

# **8th International Conference on Micromanufacturing (ICOMM 2013)**

Victoria, Canada  
25 – 28 March 2013

ISBN: 978-1-5108-1020-4

**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© remains with the authors.  
All rights reserved.

Printed by Curran Associates, Inc. (2015)

International Institution for Micromanufacturing-I2M2  
Northwestern University  
633 Clark Street  
Evanston, IL 60208

Phone: (847) 491-3263  
Fax: (847) 491-3915

k-ehmann@northwestern.edu

**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

## Technical Program for Tuesday March 26, 2013

<b>TuPP</b>	Pender Island
<b>Keynote Speech by Dr. Altintas</b>	Plenary Session
Chair: Jun, Martin Byung-Guk	Univ. of Victoria

<b>TuA1</b>	Pender Island South
<b>Session 01: Micro Cutting</b>	Regular Session
Chair: Suzuki, Norikazu	Nagoya Univ.
Co-Chair: Li, Kuan-Ming	National Taiwan Univ.

10:20-10:45, Paper TuA1.1

<i>Estimation of Transient Cutting Temperature by Remote Thermocouple Sensing Technique</i> 1	
Wang, Chia	National Taiwan Univ.
Chu, Wei-Ying	National Taiwan Univ.
Li, Kuan-Ming	National Taiwan Univ.

10:45-11:10, Paper TuA1.2

<i>Characterization and Micro End Milling of Graphene Nano Platelet (GNP) and Carbon Nanotube (CNT) Filled Nanocomposites</i> 7	
Mahmoodi, Mehdi	Univ. of Calgary
TabkhPaz, Majid	Univ. of Calgary
Park, Simon	Univ. of Calgary

11:10-11:35, Paper TuA1.3

<i>Development of Elliptical Vibration System for Vibration Assisted Micro Machining</i> N/A	
Park, Chaneel	Univ. of Calgary
Oh, Shane	Univ. of Calgary
Park, Simon	Univ. of Calgary

11:35-12:00, Paper TuA1.4

<i>Surface Finish of Ball-End Milled Microchannels</i> 16	
Hung, Wayne	Texas A&M Univ.
Berestovskyi, Dmytro	Texas A&M Univ.

**TuA2**

Pender Island North

**Session 02: Injection Molding and Micro Features**

Regular Session

Chair: Ozdoganlar, Burak

Carnegie Mellon Univ.

Co-Chair: Coulter, John

Lehigh Univ.

10:20-10:45, Paper TuA2.1

*Elastomer Molding of Micro and Nano-Scale Features* 24

Onler, Recep

Carnegie Mellon Univ.

Gozen, Bulent Arda

Carnegie Mellon Univ.

Ozdoganlar, Burak

Carnegie Mellon Univ.

10:45-11:10, Paper TuA2.2

*The Sandwich Method for Fabrication of Thin-Film Polymers with through Features* 31

Khilwani, Rakesh

Carnegie Mellon Univ.

Gilgunn, Peter

Carnegie Mellon Univ.

Ozdoganlar, Burak

Carnegie Mellon Univ.

11:10-11:35, Paper TuA2.3

*Micro Injection Molded Microtopographic Polymer Plates Used to Mechanically Direct Stem Cell Activity* 37

Rodgers, John

Lehigh Univ.

Casey, Meghan

Lehigh Univ.

Jedlicka, Sabrina

Lehigh Univ.

Coulter, John

Lehigh Univ.

11:35-12:00, Paper TuA2.4

*The Application of Commercial Injection Molding Software to Micro-Component Design and Process Development* 44

Khalilian, Sina

Univ. of Calgary

Park, Simon

Univ. of Calgary

Freiheit, Theodor

Univ. of Calgary

**TuA3**

Galiano Room 233

**Session 03: Micro Grinding**

Regular Session

Chair: Mayor, J.Rhett

Georgia Inst. of Tech.

Co-Chair: Lee, Sang Won

Sung Kyun Kwan Univ.

10:20-10:45, Paper TuA3.1

*Stochastic Scale Effects in Microgrinding Wheel Static Topography Using Machine Vision* 51

Kunz, Jacob  
Mayor, J.Rhett

Georgia Inst. of Tech.  
Georgia Inst. of Tech.

10:45-11:10, Paper TuA3.2

*A Study on Micro-Grinding Tool Condition Diagnosis Using Wavelet Packet Decomposition and Back Propagation Neural Network Methods* 58

Li, Chengjun  
Lee, Pil-Ho  
Baek, Dae Seong  
Lee, Sang Won

Sungkyunkwan Univ.  
Sungkyunkwan Univ.  
Sungkyunkwan Univ.  
Sung Kyun Kwan Univ.

11:10-11:35, Paper TuA3.3

*Material Removal During Abrasive Impregnated Brush Deburring of Micromilled Grooves in NiTi Foils* 64

Mathai, George  
Melkote, Shreyes  
Rosen, David

Georgia Inst. of Tech.  
Georgia Inst. of Tech.  
George W. Woodruff School of Mechanical Eng, Georgia Inst. of

11:35-12:00, Paper TuA3.4

*Observation of Tool Life of Micro End Mills* N/A

Martin, Blair  
Morrow, Justin  
Pfefferkorn, Frank E.

Univ. of Wisconsin  
Univ. of Wisconsin - Madison, LAMSML  
Univ. of Wisconsin-Madison

**TuA4**

Gabriola Room 237

**Session 04: Micro EDM**

Regular Session

Chair: Chuang, Yin  
Co-Chair: Maity, Kalipada

Metal Industries Res. & Development Centre  
NATIONAL INSTITUTE OF Tech. ROURKELA, ODISHA

10:20-10:45, Paper TuA4.1

*A New Combined Process on Micro-EDM and Surface Polishing* 72

Tsai, Yao-Yang

National Taiwan Univ.

10:45-11:10, Paper TuA4.2

*Optimisation of Micro-EDM Operation for Fabrication of Micro-Holes in Inconel-718 Using GA and PCA Hybrid Approach* 78

Maity, Kalipada

NATIONAL INSTITUTE OF Tech. ROURKELA, ODISHA

11:10-11:35, Paper TuA4.3

*Optimization of Planetary Movement Parameters for Micro Hole Drilling by Micro EDM* 84

Guo, Xuejie Dalian Univ. of Tech.  
Yu, Zuyuan Dalian Univ. of Tech.  
Lv, Zhongwei Dalian Univ. of Tech.  
Li, Jianzhong Dalian Univ. of Tech.  
Natsu, Wataru Tokyo Univ. of Agriculture and Tech.

11:35-12:00, Paper TuA4.4

*The Development of Hybrid EDM Apparatus* 89

Chuang, Yin Metal Industries Res. & Development Centre

**TuB1**

Pender Island South

**Session 05: Micro Forming**

Regular Session

Chair: Lee, Deug Woo Pusan National Univ.

Co-Chair: Kim, Dong Sung POSTECH

13:00-13:25, Paper TuB1.1

*Fabrication of Spinnerets for Melt-Spun Shaped Microfibers Based on LIGA Process* 95

Park, Sung Jea Pohang Univ. of Science and Tech. (POSTECH)

Na, Moon-Hee Pohang Univ. of Science and Tech. (POSTECH)

Kim, Dong Sung POSTECH

13:25-13:50, Paper TuB1.2

*Study on Micro/nano Hierarchical Pattern Applied to Thin Film by Using Micro-Forming Process* 100

Lee, Sang Min Pusan National Univ.

Lee, Deug Woo Pusan National Univ.

Lee, Seung Jun Pusan National Univ.

Choi, Soochang Korea Inst. of Machinery & materials

13:50-14:15, Paper TuB1.3

*Meso and Micro-Scaled Progressive Forming of Bulk Parts Via Directly Using of Sheet Metals* 103

Fu, Ming Wang Department of Mechanical Engineering,  
The Hong Kong Polytechnic Uni

Chan, Wai Lun The Hong Kong Polytechnic Univ.

14:15-14:40, Paper TuB1.4

*Electropolymerization Based Micromanufacturing of Three-Dimensional High Surface Area Electrodes* 111

Ho, Vinh

Univ. of California Irvine

Perez-Gonzalez, Victor

Tecnologico de Monterrey

Kulinsky, Lawrence

UCI

Madou, Marc

Univ. of California

Martinez-Chapa, Sergio

Tecnologico de Monterrey, Mexico

**TuB2**

Pender Island North

**Session 06: Texture and Patterns**

Regular Session

Chair: Ro, Seung-Kook

Korea Inst. of Machinery and Materials

Co-Chair: Kim, Gap-Yong

Iowa State Univ.

13:00-13:25, Paper TuB2.1

*Manufacturing Smart Surface Texture for the Reduction of Friction Using Micro Abrasive Air Jet Machining* 116

Choi, Soochang

Korea Inst. of Machinery & materials

Ro, Seung-Kook

Korea Inst. of Machinery and Materials

Park, Jong Kweon

korea Inst. of machinery & materials

13:25-13:50, Paper TuB2.2

*Texture Transfer Method by Using Image Processing for Bio-Inspired Surface Fabrication* 122

Syahputra, Hendra P.

Yeungnam Univ.

Ko, Tae Jo

Yeungnam Univ.

13:50-14:15, Paper TuB2.3

*Novel Machining Technique for Surface Patterning by Diamond Turning* 126

Neo, Wee Keong

National Univ. of Singapore

Huang, Rui

National Univ. of Singapore

Kumar, A. Senthil

National Univ. of Singapore

Rahman, Mustafizur

National Univ. of Singapore

14:15-14:40, Paper TuB2.4

*Generation of Parallel Micro-Channels on Cylindrical Surfaces Using Elliptical Vibration Texturing* 132

Guo, Ping

Northwestern Univ.

Ehmann, Kornel

NORTHWESTERN Univ.

**TuB3**

Galiano Room 233

**Session 07: Thin Films and Metals**

Regular Session

Chair: Subbiah, Sathyan

Nanyang Tech. Univ.

Co-Chair: Samuel, Johnson

Rensselaer Pol. Inst. (RPI)

13:00-13:25, Paper TuB3.1

*Sol-Gel Synthesis of ZrO<sub>2</sub> Coatings for Micro End Milling* 138

Morrow, Justin

Univ. of Wisconsin - Madison, LAMSML

Tejedor-Anderson, Isabel

Univ. of Wisconsin-Madison

Anderson, Marc

Univ. of Wisconsin-Madison

Pfefferkorn, Frank E.

Univ. of Wisconsin-Madison

13:25-13:50, Paper TuB3.2

*Indentation of Highly Oriented Pyrolytic Graphite Parallel to Basal Plane* 145

Buddhika, Jayasena

Nanyang Tech. Univ.

Subbiah, Sathyan

Nanyang Tech. Univ.

13:50-14:15, Paper TuB3.3

*Magnetic Pulse Cutting of Micro Metal Foils* 150

Kuhfuss, Bernd

Univ. of Bremen, Faculty of Production  
Engineering–Germany

Schenck, Christian

Univ. of Bremen, Faculty of Production  
Engineering

Wilhelmi, Philipp

Univ. of Bremen

Langstaedtler, Lasse

Univ. of Bremen

14:15-14:40, Paper TuB3.4

*Investigation on a Microextrusion Process of Parallel Protrusions from Metal Strip* 156

Stellin, Tommaso

Univ. of Erlangen-Nuremberg

Engel, Ulf

Univ. of Erlangen-Nuremberg

Merklein, Marion

Univ. of Erlangen-Nuremberg

**TuB4**

Gabriola Room 237

**Session 08: Laser Processing**

Regular Session

Chair: Chen, Jenq Shyong Micahel

National Chung Hsing Univ.

Co-Chair: Bordatchev, Evgueni

National Res. Council of Canada

13:00-13:25, Paper TuB4.1

*Fabrication of Long Period Gratings in Pure Silica Fiber and Their Application in Refractive Index Sensing* 162

Ahmed, Farid

Univ. of Victoria, Mechanical Engineering



Jun, Seungwon	Univ. of Victoria
Wild, Peter	Univ. of Victoria
Jun, Martin Byung-Guk	Univ. of Victoria

13:25-13:50, Paper TuB4.2

*Design and Fabrication of Stent with Negative Poisson's Ratio* 168

Bhullar, Sukhwinder	Univ. of Victoria
Choi, Gabriel	UVIC
Jun, Martin Byung-Guk	Univ. of Victoria

13:50-14:15, Paper TuB4.3

*Fabrication of Micro-Structures on Stainless Steel Using Femto-Second Laser Direct Writing Technology* 174

Chen, Jenq Shyong Micahel	National Chung Hsing Univ.
---------------------------	----------------------------

14:15-14:40, Paper TuB4.4

*An Analytical Model for Calculating the Temperature Distribution and Determining the Laser Forming Mechanism* 180

Lok, Morgan	Keio Univ.
Aoyama, Hideki	Keio Univ.

**TuC1**

Pender Island South

**Session 09: Micro Machines and Systems**

Regular Session

Chair: Kim, Gap-Yong	Iowa State Univ.
Co-Chair: Park, Simon	Univ. of Calgary

15:00-15:25, Paper TuC1.1

*Design of Magnetically Suspended Micro Spindle for 5-DOF Oscillation Micro Milling* 186

Ro, Seung-Kook	Korea Inst. of Machinery and Materials
Choi, Soochang	Korea Inst. of Machinery & materials
Khim, Gyungho	Korea Inst. of Machinery and Materials
Park, Jong Kweon	korea Inst. of machinery & materials

15:25-15:50, Paper TuC1.2

*Design and Characterization of Flextensional Stage Based on Terfenol-D Actuator* 191

Witthauer, Adam	Iowa State Univ.
Kim, Gap-Yong	Iowa State Univ.
Faidley, LeAnn	Iowa State Univ.
Zou, Qingze	Rutgers Univ.

15:50-16:15, Paper TuC1.3

*Process Chain for the Manufacture of Polymeric Tubular Micro-Components and "POLYTUBES Micro-Factory" Concept* 198

Qin, Yi	Univ. of Strathclyde
Perzon, Erik	Swerea IVF, AB
Chronakis, Ioannis	Tech. Univ. of Denmark, Lyngby
Calderon, Ivan	Sysmelec S.A.
Konrad, Konstantin	Fraunhofer Inst. IPA

**TuC2**

Pender Island North

**Session 10: Laser Machining and Polishing**

Regular Session

Chair: Pfefferkorn, Frank E.	Univ. of Wisconsin-Madison
Co-Chair: Bordatchev, Evgueni	National Res. Council of Canada

15:00-15:25, Paper TuC2.1

*Micro-Polishing of Inconel 718 by Picosecond Laser* 206

Hafiz, Abdullah M.	Western Univ.
Bordatchev, Evgueni	National Res. Council of Canada
Tutunea-Fatan, Remus O.	Western Univ.

15:25-15:50, Paper TuC2.2

*Irregular, Adaptive Scan Trajectories for Pulsed Laser Micro Polishing* 213

Vadali, Madhu	Univ. of Wisconsin-Madison
Ma, Chao	Univ. of Wisconsin-Madison
Li, Xiaochun	Univ. of Wisconsin-Madison
Pfefferkorn, Frank E.	Univ. of Wisconsin-Madison
Duffie, Neil	Univ. of Wisconsin-Madison

15:50-16:15, Paper TuC2.3

*Effect of Thermocapillary Flow on the Surface Profile in Pulsed Laser Micro Polishing* 220

Ma, Chao	Univ. of Wisconsin-Madison
Vadali, Madhu	Univ. of Wisconsin-Madison
Duffie, Neil	Univ. of Wisconsin-Madison
Pfefferkorn, Frank E.	Univ. of Wisconsin-Madison
Li, Xiaochun	Univ. of Wisconsin-Madison

**TuC3**

Galiano Room 233

**Session 11: Laser Forming and Machining**

Regular Session

Chair: Castagne, Sylvie

Nanyang Tech. Univ.

Co-Chair: Jun, Martin Byung-Guk

Univ. of Victoria

15:00-15:25, Paper TuC3.1

*Influence of Process Parameters on the Deformation of Copper Foils in Flexible- Pad Laser Shock Forming* 228

Nagarajan, Balasubramanian

Nanyang Tech. Univ.

Castagne, Sylvie

Nanyang Tech. Univ.

Wang, Zhongke

Singapore Inst. of Manufacturing Tech.

15:25-15:50, Paper TuC3.2

*Numerical Modeling of Excimer Laser Curved Surface Ablation* 234

Garg, Vivek

IIT Bombay

Marla, Deepak

IIT Bombay

Saxena, Ishan

Northwestern Univ.

Joshi, Suhas

Indian Inst. of Tech. Bombay

15:50-16:15, Paper TuC3.3

*Excimer Laser Micromachining on Polymers under Different Atmospheres and at Different Length Scales* 240

Akhtar, Syed Nadeem

Indian Inst. of Tech. Kanpur

Ramakrishna, S Anantha

Indian Inst. of Tech. Kanpur

Janakarajan, Ramkumar

IIT Kanpur

**TuC4**

Gabriola Room 237

**Session 12: Micro Forming Modeling**

Regular Session

Chair: Fu, Ming Wang

Department of Mechanical Engineering,  
TheHongKongPolytechnic Univ.

Co-Chair: Gelin, Jean-Claude

FEMTO-ST Inst. Univ. of Franche-Comte

15:00-15:25, Paper TuC4.1

*Effect of Grain Size on Mechanical Properties and Springback Be-Havior of Thin Metal Sheets with Varying Reduction Ratios* 245

Jiang, Cho-Pei

National Formosa Univ.

15:25-15:50, Paper TuC4.2

*A Hybrid Fracture Prediction Model of Multiphase Metals in Micro Scaled Forming Processes* 251

Ran, Jiaqi

The Hong Kong Pol. Univ.

Fu, Ming Wang

Department of Mechanical Engineering,  
The Hong Kong Polytechnic Uni

15:50-16:15, Paper TuC4.3

*Characterization of Rheological Behaviour of 316L Stainless Steel Feedstock and Numerical Results of Mixing Process Using Fluid-Structure Interaction Method* 257

Gelin, Jean-Claude

FEMTO-ST Inst. Univ. of Franche-Comte

## Technical Program for Wednesday March 27, 2013

### WeA1

Pender Island South

### Session 13: Micro Forming

Regular Session

Chair: Moumi, Eric

Univ. of Bremen, Faculty of Production Engineering

Co-Chair: Korkolis, Yannis

Univ. of New Hampshire

08:20-08:45, Paper WeA1.1

*Study of Residual Stress in Silicon Steel under Rivet Forming Process by Using the Numerical Simulation* 263

Lee, Rong-Shean

Department of Mechanical Engineering, National Cheng-Kung Univ.

Chu, Yu-Yi

Department of Mechanical Engineering, National Cheng-Kung Univ.

Lee, Hwa-Teng

Department of Mechanical Engineering, National Cheng-Kung Univ.

Chen, Hung-Sheng

Department of Mechanical Engineering, National Cheng-Kung Univ.

Tu, Kuo-Yin

Metal Industries Res. & Development Centre

Wang, Hsin-Te

Metal Industries Res. and Development Centre

Wey, Jiang-Ming

Metal Industries Res. & Development Centre

Huang, Kun-Min

Metal Industries R&D Center

08:45-09:10, Paper WeA1.2

*Influence of the Number of Impacts During Incremental Forming on the Mechanical Properties of Copper Wires* 269

Moumi, Eric

Univ. of Bremen, Faculty of Production Engineering

Kuhfuss, Bernd

Univ. of Bremen, Faculty of Production Engineering–Germany

Bomas, Hubert

IWT, Stiftung Inst. fuer Werkstofftechnik, Univ. of Brem

Koehler, Bernd

IWT, Stiftung Inst. fuer Werkstofftechnik, Univ. of Brem

09:10-09:35, Paper WeA1.3

*Investigation of Strain Gradients and Temperatures During Electrically-Assisted Microbending* 276

Kinsey, Brad

Univ. of New Hampshire

Jordan, Adam

Univ. of New Hampshire

09:35-10:00, Paper WeA1.4

*Surface Texturing in Titanium Alloy by Electrically-Assisted Micro-Rolling* 280

Ng, Man Kwan

Northwestern Univ.

Magargee, James

Northwestern Univ.

Fan, Rong

Northwestern Univ.

Gao, Robert X.

Univ. of Connecticut

Cao, Jian

Northwestern Univ.

**WeA2**

Pender Island North

**Session 14: Injection Molding**

Regular Session

Chair: Ito, Hiroshi

Yamagata Univ.

Co-Chair: Barriere, Thierry

femto-st

08:20-08:45, Paper WeA2.1

*Replication of Micronic and Submicronic Structured Surfaces Using Micro-Injection and Micro-Injection Compression Molding* 286

Barriere, Thierry

femto-st

08:45-09:10, Paper WeA2.2

*Injection Molded Nano Petri Dishes: A New Platform for Studying Cell-Nanoengineered Surface Interaction* 292

Cha, Kyoung Je

Pohang Univ. of Science and Tech. (POSTECH)

Na, Moon-Hee

Pohang Univ. of Science and Tech. (POSTECH)

Kim, Dong Sung

POSTECH

09:10-09:35, Paper WeA2.3

*Surface Replication of Microneedle Features in Micro Injection Molding* 296

Ito, Hiroshi

Yamagata Univ.

09:35-10:00, Paper WeA2.4

*Mass Production of Single Polymeric Micro Parts Due to Micro Injection Molding and X-Ray LIGA Mold Inserts* 302

Heneka, Jochen

Karlsruhe Inst. of Tech. (KIT)

**WeA3**

Galiano Room 233

**Session 15: Micro EDM and ECM**

Regular Session

Chair: Rajurkar, K.P

Univ. of Nebraska-Lincoln

Co-Chair: Park, JeongWoo

Chosun Univ.

08:20-08:45, Paper WeA3.1

*Micro-EDM Pulse Energy Distribution Ratio Determination* 305

Shao, Bai

Univ. OF NEBRASKA-LINCOLN

Rajurkar, K.P

Univ. of Nebraska-Lincoln

08:45-09:10, Paper WeA3.2

*Electrochemical Polishing of Microcomponents* 311

Hung, Wayne

Texas A&M Univ.

Berestovskyi, Dmytro

Texas A&M Univ.

09:10-09:35, Paper WeA3.3

*Vibration Electrochemical Polishing for Minimizing Surface Defects* 317

Kim, UkSu

Chosun Univ.

Park, JeongWoo

Chosun Univ.

09:35-10:00, Paper WeA3.4

*Effect of Material Microstructure on the Micro-EDM Process* 323

Elkaseer, Ahmed

Cardiff Univ.

Bigot, Samuel

Cardiff Univ.

Surleraux, Anthony

Cardiff Univ.

Rosochowski, Andrzej

Design, Manufacture and Engineering  
Management, Univ. of St

**WeB1**

Pender Island South

**Session 16: Micro Milling Processes**

Regular Session

Chair: Wiens, Gloria

Univ. of Florida

Co-Chair: Gilbin, Alexandre

FEMTO-ST Inst. UMR CNRS 6174

10:20-10:45, Paper WeB1.1

*Calculation and Simulation of Chip Ploughing Volumes in Micro Ball-End Mill Machining* 331

Luo, Shan

Univ. of Victoria

Bayesteh, Abdolreza

Univ. of Victoria, Mechanical Engineering

Jun, Martin Byung-Guk

Univ. of Victoria

Dong, Zuomin

Univ. of victoria

10:45-11:10, Paper WeB1.2

*Influence of Feed Rate in Micro-Milling Studied from Experiments and Micro-Cutting Laws Identification* 338

Gilbin, Alexandre	FEMTO-ST Inst. UMR CNRS 6174
Fontaine, Michael	FEMTO-ST Inst. UMR CNRS 6174, ENSMM Besançon
Thibaud, Sébastien	FEMTO-ST / Franche-Comté Univ.
Michel, Gerard	ENSMM
Picart, Philippe	FEMTO-ST, UMR CNRS 6174, Univ. of Franche-Comté, Besançon

11:10-11:35, Paper WeB1.3

*Demonstration of Advanced Capabilities of 5-Axis Micromilling: Geometries with High-Aspect Ratio And/or Optical Surface Quality* 344

Bordatchev, Evgueni	National Res. Council of Canada
Tauhiduzzaman, Mohammed	National Res. Council of Canada
Kugler, Till	Kugler GmbH
Katz, Alexander	Kugler GmbH
Bohr, Roland	Kugler GmbH

11:35-12:00, Paper WeB1.4

*Prevention of Self-Excited Vibrations in End-Milling by Actively Tuning Fixture Stiffness Using Fixed-Fixed Beams under Axial Load* 350

Moore, Paul	Univ. of Florida
Wiens, Gloria	Univ. of Florida

## WeB2

Pender Island North

### Session 17: Micro Cutting

Regular Session

Chair: Kapoor, Shiv G.	Univ. of Illinois - Urbana Champaign
Co-Chair: Lu, Ming-Chyuan	National Chung Hsing Univ.

10:20-10:45, Paper WeB2.1

*Performance Evaluation of Meso-Scale CBN Flexible Cutting Tool When Machining Micro-Grooves in Steel* 356

Raghavendra, Hari	Univ. of Illinois at Urbana chamapign
Kapoor, Shiv G.	Univ. of Illinois - Urbana Champaign

10:45-11:10, Paper WeB2.2

*Fundamental Study on Tool Damage in High-Speed Ceramic Milling of Inconel* 364  
718

Enmei, Risa	Nagoya Univ.
Suzuki, Norikazu	Nagoya Univ.
Shamoto, Eiji	Department of Mechanical Science and Engineering, Nagoya Univ.



Yu, Hasegawa	Guidance & Propulsion Div. Aerospace Systems, Mitsubishi Hea
Shibata, Ryota	Guidance & Propulsion Div. Aerospace Systems, Mitsubishi Hea
Hatano, Yuki	Cutting Tools Div. NGK Spark Plug Co., Ltd.
Itakura, Kazuhisa	Cutting Tools Div. NGK Spark Plug Co., Ltd.

11:10-11:35, Paper WeB2.3

*Analysis of Cutting Path Effect on Spindle Vibration Based Tool Wear Monitoring System in Micro Milling* 371

Huang, Ci-Rong	National Chung Hsing Univ.
Lu, Ming-Chyuan	National Chung Hsing Univ.

11:35-12:00, Paper WeB2.4

*Development of a Abnormality Remote Monitoring System for Micro Machining* 378

Wang, Shih-Ming	CHUNG YUAN CHRISTIAN Univ.
Ho, Chien-Da Ho	chung yuan christian Univ.
Yen, Chuntai	Innovative DigiTech-Enable Applications & Services Inst. III

### **WeB3**

Galiano Room 233

### **Session 18: Micro-Scale Processes and Systems**

Regular Session

Chair: Samuel, Johnson	Rensselaer Pol. Inst. (RPI)
Co-Chair: Jun, Martin Byung-Guk	Univ. of Victoria

10:20-10:45, Paper WeB3.1

*Hydrophobic Hierarchical Structure Manufacturing by Femtosecond Laser Ablation* N/A

Rukosuyev, Maxym	Univ. of Victoria, Mechanical Engineering
Lee, Jason	Univ. of Victoria
Jun, Martin Byung-Guk	Univ. of Victoria

10:45-11:10, Paper WeB3.2

*Manufacturing Process of Narrow Distribution Micro Alloy Powder* 384

Komatsu, Takafumi	Komatsuseiki Kosakusho
-------------------	------------------------

11:10-11:35, Paper WeB3.3

*A Fundamental Study and Modeling of the Micro-Droplet Formation in Near-Field Electro-Hydrodynamic Jet Printing* 390

Carter, William	Rensselaer Pol. Inst.
Popell, G. Colin	Rensselaer Pol. Inst.
Samuel, Johnson	Rensselaer Pol. Inst. (RPI)

11:35-12:00, Paper WeB3.4

*Conductive Thin Film Assisted Focused Ion Beam Fabrication of Nanofeatures on Insulating Materials* 398

Joe, Hang-Eun	Yonsei Univ.
Park, Jaehyeung	Yonsei Univ.
Kim, Seonghyun	Yonsei Univ.
Lee, Sang Jo	Yonsei Univ.
Min, Byung-Kwon	Yonsei Univ.

**WePP**

Pender Island

**Keynote Speech by Dr. Cho**

Plenary Session

Chair: Park, Simon

Univ. of Calgary

**WeC1**

Pender Island South

**Session 19: Tissue Engineering**

Regular Session

Chair: Willerth, Stephanie

Univ. of Victoria, Mechanical Engineering

Co-Chair: Kim, Jong Young

Andong National Univ.

14:20-14:45, Paper WeC1.1

*Development of Solid Freeform Fabrication-Based Multi-Head Tissue/organ Building System for Osteochondral Tissue Regeneration* 404

Shim, Jin-Hyung	POSTECH
Lee, Jung-Seob	POSTECH
Kim, Jong Young	Andong National Univ.
Cho, Dong-Woo	POSTECH

14:45-15:10, Paper WeC1.2

*Fabrication of Complex Shaped Scaffold Using Sacrificial Layer Process for Auricular Regeneration* 409

Lee, Jung-Seob	POSTECH
Jung, Jin Woo	POSTECH
Hong, Jung Min	POSTECH
Shim, Jin-Hyung	POSTECH
Oh, Jeong-Hoon	The Catholic Univ. of Korea
Cho, Dong-Woo	POSTECH

15:10-15:35, Paper WeC1.3

*Nanofabrication of Electrospun Fibers for Controlled Release of Retinoic Acid* 413

Mohtaram, Nima	Univ. of Victoria, Mechanical Engineering
Ko, Junghyuk	Univ. of Victoria
Carlson, Michael	Univ. of Victoria
Jun, Martin Byung-Guk	Univ. of Victoria
Willerth, Stephanie	Univ. of Victoria, Mechanical Engineering

**WeC2** Pender Island North  
**Session 20: Additive Manufacturing** Regular Session

Chair: Chen, Yong	Univ. of Southern California
Co-Chair: Baldacchini, Tommaso	Newport Corp.

14:20-14:45, Paper WeC2.1

*Fast Micro-Stereolithography Process Based on Bottom-Up Projection for Complex Geometry* 419

Chen, Yong	Univ. of Southern California
------------	------------------------------

14:45-15:10, Paper WeC2.2

*Recent Development in Two-Photon Lithography* 427

Baldacchini, Tommaso	Newport Corp.
----------------------	---------------

15:10-15:35, Paper WeC2.3

*Geometric Qualification of Polymer Micro and Meso-Scale Features Fabricated by UV-Based Additive Manufacturing* 433

Hao, Bohan	Carnegie Mellon Univ.
Korkmaz, Emrullah	Carnegie Mellon Univ.
Bediz, Bekir	Carnegie Mellon Univ.
Ozdoganlar, Burak	Carnegie Mellon Univ.

**WeC3** Galiano Room 233  
**Session 21: Microfabrication** Regular Session

Chair: Bhiladvala, Rustom	Univ. of Victoria
Co-Chair: Park, Simon	Univ. of Calgary

14:20-14:45, Paper WeC3.1

*Micro-Imprinting Onto DLC and CNT Coatings Via High Density Oxygen Plasma Etching* 440

Aizawa, Tatsuhiko	Shibaura Inst. of Tech.
Mizushima, Kento	Shibaura Inst. of Tech.
Redationo, Tugur	Univ. of Brawijaya

14:45-15:10, Paper WeC3.2

*Manufacturing of Micro-Pyramid Patterns and Verification of Their Optical Effects* 448

Jeon, Eun-chae	Korea Inst. of Machinery and Materials
Lee, Je-Ryung	Korea Univ.
Woo, Sangwon	Seoul National Univ. of Science and Tech.
Park, Eun-Sok	Korea Inst. of Machinery and Materials
Kim, Hwi	Korea Univ.
Je, Tae-Jin	Korea Inst. of Machinery and Materials
Yoo, Yeong-Eun	KIMM
Whang, Kyung-Hyun	Korea Inst. of Machinery and Materials

15:10-15:35, Paper WeC3.3

*High-Speed Fabrication of Microchannels Using Line-Based Laser Induced Plasma Micromachining (L-LIPMM)* 454

Saxena, Ishan	Northwestern Univ.
Malhotra, Rajiv	Northwestern Univ.
Ehmann, Kornel	NORTHWESTERN Univ.
Cao, Jian	Northwestern Univ.

**WeD1**

Pender Island South

**Session 22: Micro Cutting Modeling**

Regular Session

Chair: Araujo, Anna Carla	UFRJ / COPPE
Co-Chair: Annoni, Massimiliano	Pol. di Milano

16:00-16:25, Paper WeD1.1

*Micro Milling Cutting Forces on Machining Aluminium Alloy* 460

Araujo, Anna Carla	UFRJ / COPPE
Mougo, Adriane Lopes	COPPE/UFRJ
Campos, Fabio Oliveira	COPPE/UFRJ

16:25-16:50, Paper WeD1.2

*Effect of the Tool Locus on the Cutting Thickness in the Ball Endmill Process* 466

Ono, Takenori	Kyushu Sangyo Univ.
---------------	---------------------

16:50-17:15, Paper WeD1.4

*Experimental Verification of a Slip-Line Field Model of Orthogonal Cutting in the Microscale* 472

Annoni, Massimiliano	Pol. di Milano
Biella, Gabriele	Pol. di Milano
Mayor, J.Rhett	Georgia Inst. of Tech.
Rebaioli, Lara	Pol. di Milano
Semeraro, Quirico	Dipartimento di Meccanica, Pol. di Milano

<b>WeD2</b>	Pender Island North
<b>Session 23: Nano Manufacturing</b>	Regular Session

Chair: Cao, Jian	Northwestern Univ.
Co-Chair: Brousseau, Emmanuel	Cardiff Univ.

16:00-16:25, Paper WeD2.1

*Towards CNC Automation in AFM Probe-Based Nano Machining* 480

Brousseau, Emmanuel	Cardiff Univ.
Arnal, Benoit	Arts et Metiers ParisTech
Thiery, Stephane	Arts et Metiers ParisTech
Nyiri, Eric	Arts et Metiers ParisTech
Gibaru, Olivier	Arts et Metiers ParisTech
Mayor, J.Rhett	Georgia Inst. of Tech.

16:50-17:15, Paper WeD2.3

*An Experimental Analysis of Diamond Tip Wear During Nanomilling of Single Crystal Silicon* 488

Gozen, Bulent Arda	Carnegie Mellon Univ.
Ozdoganlar, Burak	Carnegie Mellon Univ.

16:50-17:15, Paper WeD2.4

*Micro-Scale Mechanical Testing of Non-Woven Carbon Nanotube Sheets and Yarns* 495

Magargee, James	Northwestern Univ.
Morestin, Fabrice	INSA-Lyon
Cao, Jian	Northwestern Univ.
Jones, Justin S.	NASA Goddard Space Flight Center

<b>WeD3</b>	Galiano Room 233
<b>Session 24: Electrospinning</b>	Regular Session

Chair: Jeong, Young Hun	Korea Pol. Univ.
Co-Chair: Kulinsky, Lawrence	UCI

16:00-16:25, Paper WeD3.1

*Fabrication of Nanofibrous Patterns Using Direct-Write Electrospinning* 501

Jeong, Young Hun

Korea Pol. Univ.

16:25-16:50, Paper WeD3.2

*Parametric Studies of Melt Electrospinning Poly  $\epsilon$  (caprolactone) Fibers for Tissue Engineering Applications* 507

Ko, Junghyuk

Univ. of Victoria

Mohtaram, Nima

Univ. of Victoria, Mechanical Engineering

Lee, Patrick C.D.

Dow chemical company

Willerth, Stephanie

Univ. of Victoria, Mechanical Engineering

Jun, Martin Byung-Guk

Univ. of Victoria

16:50-17:15, Paper WeD3.3

*Fabrication of Aligned and Suspended Carbon Fibers with Electro-Mechanical Spinning* 513

Canton, Giulia

Univ. of California Irvine

Kulinsky, Lawrence

UCI

Madou, Marc

Univ. of California

## Technical Program for Thursday March 28, 2013

### ThA1

Pender Island South

#### Session 25: Micro Cutting

Regular Session

Chair: Ozdoganlar, Burak

Carnegie Mellon Univ.

Co-Chair: Matsumura, Takashi

Tokyo Denki Univ.

08:20-08:45, Paper ThA1.1

*Microstructural Analysis of Ultrasonic Vibration Assisted Turning of Ti Alloy Ti-6Al-4V* 520

Patil, Sandip

Bharat Forge Ltd. Pune

Joshi, Suhas

Indian Inst. of Tech. Bombay

Tewari, Asim

IIT Bombay

08:45-09:10, Paper ThA1.2

*Anisotropy in Micro Cutting of Sapphire* 526

Matsumura, Takashi

Tokyo Denki Univ.

Yamaguchi, Tetsuya

Tokyo Denki Univ.

Endo, Yuki

Tokyo Denki Univ.

09:10-09:35, Paper ThA1.3

*2-Dimensional Ploughing Simulation Model Development in Micro Flat End Milling* 532

Bayesteh, Abdolreza

Univ. of Victoria, Mechanical Engineering

Gym, Dan

Univ. of British Columbia

Jun, Martin Byung-Guk

Univ. of Victoria

09:35-10:00, Paper ThA1.4

*Adiabatic Cutting of Wires with Submillimeter Diameters* 538

Wilhelmi, Philipp

Univ. of Bremen

Kuhfuss, Bernd

Univ. of Bremen, Faculty of Production Engineering–  
Germany

Schenck, Christian

Univ. of Bremen, Faculty of Production Engineering

### ThA2

Pender Island North

#### Session 26: Micro Forming and Rolling

Regular Session

Chair: Ngaile, Gracious  
Co-Chair: Samuel, Johnson

North Carolina State Univ.  
Rensselaer Pol. Inst. (RPI)

08:20-08:45, Paper ThA2.1

*Study of Tribological Conditions in the Micro Contact Interface between Tool and Workpiece with Micro Asperity-Valley* 544

Nonaka, Tomohiro  
Sakata, Yutaka  
Marumo, Yasuo  
Ruan, Liquan  
Zhang, Qidi

Nishnippon Inst. of Tech.  
Nishinippon Inst. of Tech.  
Kumamoto Univ.  
Kumamoto Univ.  
Kumamoto Univ.

08:45-09:10, Paper ThA2.2

*Development of a Micro-Tube Hydroforming Die System* 550

Ngaile, Gracious

North Carolina State Univ.

09:10-09:35, Paper ThA2.3

*Modeling of Size Effects by Dislocation Density Based Non-Local Crystalline Plasticity* 556

Zhang, Haiming  
Dong, Xianghuai

Shanghai Jiao Tong Univ.  
Shanghai Jiao Tong Univ.

09:35-10:00, Paper ThA2.4

*Effect of Grain-Size on the Micro-Milling Responses of Aluminum-Silicon Carbide Composites* 563

Chu, Bryan  
Zhu, Can  
  
Samuel, Johnson  
Kim, Gap-Yong

Rensselaer Pol. Inst.  
Iowa State Univ. Department of Mechanical Engineering  
Rensselaer Pol. Inst. (RPI)  
Iowa State Univ.

### **ThA3**

Galiano Room 233

#### **Session 27: Micro Drilling**

Regular Session

Chair: Wuthrich, Rolf  
Co-Chair: Mativenga, Paul

Concordia Univ.  
The Univ. of Manchester

08:20-08:45, Paper ThA3.1

*Improving the Performance of Sequential Mechanical Micro Drilling for Nickel Base Super Alloys* 570

Mativenga, Paul  
Nair, Manu haridas

The Univ. of Manchester  
The Univ. of Manchester



08:45-09:10, Paper ThA3.2

*Burr Formation Analysis in High Speed Micro Drilling of Ti6Al4V* 576

Yadav, Shubham Indian Inst. of Tech. Bombay, Powai, Mumbai, Maharashtra  
Bajpai, Vivek Indian Inst. of Tech. Bombay  
Kashid, Milind Indian Inst. of Tech. Bombay  
Singh, Ramesh INDIAN Inst. OF Tech. BOMBAY, MUMBAI, INDIA.

09:10-09:35, Paper ThA3.3

*Towards Force Feedback Algorithms for SACE Glass Micro-Drilling* 584

Abou Ziki, Jana D. Concordia Univ.  
Wuthrich, Rolf Concordia Univ.

09:35-10:00, Paper ThA3.4

*Micro-Scale Drilling of Bulk Metallic Glass* 590

Zhu, James Univ. of Illinois: Urbana-Champaign  
Kim, Hyun J. Univ. of Illinois - Urbana Champaign  
Kapoor, Shiv G. Univ. of Illinois - Urbana Champaign

**ThB1**

Pender Island South

**Session 28: Sensors**

Regular Session

Chair: Park, Simon Univ. of Calgary  
Co-Chair: Kim, Woo Soo Simon Fraser Univ.

10:20-10:45, Paper ThB1.1

*Hybridizing Micromachining and Microfabrication for Sensor Chips* 598

Bhiladvala, Rustom Univ. of Victoria

10:45-11:10, Paper ThB1.2

*Carbon Nanotube (CNT) Nanocomposite Based Force Sensors* 603

Parmar, Kaushik Univ. of Calgary  
TabkhPaz, Majid Univ. of Calgary  
Park, Simon Univ. of Calgary  
Mostofa, Golam Univ. of Calgary

11:10-11:35, Paper ThB1.3

*Directly Printed Flexible Accelerometer with Silver Nano Inks* 611

Kim, Woo Soo Simon Fraser Univ.  
Lei, Chupeng Simon Fraser Univ.

11:35-12:00, Paper ThB1.4

*Development of Defect Detection System for Sheet Products* 617

Nonaka, Tomohiro

Nishnippon Inst. of Tech.

Sakata, Yutaka

Nishinippon Inst. of Tech.

Marumo, Yasuo

Kumamoto Univ.

**ThB2**

Pender Island North

**Session 29: Injection Molding Systems**

Regular Session

Chair: Dohda, Kuniaki

Northwestern Univ.

Co-Chair: Aizawa, Tatsuhiko

Shibaura Inst. of Tech.

10:20-10:45, Paper ThB2.1

*Demoulding Forces in Hot Embossing: Model Development and Validation* 623

Omar, Fuad

Cardiff Univ.

Elkaseer, Ahmed

Cardiff Univ.

Brousseau, Emmanuel

Cardiff Univ.

Kolew, Alexander

Karlsruhe Inst. of Tech.

Prokopovich, Polina

Cardiff Univ.

10:45-11:10, Paper ThB2.2

*Micro Mold-Stamping of Plastic Mini-Turbofans Via Table-Top CNC-Pressing System* 631

Aizawa, Tatsuhiko

Shibaura Inst. of Tech.

Nakajima, Mari

Shibaura Inst. of Tech.

Kurozumi, Shu-Ichi

Nano-Film Coat, Ilc.

Iwa, Shota

Micro-Forming Lab. Ilc.

Itoh, Kuniyoshi

Micro Fabrication Lab. LLC

11:10-11:35, Paper ThB2.3

*Manufacturing Guidelines for Micro Injection Molds* 639

Garcia, Gerardo Antonio

Tecnologico de Monterrey

Siller, Hector R.

Tecnologico de Monterrey

Medrano-Tellez, Alexis G.

Tecnologico de Monterrey

11:35-12:00, Paper ThB2.4

*Effect of Die Shape and Tribological Condition on Micro Extrusion of 6063 Aluminum Alloy* 646

Takatsuji, Norio

Univ. of Toyama

Dohda, Kuniaki

Northwestern Univ.

Makino, Takahiro  
Funaduka, Tatsuya

Univ. of Toyama  
Univ. of TOYAMA

11:35-12:00, Paper ThB2.5

*Ultra-Precision Grinding of Aspheric Cemented Carbide Lens Mold for Plastic Injection Molding* 653

Nemoto, Akihiko  
Murata, Yasuhiko  
Ohmori, Hitoshi  
Ito, Hitoshi

Yamagata Univ.  
Nippon Inst. of Tech.  
RIKEN  
Yamagata Univ.

**ThB3**

Galiano Room 233

**Session 30: Micro EDM and Micro Milling**

Regular Session

Chair: Fassi, Irene  
Co-Chair: Subbiah, Sathyan

National Res. Council  
Nanyang Tech. Univ.

10:20-10:45, Paper ThB3.1

*Field Induced Jet Micro-EDM* 659

Zhao, Wansheng  
Kang, Xiaoming  
Xu, Kaixian

Shanghai Jiao Tong Univ.  
Shanghai Jiao Tong Univ.  
Shanghai Jiao Tong Univ.

10:45-11:10, Paper ThB3.2

*Investigation of Fill Factor and Tool Path Effects on Micro-EDM Milling of Micro-Cavities* 664

Marrocco, Valeria  
Modica, Francesco  
Fassi, Irene

CNR-ITIA, Inst. of Industrial Tech.  
Inst. of Industrial Technology and  
Automation  
National Res. Council

11:10-11:35, Paper ThB3.3

*Evaluation of Rotating Probes for Acoustic Emission Contact Sensing* 670

Elfurjani, Salah  
Valinasab, Behzad  
Jun, Martin Byung-Guk

Univ. of Victoria, Mechanical Engineering  
Univ. of Victoria  
Univ. of Victoria

11:35-12:00, Paper ThB3.4

*Feasibility of Lignin As Additive in Metalworking Fluids* 676

Zhang, Yanqiao  
Jun, Martin Byung-Guk

Univ. of Victoria  
Univ. of Victoria