotondrabe	1303
Quantitative Assessment of Reactive and Non-Reactive Binder Systems on First Ply Adhesion for Dry Fiber Placement Processes F. Helber, S. Carosella and P. Middendorf	1317
Mechanical Behaviour of Magnesium Alloy Based - Fiber Metal Laminates after Fabrication Using Different Metal Surface Treatments Z. Liu, E. Simonetto, A. Ghiotti and S. Bruschi	1327
Effect of the Geometries on the Fabric's Formability R. Azzouz and S. Allaoui	1336

Frictional and Cohesion Behavior of Natural Tows in Order to Assess the Tow Sliding during Composite Forming	
M.M. Salem, E. De Luycker, M. Fazzini and P. Ouagne	1343
Flow Behaviour of Carbon Fibre Sheet Moulding Compound	
C.C. Qian, H. Yuan, M. Jesri, M. Khan and K.N. Kendall	1350
Formability Experiments for Unidirectional Thermoplastic Composites	
D. Brands, L.G. di Genova, E.R. Pierik, W.J.B. Grouve, S. Wijskamp and R. Akkerman	1358
Capillary Driven Saturation of Textile Reinforcing Structures Proposal for an Extension of Lucas-Washburn Equation	
R. Schledjewski, Y. Blöchl and S. Neunkirchen	1372
Post-Forming Limits of Carbon Fibre Reinforced Thermoplastic Tubular Structures in a Rotary Draw Bending Process	
M.Y. Li, C. Stokes-Griffin, S. Sommacal and P. Compston	1379
Large Scale Forming of Non-Crimp Fabrics for Aerostructures	
C. Jimenez Martin, V. Maes, T. McMahon and J. Kratz	1387
Towards 3D Process Simulation for <i>In Situ</i> Hybridization of Fiber-Metal-Laminates (FML)	
C.T. Poppe, H.O. Werner, M. Kruse, H. Chen, N. Ben Khalifa, F. Henning and L. Kärger	1399
Investigation of the Membrane Behavior of UD-NCF in Macroscopic Forming Simulations	
B. Schäfer, S. Haas, P. Boisse and L. Kärger	1413
Anomaly Detection during Thermoplastic Composite Infusion: Monitoring Strategy through Thermal Sensors	
P. Le Bot, G. Lebreton, N. Siddig, P. Couarraze, O. Fouché, C. Sébastien, A. De Fongalland, F. Cara and P. Gérard	1423
Defects Reduction in the Robotic Layup Process	
A. Gambardella, V. Esperto, F. Tucci and P. Carlone	1437
Offline Robot-Path-Planning and Process Simulation for the Structural Analysis of Coreless Wound Fibre-Polymer Composite Structures	
S. Hügler, E. Genc, J. Dittmann and P. Middendorf	1445

Chapter 9: Innovative Joining by Forming Technologies

In-Mold-Assembly of Hybrid Bending Structures by Compression Molding	
T. Stallmeister and T. Tröster	1457
Further Development of an Adaptive Joining Technique Based on Friction Spinning to Produce Pre-Hole-Free Joints	
C. Wischer and W. Homberg	1468
Realtime Prediction of Self-Pierce Riveting Joints - Prognosis and Visualization Based on Simulation and Machine Learning	
T. Falk, C. Schwarz and W.G. Drossel	1479
Investigations on Combined <i>In Situ</i> CT and Acoustic Analysis during Clinching	
D. Köhler, R. Stephan, R. Kupfer, J. Troschitz, A. Brosius and M. Gude	1489
The Effect of the Setting Force on the Fatigue Resistance of a Blind Rivet Nut Set in CFRP	
A. Van de Velde, J. Ivens, J. Maeyens and S. Coppieters	1498
Influence of the Surrounding Sheet Geometry on a Clinched Joint	
S. Martin, K. Kurtusic and T. Tröster	1505
Experimental and Numerical Investigation on Manufacturing-Induced Pre-Strain on the Load-Bearing Capacity of Clinched Joints	
C.R. Bielak, M. Böhnke, M. Bobbert and G. Meschut	1516
Analysis of Machine-Sided Influences during Clinching	
T. Grimm and W.G. Drossel	1527
Influence of the Sheet Edge Condition on the Fracture Behavior of Riv-Bonded Aluminum-Magnesium Joints	
J. Domitner, Z. Silvayeh, J. Predan, F. Jerenec, P. Auer, J. Stippich, L. Ferlič, P. Štefane, C. Sommitsch and N. Gubelj	1541
Preliminary Study of FSW Process of Dissimilar Aluminium Alloys in Battery Pack Assembly for Hybrid Vehicles Production	
F. Napolitano, F. Scherillo, A. El Hassanin, V. Esperto, P. Carlone, A. Squillace, R. Casarin and C. Verde	1549

Data-Based and Analytical Models for Strength Prediction of Mechanical Joints N. Vancraeynest, M. Jäckel, S. Coppieters and W.G. Drossel	1556
Functionality Study of an Optical Measurement Concept for Local Force Signal Determination in High Strain Rate Tensile Tests M. Böhnke, E. Unruh, S. Sell, M. Bobbert, D. Hein and G. Meschut	1564

Chapter 10: Machining and Cutting

Characterization of Abrasion and Erosion Mechanisms during Abrasive Waterjet Machining of Hard Metals R. Morisset, P. Gilles, G. Cohen and M. Gregoire	1575
Influence of the Workpiece Material and Cooling Condition on the Texture Obtained through Ultrasonic Vibration-Assisted Machining R. Bertolini, I. Castagnotto, A. Ghiotti and S. Bruschi	1581
Nitrogen Supersaturation into AISI420 Mold for Precise Machining T. Aizawa, H. Morita and T. Fukuda	1591
Drillability of Magnesium-Based Fiber Metal Laminates Obtained via Hot Metal Pressing with Different Metal Surface Treatments L. Lizzul, R. Bertolini, M. Sorgato, A. Ghiotti and S. Bruschi	1601
Numerical and Experimental Investigations in Orthogonal Milling of 15-5PH Stainless Steel G. Methon, C. Courbon, R. M'Saoubi, M. Girinon and J. Rech	1609
Influence of Coulomb's Friction Coefficient in Finite Element Modeling of Orthogonal Cutting of Ti6Al4V N. Kugalur Palanisamy, E. Rivière Lorphèvre, P.J. Arrazola and F. Ducobu	1619
Tribocorrosion Behavior of Ti6Al4V Machined and Burnished Components for Biomedical Application G. Rotella, M.R. Saffioti, M. Sanguedolce, D. Umbrello and L. Filice	1629
Cutting Force in Drilling with Flat Bottom Drill S. Tamura and T. Matsumura	1636
Fabrication of Anti-Icing Surface Structures on Aluminum Alloy for Aerospace Applications A. Cholkar, R. McCann, D. Kinahan and D. Brabazon	1643
Experimental Analysis of Circular Milling for Material Identification in Aerospace Industry S. Deshpande, A.C. Araujo, P. Lagarrigue and Y. Landon	1650
Comparative Study of the Drilling Operation in Duplex Stainless Steels with Drills of Two and Three Cutting Edges J. Marouvo, P. Ferreira and F. Simões	1660
Optimization of Machining Process for Improved Sustainability G. Rotella, R. Franchi and A. Del Prete	1671

Chapter 11: Non-Conventional Processes

Selected Aspects of Surface Integrity of Inconel 625 Alloy after Dry-EDM in Carbon Dioxide A. Żyra, S. Skoczypiec and R. Bogucki	1681
On the Suitability of Induction Heating for the Manufacture of Reinforced Aluminum Foam Structures A. Formisano, L. Boccarusso, M. Durante, F. Galise, A. Langella, B. Palmieri and A. Viscusi	1689
Experimental Investigation of the Effect of EDM Debris Particles Mixed into the Dielectric Fluid on Tool Feed Rate in Drilling-EDM M. Risto, U. Wasmuth and J. Kotschenreuther	1696
Synthesis of ZnO and CuO Nanowires by Thermal Oxidation on Metallic Substrates M.M. Arafat, A.S.M.A. Haseeb, S. Rozali, D. Brabazon, B.M.A. Rahman, K.T.V. Grattan and S. Naher	1703
Mechanical Behavior of Innovative Reinforced Aluminum Foam Panels M. Durante, L. Boccarusso, L. Carrino, A. Formisano and A. Viscusi	1713
Recycling of Powders from Cutting of Medium Density Fiberboard F. Quadrini, D. Bellisario, L. Iorio, A. Proietti, M. Regi and S. Loredana	1719

Impact of Die Coatings on Forming Conditions in Electromagnetic Embossing of Thin Sheet Metal	
B. Beckschwarte, J. Heidhoff, L. Langstädtler, C. Schenck, O. Riemer and B. Kuhfuss	1725
Evaluating the Corrosion Resistance of Inconel 625 Coatings, Processed by Compact Plasma Spray, for Applications in Concentrating Solar Power Plants	
F. Rubino, D. Merino, C. Munez and P. Poza	1736
Thermal Barrier Coatings (TBCs) Produced by Air Plasma Spray: Repair by Grinding and Waterjet (WJ) Processes	
L. Boccarusso, M. Durante, A. Formisano, A. Langella and F.M.C. Minutolo	1746
Friction Stir Welding of Thin Sheets of the AA2024-T3 Alloy with a Ceramic Tool: RSM and ANOVA Study	
P. Mysliwiec and R.E. Śliwa	1756
Influence of the Laser Welding Direction of Thin DP600 and the Residual Stresses Relaxation Obtained by Simulation and Neutron Diffraction	
M.R. Liu, A. Kouadri-Henni and B. Malard	1762
Special Features of the Non-Conventional Cutting (ECM, EDM) of Wool-Like Material Structures	
H.P. Schulze, M. Herzig, O. Kroening and H. Schiedung	1770
Evaluation of the Rheological Behaviour of Magnetorheological Fluids Combining Bulge Tests and Inverse Analysis	
A. Cusanno, A. Piccininni, P. Guglielmi and G. Palumbo	1778
Bond Strength of Co-Bonded Thermoplastic Leading Edge Protection (LEP): The Effect of Processing-Driven Interphase Morphology	
O. Erartsin, J. Zanjani and I. Baran	1786
CNT/2009Al Aluminum Matrix Composite Sheet Forming for a V-Shaped Skin Part	
B.S. Liu, F.C. Cao, Y.S. Zeng, W. Wu, D.R. Ni and R. Pan	1795
Numerical Analyses of Deformation Mechanisms in a Novel Dimensional Calibration Technique for Thin-Walled, Open Extrusions	
X.Y. Zhou, J. Ma and T. Welo	1802
Investigation of the Forming Behavior of Copper Wires for the Compaction of Windings for Electric Machines	
M. Halwas, F. Wirth and J. Fleischer	1809

Chapter 12: Polymers Processing and Thermomechanical Properties

Comparison of Conventional and Conformal Cooling Channels in the Production of a Commercial Injection-Moulded Component	
M. Kariminejad, M. Kadivar, M. McAfee, G. McGranaghan and D. Tormey	1821
Observations of Polymer Foam Development during Rotational Moulding	
A. Pritchard, P. Martin, M. McCourt, M. Kearns and E. Cunningham	1832
Numerical Simulation of Recycled PET Preforms Infrared Heating Including Force Convection Effect in the Industrial ISBM Ovens	
A.D. Le, R. Gilblas, Y. Le Maout and F. Schmidt	1842
Rapid Heat Control for Thermoplastic Injection Tooling Using Lattice Structures as Heat Exchanger	
A. Lepoivre, D. Edelin, N. Baudin, J. Soto, M. Villière, B. Redais, D. Delaunay and V. Sobotka	1850
Towards a Holistic Approach for an Efficient Determination of the Rheological Behavior of Sheet Molding Compounds for Process Simulation	
A.J. Imbsweiler, Y. Shinoura, D. Colin, S. Zaremba and K. Drechsler	1864
Role of Viscosity on Optimum Polymer-Fibre Interaction during Rotational Moulding Sintering	
D. Castellanos, P. Martin, M. McCourt, M. Kearns, J. Butterfield and P. Cassidy	1874
A Two-Temperature Model Based on Fin-Approximation for Transient Longitudinal Heat Transfer in Unidirectional Composite	
G. Dusserre	1882
Numerical and Experimental Study of Polymers Microwaves Heating	
P.J. Fesharaki, M. Boutaous and S.H. Xin	1890

Measurement and Analysis of Deformation Behavior of Polyethylene Tube Subjected to Linear Loading and Unloading Stress Paths with Large Strain	
S. Kubo, T. Kuwabara, T. Sumiyama, T. Kobayashi, K. Fruichi and C. Nonomura	1900
Measurement of Biaxial Deformation Behavior and Material Modeling for HI-PVC Using Multiaxial Tube Expansion Test	
S. Obuchi, S. Kubo and T. Kuwabara	1907
A New Solution for Viscosity Identification in a Polymer Production Line via Convection Analysis	
Q. Lin, N. Allanic, M. Girault, R. Deterre and P. Mousseau	1914

Chapter 13: Materials Behaviour Modelling

Characterization and Modelling of Sheet Material with Graded Strength for more Accurate Finite Element Analysis	
M. Lenzen, M. Kraus and M. Merklein	1923
Combined Probabilistic Approach and Stress State Dependency on the Failure Modeling of HPDC Aural-2 Alloy	
Y.F. Zhang, F.H. Shen, J. Zheng, S. Münstermann and W.J. Han	1931
Damage Analysis of Hybrid Composites Under Multi-Impact Loads: An Experimental and Numerical Study	
M. Bruno, L. Carrino, F. Donadio, L. Esposito, V. Lopresto, I. Papa and A. Viscusi	1939
Numerical and Experimental Investigations on the Mechanical Properties of Milled Specimens from an AA7020 Tube	
J. Reblitz, F. Reuther, R. Tr��n, V. Kr��usel and M. Merklein	1949
Numerical Investigation of Al-Reinforced CFRP Composite under Low-Velocity Impact	
M.P. Falaschetti, N. Zavatta, F. Rondina, E. Troiani and L. Donati	1959
Establishment of Thermal Deformation Constitutive Equation of TA15 Titanium Alloy	
S. Guo, G. Yang, Y.W. Zhai, L.Y. Zhou, G.J. Hao and D.H. Qiu	1969
Influence of the Grain Boundary Curvature Model on Cellular Automata Static Recrystallization Simulations	
S. Niewczas, M. Sitko and L. Madej	1977
Fracture Prediction of Third Generation Advanced High Strength Steels Using Hosford-Coulomb Damage Model	
M. Jimenez, A. dos Santos, R. Amaral, D.J. Cruz and J.C. de S��	1986
On Considering the Influence of Kinematic Hardening in Finite Element Simulation of Hot Levelling of Structural Steel Heavy Plates	
N.K. Baru, M. Laugwitz, M. Jochum and J. Lohmar	1993
Periodic Homogenization in Crystal Plasticity: A Comparative Study between 3D and 2D	
S. Mirhosseini, S. Perdahcioglu, C. Soyarslan and T. van den Boogaard	2004
Work Hardening of Metallic Sheets under Tension-Compression and Simple Shear Reverse Loading	
D.J. Cruz, A.F.G. Pereira, V.M. Sim��es, R. Amaral, A. dos Santos and M.C. Oliveira	2012
A Model to Construct and Predict Flow Curve of Materials from Compression Test Results with Machine Learning Models Using Python	
T. Aydin, F. Kocat��rk and D. Zeren	2022
Intelligent Iterative Experimental Design to Achieve Maximum Model Quality for Phase Change of 22MnB5	
T. Hart-Rawung, J. Buhl, S. H��rtel and M. Bambach	2031
Estimation of the Effective Magnetic Properties of Two-Phase Steels	
C. Soyarslan, J. Havinga, L. Abelmann and T. van den Boogaard	2040
FE Crash Modeling of Aluminum-FRP Hybrid Components Manufactured by a Hybrid Forming Process	
S. Jayakumar, L. Stolz, S. Anand, A. Hajdarevic and X.F. Fang	2050
The Virtual Fields Method to Indirectly Train Artificial Neural Networks for Implicit Constitutive Modelling	
R. Louren��o, A. Andrade-Campos and P. Georgieva	2060
Modelling the Effect of Barrier Layers on the Tensile Properties of Paperboard Materials for Liquid Packaging	
P. Singh, A. Ghiotti, E. Simonetto and S. Bruschi	2069

Influence of Plastic Deformation on the Hydrogen Embrittlement Susceptibility of Dual Phase Steels	
A. Drexler, B. Helic, Z. Silvayeh, C. Sommitsch, K. Mraczek and J. Domitner	2077
Fracture Characterization of Advanced High Strength Steel USS CR980XG3 Using Phase-Field Diffusive Approach in Ductile Solids	
E. Azinpour, M. Jimenez, A. dos Santos and J.C. de Sá	2092
Crystal Plasticity Modeling of Al Alloy under Linear and Non-Linear Loading	
R.F. Juan, W.Q. Liu, X.G. Inza, X.D. Ureta, J. Mendiguren and J.H. Lian	2099
Viscoplastic Self-Consistent (VPSC) Modeling for Predicting the Deformation Behavior of Commercial EN AW-7075-T651 Aluminum Alloy	
J. Domitner, R.H. Buzolin, S. Patil, P. Auer, N. Papenberg, E. Kabliman, Z. Silvayeh, A. Drexler and F. Grabner	2109
Investigation on Homogeneous Modeling of Gyroid Lattice Structures: Numerical Study in Static and Dynamic Conditions	
E. Mancini, M. Utzeri and M. Sasso	2119

Chapter 14: Lionel Fourment MS on Optimization and Inverse Analysis in Forming

Error Estimation of the 3D Reconstruction of a Displacement Field from DIC Measurements	
M.G. Oliveira, A. Lattanzi, S. Thuillier, A. Andrade-Campos and M. Rossi	2129
Extension of a Simulation Model of the Freeform Bending Process as Part of a Soft Sensor for a Property Control	
S.C. Stebner, D. Maier, A. Ismail, M. Dölz, B. Lohman, W. Volk and S. Münstermann	2137
On the Identification of Material Constitutive Model Parameters Using Machine Learning Algorithms	
A. Marques, A. Pereira, B. Ribeiro and P.A. Prates	2146
Variance-Based Sensitivity Analysis of the Biaxial Test on a Cruciform Specimen	
A.F.G. Pereira, M.C. Oliveira, J.V. Fernandes and P.A. Prates	2154
Identification of Anisotropic Yield Functions Using FEMU and an Information-Rich Tensile Specimen	
Y. Zhang, A. Andrade-Campos and S. Coppieters	2162
Data-Driven Derivation of Sheet Metal Properties Gained from Punching Forces Using an Artificial Neural Network	
A. Schenek, M. Görz, M. Liewald and K.R. Riedmüller	2174
Calibration of the Elasto-Plastic Properties of Friction Stir Welded Blanks in Aluminum Alloy AA6082	
F. Tucci, A. Andrade-Campos, S. Thuillier and P. Carlone	2183
Material Parameter Identification of Elastoplastic Constitutive Models Using Machine Learning Approaches	
N. Bastos, P.A. Prates and A. Andrade-Campos	2193
A Method for Benchmarking of FEM Packages for Multi-Stage Sheet Metal Forming Simulations	
M. Strano, Q. Semeraro and M. Panzeri	2201
Identification of Swift Law Parameters Using FEMU by a Synthetic Image DIC-Based Approach	
J. Henriques, M. Conde, A. Andrade-Campos and J. Xavier	2211
Integrated Thermomechanical Characterization of Metals Using the Virtual Fields Method	
M. Rossi, A. Lattanzi and L. Morichelli	2222
On the Design of a Heterogeneous Mechanical Test Using a Nonlinear Topology Optimization Approach	
M. Gonçalves, A. Andrade-Campos and S. Thuillier	2228
Parameter Identification of Swift Law Using a FEMU-Based Approach and an Innovative Heterogeneous Mechanical Test	
M. Conde, J. Henriques, S. Coppieters and A. Andrade-Campos	2238
Formability Assessment of Variable Geometries Using Machine Learning - Analysis of the Influence of the Database	
C. Zimmerling, B. Fengler and L. Kärger	2247

Parameter Identification and Modeling of Hardening to Preserve Identical Predictions under Monotonic Loading	
Y.F. Yang, G. Vincze, C. Baudouin, H. Chalal and T. Balan	2258
In-Process Monitoring of Springback in Industrial Bending Using a Laser Sensor-Based Method	
X. He, J. Ma, S.A. Tronvoll and T. Welo	2266

Chapter 15: New and Advanced Numerical Strategies for Material Forming

Towards a Hybrid Twin Model to Obtain the Formability of a Car Body Part in Real Time	
I. Peinado-Asensi, N. Montes, E. García and A. Falcó	2277
Reduced FFT-Based Simulation of a Mechanically Loaded Clustered Microstructure Using an Adaptive Set of Fourier Modes	
J. Waimann, C. Gierden, A. Schmidt, B. Svendsen and S. Reese	2285
Numerical Investigation of Influence of Spot Geometry in Laser Peen Forming of Thin-Walled Ti-6Al-4V Specimens	
D. Pörtl, S. Keller, S. Chupakhin, S.T. Sala, N. Kashaev and B. Klusemann	2293
Modelling of Ceramic Particle Motion during Semi-Solid Forming of Aluminium Matrix Composites via CFD-DEM Four-Way Coupling	
M. Speth, J. Heine, K.R. Riedmüller and M. Liewald	2303
Real-Time Quality Control in Thin Glass Forming Using Infrared Thermography and Deep Learning	
A.T. Vu, P.A. Vogel, A. Siva Subramanian, T. Grunwald and T. Bergs	2312

Chapter 16: Sustainability on Material Forming

Fabrication of Billet from Aluminum Alloys AA 2011-T3/7075 Chips through Friction Stir Consolidation	
A. Latif, G. Ingarao, R. Di Lorenzo and L. Fratini	2325
A Simulative Method for Studying the Bonding Condition of Friction Stir Extrusion	
S. Bocchi, G. D'Urso, C. Giardini and G. Maccarini	2333
Analysis, Prediction and Reduction of Emissions in an Industrial Hot Forming Process Chain for the Manufacture of Sheet Metal Components	
M.C. Ghattamaneni, S. Wernicke, T.S. Hainmann, H. Sulaiman and A.E. Tekkaya	2342
A Preliminary Investigation of Energy Consumption for Turning Ti6Al4V EBM Cylindrical Parts	
E. Cozzolino, A. Astarita, R. Borrelli, S. Franchitti, V. Lopresto and C. Pirozzi	2355
Resistance Heating by Means of Direct Current for Resource-Saving CO₂-Neutral Hot Stamping	
B.A. Behrens, S. Hübner, L. Albracht and E. Farahmand	2363
Enabling Sustainability in Glass Optics Manufacturing by Wafer Scale Molding	
C. Strobl, P.A. Vogel, A.T. Vu, H. Mende, T. Grunwald, R.H. Schmitt and T. Bergs	2371
Improvement of Package Properties with Formed Functional Surface Features	
V. Leminen, P. Tanninen, A. Pesonen and S. Matthews	2382
An Approach for an Innovative 3D Steel Strip Straightening Machine for Curvature and Saber Compensation	
F. Bader, L. Bathelt, E. Djakow, C. Henke, W. Homberg and A. Trächtler	2391
Innovative Assistance System for Setting up a Mechatronic Straightening Machine	
L. Bathelt, F. Bader, E. Djakow, C. Henke, A. Trächtler and W. Homberg	2397