Technical Papers

- Multi response optimization of process parameters in electrical discharge machining using TOPSIS
  Salonica Sravani P and Vishnuvardhan Reddy D

- Experimental investigation on AL₂O₃ ceramics by powder mixed electrochemical discharge (PM-ECDM) process
  Dhanvijay MR and Ahuja BB

- Tool wear modeling in face milling using acoustic emission – artificial neural network approach
  Srinivasa Pai P and Rashmi P Shetty

Select Bibliography: Electrical Discharge Machining (EDM)

Photo Gallery: Vintage Machine: 19th Century Forming and Punching machinery used on sheet metal and heavy plate by Hilles & Jones Company, Wilmington, DEL

Calendar of Events

Technology Trends

Select Bibliography of Standards: EDM

Manufacturing Technology Abstracts

Patent Abstracts: Electrical Discharge Machining

1. Fabrication of micro spherical electrode by one pulse EDM and their application in electrochemical micromachining
   Liu, Yong; Cai, Huitao; Li, Hansong [J of Manufacturing Processes, V 17, 2015, Starting page 162, 9 Pages] Rec. No: 110549

2. Material removal mechanism in low-energy micro-EDM process
   Qian, Jun; Yang, Fei; Wang, Jun; Lauwers, Bert; Reynaerts, Dominiek [CIRP Annals, V 64, N 1, 2015, Starting page 225, 4 Pages] Rec. No: 110673

3. Real-time evaluation of gap flushing in electrical discharge machining
   Goodlet, Alexander; Koshy, Philip [CIRP Annals, V 64, N 1, 2015, Starting page 241, 4 Pages] Rec. No: 110672

4. Investigation on the influence of the dielectrics on the material removal characteristics of EDM
   Zhang, Yanzhen; Liu, Yonghong; Shen, Yang; Ji, Renjie; Li, Zhen; Zheng, Chao [J of Materials Processing Technology, V 214, N 5, 2014, Starting page 1052, 10 Pages] Rec. No: 110388

5. Study of EDM cutting of single crystal silicon carbide
   Zhao, Yonghua; Kunieda, Masanori; Abe, Kohzoh [Precision Engg, V 38, N 1, 2014, Starting page 92, 8 Pages] Rec. No: 109707

6. Macroscopic mechanical model of wire electrode deflection considering temperature increment in MS-WEDM process
   Zhang, Guojun; Chen, Zhi; Zhang, Zhen; Huang, Yu; Ming, Wuyi; Li, He [Int J of Machine Tools & Manufacture, V 78, 2014, Starting page 41, 13 Pages] Rec. No: 110384

7. Analysis and performance of slotted tools in electrical discharge drilling
   Nastasi, Ramy; Koshy, Philip [CIRP Annals, V 63, N 1, 2014, Starting page 205, 4 Pages] Rec. No: 110249

8. Compound machining of titanium alloy by super high speed EDM milling and arc machining
   Wang, Fei; Liu, Yonghong; Zhang, Yanzhen; Tang, Zemin; Ji, Renjie; Zheng, Chao [J of Materials Processing Technology, V 214, N 3, 2014, Starting page 531, 8 Pages] Rec. No: 110127

9. Fabrication of deep micro-holes in reaction-bonded SiC by ultrasonic cavitation assisted micro-EDM

10. Clarification of EDM gap phenomena using transparent electrodes
    Kitamura, Tomoo; Kunieda, Masanori [CIRP Annals, V 63, N 1, 2014, Starting page 213, 4 Pages] Rec. No: 110129

11. Micro-electrical discharge machining of polycrystalline diamond using rotary cupronickel electrode
    Yan, Jiawang; Watanabe, Kazunori; Aoyama, Tojiro [CIRP Annals, V 63, N 1, 2014, Starting page 209, 4 Pages] Rec. No: 110164

12. Simulation model of debris and bubble movement in consecutive-pulse discharge of electrical discharge machining

13. Experimental analysis on micro-electrical discharge machining performance using boron carbide (B4C) powder mixed dielectrics

14. Development of sleeve and spool assembly of hydraulic Spool valve by precision engineering

15. Debris and consequences in micro electric discharge machining of micro-holes
    Ekmekci, Bülent; Sayar, Atakan [Int J of Machine Tools & Manufacture, V 65, 2013, Starting page 58, 10 Pages] Rec. No: 109433

16. Mathematical and numerical modeling of the effect of input-parameters on the flushing efficiency of plasma channel in EDM process
    Shabgard, Mohammadreza; Ahmadi, Reza; Seyedzavvara, Mirsadegh; Nadimi Bavil Oliaei, Samad [Int J of Machine Tools & Manufacture, V 65, 2013, Starting page 79, 9 Pages] Rec. No: 109434

17. Building an EDM process model by an
instrumental variable approach based on two interactive Kalman filters
Zhou, Ming; Meng, Xianyi; Qin, Jianjun; Chen, Zhigang; Lian, Xiangjiao [Precision Engg, V 37, N 1, 2013, Starting page 146, 13 Pages] Rec. No: 109490

18. Study of unidirectional conductivity on the electrical discharge machining of semiconductor crystals
Mingbo, Qiu; Zhidong, Liu; Zongjun, Tian; Wei, Wang; Yinhui, Huang [Precision Engg, V 37, N 4, 2013, Starting page 902, 6 Pages] Rec. No: 109489

19. Applications of acoustic mapping in electrical discharge machining
Smith, Craig; Koshy, Philip [CIRP Annals, V 62, N 1, 2013, Starting page 171, 4 Pages] Rec. No: 109559

20. Development of an ultrathin BD-PCD wheel-tool for in situ microgroove generation on NAK80 mold steel

21. Analysis of the electrochemical behaviors of WC–Co alloy for micro ECM
Choi, Se Hwan; Kim, Bo Hyun; Shin, Hong Shik; Chung, Do Kwan; Chu, Chong Nam [J of Materials Processing Technology, V 213, N 4, 2013, Starting page 621, 10 Pages] Rec. No: 109764

22. Machining efficiency of powder mixed near dry electrical discharge machining based on different material combinations of tool electrode and workpiece electrode
Bai, Xue; Zhang, Qinhe; Zhang, Jianhua; Kong, Dezheng; Yang, Tingyi [J of Manufacturing Processes, V 15, N 4, 2013, Starting page 474, 9 Pages] Rec. No: 109763

23. Experimental investigation, intelligent modeling and multi-characteristics optimization of dry WEDM process of Al–SiC metal matrix composite
Fard, Reza Kashiry; Afza, Reza Azar; Teimouri, Reza [J of Manufacturing Processes, V 15, N 4, 2013, Starting page 483, 12 Pages] Rec. No: 109769

24. TEM study on the electrical discharge machined surface of single-crystal silicon
Murray, JW; Fay, MW; Kunieda, M; Clare, AT [J of Materials Processing Technology, V 213, N 5, 2013, Starting page 801, 9 Pages] Rec. No: 109817

25. Effect of metal coating on machinability of high purity germanium using wire electrical discharge machining

26. EDM turning using a strip electrode
Ki Young Song; Do Kwan Chung; Min Soo Park; Chong Nam Chu [J of Materials Processing Technology, V 213, N 9, 2013, Starting page 1495, 6 Pages] Rec. No: 109911

27. Effects of the condition of the tubular electrode on hole size and shape in micro deep hole electrical discharge machining
Balasubramanian, R; Ranjan, Prabhat; Borole, Vivek J; Kandaswamy, E; Suri, VK [Int J of Precision Technology, V 3, N 1, 2012, Starting page 3, 11 Pages] Rec. No: 108531


29. Setup Planning Automation for Six-Axis Wire Electrical Discharge Machining

30. Machinability studies on laser-sintered iron-silicon carbide metal matrix composites using wire electrical discharge machining

31. Investigation effect of the machining parameters on the material removal rate in the WEDM of AISI D3 tool steel.
Anburaj, R; Udayaparakash, J; Ezilarasan, C [Manufacturing Technology Today, V 11, N 6, 2012, Starting page 5, 10 Pages] Rec. No: 108776

32. Modeling and analysis of average cutting speed in WEDM of SiCp/6061 Al metal matrix composite.
NATIONAL

21 - 23 Sep 2016
Laser World of Photonics India Bangalore
BIEC - Bangalore International Exhibition Center, 10th Mile, Tumkur Road, 562123 Bangalore, Karnataka
Contact:
MMI India Pvt. Ltd.
5th Floor, Cardinal Gracias Road
400 052 Mumbai, India
Tel: +91 (2) 2 42554700  Fax: +91 (2) 2 42554719
Email: info@mmi-india.in
Web: www.mmi-india.in

22 - 24 Sep 2016
International exhibition on packaging material and technology
Pragati Maidan Exhibition Center, Mathura Road, 110002 New Delhi
Contact:
Koelnmesse YA Tradefair Pvt. Ltd.
Office 1102, 11th Floor DLH Park, S. V. Road
400067 Mumbai, India
Tel: +91 (0) 22 28715200
Fax: +91 (0) 22 28715222
Email: info@koelnmesse-india.com
Web: www.koelnmesse-india.com

23 - 25 Sep 2016
International exhibition & conference for automation & robotics
Auto Cluster Exhibition Center, Pune, Maharashtra
Contact:
IBK Media, 224, B Wing, Pranik Chambers, Sakinaka, Andheri East, 400072 Mumbai
Tel: +91 (2) 28574011  Fax: +91 (2) 28574011
Email: ajay.kumar@ibkmedia.com
Web: http://www.tradefairdates.com

29 Sep - 02 Oct 2016
Machine Tool Expo 2016 –Pune
Auto Cluster Exhibition, Centre, Pune
Contact:
Mahesh, T: +91 (0) 9886680466
E: Mahesh@imtma.in
Bangalore International Exhibition Centre (BIEC), 10th Mile, Tumkur Road, Madavara Post, Bangalore - 562 123, Karnataka
Tel: +91 80 6624 6600  Fax: +91 80 6624 6661
Web: info@imtma.in

05 - 07 Oct 2016
Bombay Convention & Exhibition Centre Western Express Highway, NESCO, Goregaon East, Mumbai, Maharashtra 400063
Contact:
Messe Duesseldorf, Stockumer Kirchstrasse 61 D-40474 Düsseldorf
Tel: +49 - 211 - 4560 900  Fax: +49 - 211 - 4560 668
Email: info@messe-duesseldorf.de
Web: http://eventegg.com/metallurgy-india/

06 - 07 Oct 2016
6th International Conference on ‘Additive Manufacturing Technologies-AM 2016
Hotel Lalit Ashok, Bengaluru
Contact:
Additive Manufacturing Society of India (AMSI)
#42, BSK 3rd Stage, 3rd Phase, 3rd Block 9th Cross, Bangalore-560 085
Tel: +91 9483717449
Fax: +91 80 26729437/ 32422663
Email: contact@amsi.org.in
Web: http://amsi.org.in

21 Oct 2016
Smart Manufacturing Summit
Hotel Le Meridien, New Delhi, India
Contact:
Confederation of Indian Industry, Lodi Road, New Delhi-110003, Visakhapatnam
Web: http://10times.com

07 - 11 Nov 2016
Intl Conf on Technologically Advanced Materials & Asian Meeting on Ferroelectricity (ICTAM-AMF10)
Conference Center, University of Delhi, Delhi
Contact: Prof. R. P. Tandon, General Chair,
ICTAM-AMF10  Tel:+91-9818229608
Email: amfnd10@gmail.com
Web: www.amf2016.in

11 - 13 Nov 2016
Umex Chennai: Trade fair for used machinery
Chennai Trade Center, Poonamali High Road, 600010 Chennai, Tamil Nadu
Contact:
ITEI International Trade and Exhibitions India Pvt. Ltd., E519 Floral Deck Plaza, Central MIDC Road, Opp SEEPZ, 400093 Mumbai
Tel: +91 (0) 22 28398000  Fax: +91 (0) 22 28390502
Email: info@itei.in  Web: www.itei.in
23 - 26 Nov 2016
International trade fair for engineering, machine tools, automation & automotive technology
Race Course Ground, Race Course Road, Sadar, Rajkot, Gujarat
Contact:
K & D Communication Ltd., 4th Floor, Chinubhai House, 7-B Amrutbaug Society, Ahmedabad
Tel: +91 (0)79 26469725 Fax: +91 (0)79 26403087
Email: events@kmgindia.com
Web: http://www.tradefairdates.com

29 Nov 2016
Edition of Manufacturing Summit
Trident Hotel, Mumbai
Contact:
Confederation of Indian Industry
Lodi Road, New Delhi-110003
Visakhapatnam, India
Web: http://www.eventseye.com

01 - 03 Dec 2016
Surface Technology India Mumbai
Bandra Kurla Complex, Mumbai, Maharashtra
Contact:
Hannover Milano Fairs India Pvt Ltd., No 13/16, Vatika Business Centre Wing B, 400076 Mumbai
Tel: +91 (0)22 42369710 Fax: +91 (0)22 42019191
Email: info@hmf-india.com
Web: www.hmf-india.com

01 - 03 Dec 2016
International exhibition for materials handling, intralogistics, storage and logistics
Bandra Kurla Complex, Maharashtra, 400051 Mumbai, Maharashtra
Contact:
Hannover Milano Fairs India Pvt Ltd., No 13/16, Vatika Business Centre Wing B, 400076 Mumbai
Tel: +91 (0)22 42369710 Fax: +91 (0)22 42019191
Email: info@hmf-india.com
Web: www.tradefairdates.com

12 - 15 Dec 2016
Intl trade fair for construction machinery, building material machines, mining machines and construction vehicles
NSIC Exhibition Ground, Okhla Industrial Estate, 110020 New Delhi
Contact:
MMI India Pvt. Ltd., 5th Fl., Cardinal Gracias Rd, 400 052 Mumbai
Tel: +91 (2) 2 42554700 Fax: +91 (2) 2 42554719
Email: info@mmi-india.in
Web: www.tradefairdates.com

28 Sep 2016
Exhibition of products of the process control, instrumentation, control and control technology
Friedrich–Ebert-Halle, Erzbergerstr. 89, 67063 Ludwigshafen, Rhineland-Palatinate, Germany
Contact:
Meorga GmbH, Sportplatzstr. 27 66809 Nalbach, Germany
Tel: +49 (0)6838 8960035 Fax: +49 (0)6838 983292
Email: info@meorga.de
Web: www.meorga.de

29 Sep - 01 Oct 2016
Trade fair for the professional metallurgy industry
Istanbul Fuar Merkez - IFM, IFM Istanbul Expo Center, Istanbul, Istanbul, Turkey
Contact:
Hannover-Messe Ankiros Fuarcilik A.S.
Abdullah Cevdet Sok 6/2, 06680 Ankara, Turkey
Tel: +90 (0)312 4396792 Fax: +90 (0)312 4396766
Email: info@ankiros.com
Web: www.ankiros.com

05 - 07 Oct 2016
Trade fair for mechanical components and materials technology
Intex Osaka International Exhibition Center, 1-5-102, Nanko-kita, Suminoe-ku, 531-6035 Osaka, Osaka, Japan
Contact:
Reed Exhibitions Japan Ltd.
1-26-2 Nishishinjuku 163-0570 Tokyo, Japan
Tel: + 81 (3) 33498501 Fax: + 81 (3) 33498599
Email: info@reedexpo.co.jp
Web: www.reedexpo.co.jp

10 - 13 Oct 2016
World's leading trade fair for automation in production and assembly
Messe Stuttgart, Messepiazza 1, 70629 Stuttgart, Baden-Wurttemberg, Germany
Contact:
Messe Sinsheim GmbH
Neulandstr. 27 74889 Sinsheim, Germany
Tel: +49 (0)7261 6890 Fax: +49 (0)7261 689220
Email: info@messe-sinsheim.de
Web: www.messe-sinsheim.de
AMB China Nanjing: Machine tools exhibition
Nanjing International Expo Center,
Yanshan Road, 210019 Nanjing, Jiangsu, China
Contact:
Messe Stuttgart China Ltd.
Room 13A, Huadu Mansion, 838 Zhangyang Road,
Pudong, 200122 Shanghai, China
Tel: +86 (0)21 50811929   Fax: +86 (0)21 50813069
Email: info@messe-stuttgart.com.cn
Web: www.messe-stuttgart.com.cn

International metal and steel trade fair for Southeast Asia
Jakarta International Expo, Arena PRJ Kemayoran,
14410 Jakarta, Jakarta, Java, Indonesia
Contact:
Messe Düsseldorf Asia Pte Ltd
3 HarbourFront Place
099254 Singapore, Singapore
Tel: +65 63329620    Fax: +65 63329655
Email: mdafairs@singnet.com.sg
Web: mda.messe-dusseldorf.com

25 - 29 Oct 2016
International technology exhibition for sheet metal working
Messe Hannover, Messegelände, 30521 Hanover,
Lower Saxony, Germany
Contact:
Mack Brooks Exhibitions Ltd.
Romeland House, Romeland Hill
AL3 4ET St Albans, United Kingdom of Great Britain and Northern Ireland
Tel: +44 (0)1727 814400    Fax: +44 (0)1727 814401
Email: info@mackbrooks.com
Web: www.mackbrooks.com

29 - 31 Oct 2016
5th International Conference on Material Science and Engineering Technology (ICMSET 2016)
Postal Code 113-8656 7-3-1 Hongo, Bunkyo-ku, Tokyo
Contact:
University of Tokyo, Japan
Tel: +86-13467777771
Email: icmset@sina.cn    Web: www.icmset.com

08 - 11 Nov 2016
Metal Expo Moscow: International industrial exhibition
All-Russian Exhibition Center (VVC), Estate 119,
129223 Moscow, Moscow, Russian Federation
Contact:
Expo-Park Exhibition, 165, 10, Krymsky val
119049 Moscow, Russian Federation
Tel: +7 (4)95 6579922   Fax: +7 (4)95 6057210
Email: mailbox@expopark.ru
Web: www.expopark.ru

15 - 18 Nov 2016
International exhibition and conference on additive technologies and tool making
Messe Frankfurt, Ludwig-Erhard-Anlage 1, 60327 Frankfurt, Hesse, Germany
Contact:
Mesago Messe Frankfurt GmbH
Rotebühlstr. 83-85
70178 Stuttgart, Germany
Tel: +49 (0)711 619460    Fax: +49 (0)711 6194691
Email: info@mesago.com
Web: www.mesago.de

17 - 20 Nov 2016
International exhibition for machine tools, industrial tools, welding and cutting equipment
CICC Cairo International Convention Center,
El Nasr Rd., 11757 Cairo, Cairo, Egypt
Contact:
International Fairs Group, 10 Fok, El Motawaset,
Osman Towers, Maadi, 11757 Cairo, Egypt
Tel: +20 (0)2 25247996    Fax: +20 (0)2 25264499
Email: ifg@access.com.eg
Web: www.ifg-eg.com

19 - 22 Nov 2016
Intl Metal Industry Technology Exhibition
Kintex Korea International Exhibition Center,
Daehwa-dong Ilsan-seogu, 411-766 Goyang,
Gyeonggi, South Korea
Contact:
Korea Trade Fairs Ltd.
#710, Kumsan Bldg., 17-1, Youido-dong,
Youngdeungpo-Gu, Seoul, South Korea
Email: master1@ktfairs.com           Web: ktfairs.com

06 - 08 Dec 2016
International Metal Technology Taiwan IMT Kaohsiung: Taiwan’s first and only exhibition for metal technology
KECC Kaohsiung Exhibition and Convention Center,
No. 274, Zhongzhèng 4th Rd, Yancheng District,
Kaohsiung, Kaohsiung, Taiwan
Contact:
Kaigo Co., Ltd.
8F -3, No. 9, Dehuei Street, 10461 Taipei, Taiwan
Email: info@kaigo.com.tw
Web: www.kaigo.com.tw
<table>
<thead>
<tr>
<th>MANUFACTURING TECHNOLOGY ABSTRACTS</th>
</tr>
</thead>
<tbody>
<tr>
<td>CAD/CAM/CAE</td>
</tr>
<tr>
<td>FORMING</td>
</tr>
<tr>
<td>SHEET METAL WORKING</td>
</tr>
<tr>
<td>INDUSTRIAL ENGINEERING</td>
</tr>
<tr>
<td>MACHINE TOOLS</td>
</tr>
<tr>
<td>MACHINING</td>
</tr>
<tr>
<td>NON TRADITIONAL MACHINING</td>
</tr>
<tr>
<td>GRINDING</td>
</tr>
<tr>
<td>MANUFACTURING SYSTEMS</td>
</tr>
<tr>
<td>DIGITAL MANUFACTURING SYSTEMS</td>
</tr>
<tr>
<td>VIRTUAL FACTORY</td>
</tr>
<tr>
<td>MEASUREMENT TESTING</td>
</tr>
<tr>
<td>PLANT ENGINEERING</td>
</tr>
<tr>
<td>NANO TECHNOLOGY</td>
</tr>
<tr>
<td>PRECISION ENGINEERING</td>
</tr>
<tr>
<td>PRODUCT DESIGN &amp; MANUFACTURE</td>
</tr>
<tr>
<td>TOOLS &amp; TOOLING</td>
</tr>
<tr>
<td>TRIBOLOGY</td>
</tr>
</tbody>
</table>
Abstracts

Manufacturing Technology Today, August 2016

MANUFACTURING TECHNOLOGY ABSTRACTS

CAD/CAM/CAE

110782 Proposal of a design method for semi-destructive disassembly with split lines

Umeda, Yasushi; Miyaji, Naoya; Shiraishi, Yumi; Fukushige, Shinichi [CIRP Annals, v 64, n 1, 2015, Starting Page 29, Pages 4] This paper proposes a computer-aided design method for semi-destructive disassembly with split lines. This method aims at extracting reusable, recyclable, or hazardous components more efficiently than manual disassembly with higher quality than shredding. The split line is a shape feature of a product that enables to destruct the product into desired shape, like pull tabs of cans. The proposed method aids a designer in adding proper split lines to extract target components. A case study showed that the semi-destructive disassembly sequence of an air conditioner with the split lines reduces the number of steps needed for extracting a target component. (10 refs, 8 figs, 1 table) (AA)

110783 Simulation-based deburring tool and process development

Schutzer, Klaus; Abele, Eberhard; Guth, Sebastian [CIRP Annals, v 64, n 1, 2015, Starting Page 357, Pages 4] This paper presents a simulation-based development of a new deburring tool and a CAM-assisted method to deburr intersections of cross-drilled holes. By analyzing and applying derived mathematic equations to construct a three-dimensional view of these contours, a cutting edge specifically aligned to the intersection is developed. The intervention conditions and the synchronization of the tool and numeric control approach require 3-axis machining. This ensures a uniform chamfer along the circumference of the intersection despite the fluctuating cutting conditions. CAM-assisted deburring reveals the exact position of the burr, allowing the deburring tool to adapt to cross-drilled holes of different diameters. (31 refs, 8 figs) (AA)

FORMING

110784 Development of a new and simplified procedure for the experimental determination of forming limit curves

Karadogan, C; Tamer, ME [CIRP Annals, v 64, n 1, 2015, Starting Page 265, Pages 4] This study aims to eliminate the off-centric initiation of localization caused by friction in the Nakazima testing of forming limit curves (FLCs). Our proposed approach uses an ordinary Nakazima testing equipment and standard Nakazima geometries for specimens. The principle is based on a layer of relatively thick, flexible and durable polyurethane disc, whose coherent deformation ensures strain localization at the pole. The main advantages of this approach are the simplicity of the equipment and testing, inexpensiveness, and yet the coverage of the entire strain range relevant to sheet metal forming. The technique is validated by experimental and numerical FLC investigations. (12 refs, 9 figs, 2 tables) (AA)

110785 Environmental assessment of solid state recycling routes for aluminium alloys: Can solid state processes significantly reduce the environmental impact of aluminium recycling?

Duflou, Joost R; Tekkaya, A Erman; Haase, Matthia; Welo, Torgeir; Vanmeensel, Kim; Kellens, Karel; Dewulf, Wim; Paraskevas, Dimos [CIRP Annals, v 64, n 1, 2015, Starting Page 37, Pages 4] Solid state recycling techniques allow the manufacture of high density aluminium alloy parts directly from production scrap. In this paper the environmental impacts associated with ‘meltless’ scrap processing routes based on three different techniques, namely hot extrusion, screw extrusion and spark plasma sintering (SPS), are compared with the corresponding remelting route as reference. Analysis of the obtained results allows clear conclusions on the perspectives offered by solid state recycling for systematic environmental impact reduction of aluminium recycling with material and energy savings as most important influencing factors. An overall impact reduction with a factor 2 for the SPS route and 3–4 for the extrusion routes is found to be realistic. (19 refs, 4 figs, 3 tables) (AA)
Abstracts

SHEET METAL WORKING

110786 Plastic flow and its control in sheet–bulk metal forming of thin-walled functional components

Merklein, Marion; Löffler, Maria; Schneider, Thomas [CIRP Annals, v 64, n 1, 2015, Starting Page 245, Pages 4] This paper deals with a manufacturing process for sheet metal components with integrated functional elements by sheet–bulk metal forming. In a single forming stage a cup-shaped base body with thin- walled features is deep drawn and its geometry is calibrated by upsetting. The fundamental numerical and experimental investigations include the analysis of the die filling behaviour, part geometry and mechanical properties due to strain hardening with respect to the variation of the blank layout, forming force and material strength. Finally, the process limits are identified and approaches for their enhancement by the application of tailored surfaces are presented. (11 refs, 11 figs) (AA)

110787 Interaction of heat generation and material behaviour in sheet metal blanking

Demmel, Peter; Hoffmann, Hartmut; Golle, Roland; Intra, Carsten; Volk, Wolfram [CIRP Annals, v 64, n 1, 2015, Starting Page 249, Pages 4] A temperature rise occurs in the sheet metal and tool parts due to the dissipation of a large part of plastic work during blanking. The resulting temperature in the shearing zone has various impacts on the process. The correlation between the temperature rise and sheet metal behavior under varying process parameters is investigated. Causal associations can be shown by in-situ measurements of the dynamic temperature development at the cutting edge of the punch and analyses of the sheet metal behaviour. The presented results provide essential knowledge for further experimental, analytical and numerical blanking investigations. (10 refs, 5 figs) (AA)

110788 Renewable energy integration into factories: Real-time control of on-site energy systems

Ghadimi, Pouya; Kara, Sami; Kornfeld, Bernard [CIRP Annals, v 64, n 1, 2015, Starting Page 443, Pages 4] On-site, renewable energy supply systems have potential to create tangible economic and environmental improvements for the manufacturing industry. However, integrated energy supply and demand management is challenging due to the complex and dynamic nature of the problem. This paper presents a real-time operations management solution for integrating renewable energy into factories. A closed-loop and reactive control system is developed based on reliable models of energy supply options. An Australian industry case is used to demonstrate the validity and the practicality of the proposed solution. (21 refs, 4 figs) (AA)

110789 Automated vision-based live ergonomics analysis in assembly operations

Kruger, Jorg; Nguyen, The Duy [CIRP Annals, v 64, n 1, 2015, Starting Page 9, Pages 4] Manual analysis and optimisation of ergonomic parameters can be tedious when process and worker’s body size variance is high. Automating this process would reduce workload and enable developing assistance systems for worker support. This paper presents a system which computes the positions of the parts of the body from input depth images and assesses ergonomics scores. The method is based on Particle Swarm Optimisation (PSO). By parallel processing on graphics hardware (GPU), the system is able to provide ergonomic feedback within a few seconds. (13 refs, 5 figs, 1 table) (AA)

110790 Evaluation of dynamic stiffness of machine tool spindle by non-contact excitation tests

Matsubara, Atsushi; Tsujimoto, Shota; Kono, Daisuke [CIRP Annals, v 64, n 1, 2015, Starting Page 365, Pages 4] This paper presents a non-contact excitation method for evaluating the dynamic stiffness of a rotating spindle. The spindle response to an excitation force is measured, and frequency response functions (FRFs) are obtained. Based on...
Abstracts

the measured FRFs, dynamic uncertainty and its effect on cutting stability are investigated. Regenerative forces are generated using displacement feedback with a time lag element, and a closed-loop excitation test is executed automatically. The stability map obtained from the closed-loop test and the stability charts calculated from the FRFs are compared, and the uncertainty of the spindle dynamics during operations is clarified. (19 refs, 10 figs) (AA)

110791 Prediction and control of drilling-induced damage in fibre-reinforced polymers using a new hybrid force and temperature modelling approach

Sadek, A; Shi, B; Meshreki, M; Duquesne, J; Attia, MH [CIRP Annals, v 64, n 1, 2015, Starting Page 89, Pages 4] Reliable force and temperature prediction in drilling of fibre-reinforced polymers (FRPs) is the key to controlling drilling-induced damage. A novel hybrid analytical-numerical model is developed to capture time-varying forces and temperatures during transient and steady-state drilling of FRPs. Although the generalized force model is calibrated using a unidirectional FRP material and a single tool type, it can apply to wide ranges of drilling conditions, tool geometries, and laminate configurations. A methodology to define the damage criteria is presented. Extensive experimental validation confirmed the accurate predictions of delamination and thermal damage; such performance cannot be achieved by any available model. (10 refs, 8 figs, 1 table) (AA)

110792 Transmission Kikuchi Diffraction study of texture and orientation development in nanostructured hard turning layers

Bedekar, Vikram; Shivpuri, Rajiv; Avishai, Amir; Hyde, R Scott [CIRP Annals, v 64, n 1, 2015, Starting Page 73, Pages 4] Orientation study was performed on the hard turning layers by utilizing newly developed Transmission Kikuchi Diffraction technique complemented by glancing angle X-ray diffraction and high resolution transmission electron microscopy (HRTEM). Results indicate that the hard turning process transforms the typical martensite lath/plate structure into equiaxed grains with low angle (<108) boundaries. At lower cutting speeds, the texture was shear dominated while at high cutting speeds, conditions, hard turning could be utilized to tailor the surface nanostructures for enhanced service life. (10 refs, 7 figs) (AA)

110793 Experimental and numerical assessment of subsurface plastic deformation induced by OFHC copper machining

Outeiro, JC; Campocasso, S; Denguir, LA; Fromentin, G; Vignal, V; Poulachon, G [CIRP Annals, v 64, n 1, 2015, Starting Page 53, Pages 4] Strain distributions in the machined surface and subsurface of OFHC copper workpieces were determined experimentally and through numerical simulations. An experimental setup, comprising a double frame camera and a pulsed laser, was developed to measure the displacement fields using the digital image correlation (DIC) technique; strain distributions were then calculated. A numerical orthogonal cutting model was also developed and applied in order to predict such distributions. Comparison between simulated and measured results enabled an understanding of the fundamental mechanisms of plastic deformation of the machined surface of OFHC copper. (12 refs, 7 figs) (AA)

110794 Influence of polarity on the performance of Blasting Erosion Arc Machining

Zhao, Wansheng; Xu, Hui; Gu, Lin; Hong, Han; Rajurkar, KP [CIRP Annals, v 64, n1, 2015, Starting Page 213, Pages 4] Blasting Erosion Arc Machining (BEAM) is proposed to achieve high-efficiency machining for difficult-to-cut materials such as high-temperature alloys. By creatively controlling the arc plasma with the mechanism named hydrodynamic arc breaking, BEAM can remove bulk material with a high material removal rate (MRR). However, the BEAM generated surface is rough and requires additional post processing. In order to improve the resulting surface quality, positive electrode polarity BEAM was performed by using graphite bundled electrode to machine AISI D2 steel workpiece in this study. Experimental results demonstrate that compared with negative electrode BEAM, machining with positive polarity achieves a better surface quality with less MRR and high relative tool wear ratio (TWR). The explanation of the differences can be attributed to the
performance of arc plasma resulting from the variation of the flushing velocity in the discharge gap. Therefore, it is possible to machine with high efficiency and a better control of the profile and surface quality of the workpiece by combining negative and positive (N-P) BEAM processes together. (11 refs, 6 figs, 1 table) (AA)

NON TRADITIONAL MACHINING

110795 Influence of external hydrostatic pressure on machining characteristics of electrical discharge machining

Koyano, Tomohiro; Hosokawa, Akira; Suzuki, Shodai; Ueda, Takashi [CIRP Annals, v 64, n 1, 2015, Starting Page 229, Pages 4] Electrical discharge machining (EDM) tests were conducted under various external hydrostatic pressure to investigate the influence of gas bubbles. High-speed camera observation of a single pulse discharge revealed that decreasing the hydrostatic pressure increased the bubble diameter and thus the bubble pressure decreases. Thus, the removal volume of a single discharge increases as the hydrostatic pressure decreases because of the lowered boiling point. However, the results of sinking EDM showed that the material removal rate is not determined solely by the removal volume of a single pulse discharge. This indicates that bubbles have a significant flushing effect on EDM processes. (11 refs, 9 figs, 3 tables) (AA)

110796 Mirror-like finishing by electrolyte jet machining

Kawanaka, Takuma; Kunieda, Masanori [CIRP Annals, v 64, n 1, 2015, Starting Page 237, Pages 4] This paper describes a mirror-like finishing technique by electrolyte jet machining. When the jet is still, the workpiece area where it collides into can be selectively finished to a mirror-like surface due to high current density at the center of the jet. When the jet is being translated, the low current density in the radial flow of the impinging jet deteriorates the surface roughness while the jet is passing over the surface. This problem can be resolved by reciprocating the jet at a high translating speed. Pulsed current and bipolar pulse also realizes mirror-like finishing even at low translating speeds. (16 refs, 14 figs) (AA)

110797 Wire breakage and deflection caused by nozzle jet flushing in wire EDM

Okada, A; Konishi, T; Okamoto, Y; Kurihara, H [CIRP Annals, v 64, n 1, 2015, Starting Page 233, Pages 4] High flow rate in nozzle jet flushing is effective for smooth debris exclusion from the wire EDM gap, but this leads to large wire deflection and vibration, resulting in the wire breakage and low shape accuracy. In this paper, the influence of nozzle jet flushing on wire breakage was experimentally investigated with varying the machined kerf length and machining conditions. Furthermore, the flow fields and debris residence time in the kerf, hydrodynamic stress distributions acting on the wire, and wire deflections were numerically analyzed. Based on the analyzed results, the causes of wire breakage were discussed. (15 refs, 10 figs, 3 tables) (AA)

GRINDING

110798 Micro grinding with ultra small micro pencil grinding tools using an integrated machine tool

Aurich, Jan C; Carrella, Marina; Walk, Michael [CIRP Annals, v 64, n 1, 2015, Starting Page 325, Pages 4] Micro grinding offers a high potential when machining microstructures in hard and brittle materials. In this context, a new machine tool—the nano grinding center—was developed, which allows to manufacture and apply ultra small micro pencil grinding tools without re-clamping. With this new machine tool, the influence of grain size, grain concentration, and process parameters on the material removal mechanisms was investigated during micro grinding of silicon with grinding tool diameters of 40 mm and 4 mm. Measurements of
process forces, surface quality and accuracy were carried out and the results are discussed. (13 refs, 8 figs, 2 tables) (AA)

110799 Dry grinding process with workpiece precooling

Oliveira, Joao FG; Silva, Eraldo J; Coelho, Reginaldo T; Brozek, Lukas; Bottene, Alex C; Marcos, Gustavo P [CIRP Annals, v 64, n 1, 2015, Starting Page 329, Pages 4] This paper proposes a workpiece cooling prior to grinding in order to allow a dry processing. Tests and simulation showed good potential. The obtained part quality is good, and there is no thermal damage since there is a higher heat flux from the grinding zone to the workpiece due to the much lower temperature of the last. The process design is a key task for good results and should include a precise determination of the cooling conditions that allow the grinding cycle heating to bring the part temperature close to the environment at the end of spark-out. (13 refs, 8 figs, 2 tables) (AA)

110800 Cutting characteristics of electroplated diamond tools with laser-generated positive clearance

Warhanek, M; Walter, C; Huber, S; Hanni, F; Wegener, K [CIRP Annals, v 64, n 1, 2015, Starting Page 317, Pages 4] Conventional grinding wheels and dressing tools suffer from problematic chipping conditions at the abrasive grains, caused by near-zero or negative clearance angles at the micro-cutting edges. This paper introduces electroplated diamond dressing tools with positive clearance angles, generated by ultrashort pulsed laser ablation. A series of generic dressing experiments with varying parameters on vitrified bond corundum grinding wheels and long-term tests are presented for a comparative performance assessment of laser-conditioned and conventionally prepared tools. The results are applied to an analysis of the interdependency between the topography of the abrasive layer and the cutting characteristics of dressing tools. (13 refs, 8 figs, 2 tables) (AA)

110801 Control of the contact force in a pre-polishing operation of free-form surfaces realised with a 5-axis CNC machine

Chaves-Jacob, J; Linares, JM; Sprauer, JM [CIRP Annals, v 64, n 1, 2015, Starting Page 309, Pages 4] The challenge is to control the radial force applied during pre-polishing operations realised with milling machines. This permits managing the contact pressure between the tool and the machined surface. Since CNC machines are controlled in position but not force, a flexible tool is used to obtain a smooth connection between contact force and tool position. A Design Of Experiment demonstrates the major role of the radial engagement. A 5-axis toolpath is proposed to optimise pre-polishing operations of free-form surfaces. It accounts for the real tool shape, thus improving the stability of contact force. Experiments are realised to validate the developments. (9 refs, 9 figs, 1 table) (AA)

110802 Process mechanism in shape adaptive grinding (SAG)

Beaucamp, Anthony; Namba, Yoshiharu; Charlton, Phillip [CIRP Annals, v 64, n 1, 2015, Starting Page 305, Pages 4] Shape adaptive grinding (SAG) is a novel process for freeform machining of difficult materials such as ceramics and hard metals. Despite low stiffness requirement from the machining equipment, due to the “semi-elasticity” of the process (achieved by a combination of elastic tool with rigid pellets), ductile mode grinding can be achieved with high surface finish. In this paper, the SAG process mechanism is investigated by studying how the size and shape of the pellet bonded abrasives evolve over time, measuring grinding forces for various process parameters, and comparing the equivalent chip thickness and specific energy with the observed grinding modes. (8 refs, 10 figs, 3 tables) (AA)
MANUFACTURING SYSTEMS

110803 Static total cost comparison model to identify economic fields of application of Cellular Manufacturing for milling and drilling processes versus done-in-one-concepts
Metternich, Joachim; Abele, Eberhard; Bechtloff, Sven; Seifermann, Stefan [CIRP Annals, v 64, n 1, 2015, Starting Page 471, Pages 4] The predominant approach on machining is to manufacture a workpiece on a complex done-in-one machine tool. In contrast, the Cellular Manufacturing concept splits up the machining steps and distributes them sequentially to several simpler and cost-efficient machine tools with a higher manual workload. Both concepts are technically feasible, but the question which approach is favorable from an economic perspective is still open. This article first identifies relevant input factors like machining tasks, operator work content, labor and capital costs, etc. Available machine tools are grouped by a k-means cluster analysis, human tasks of operation are identified by an MTM-UAS analysis. Together with key performance indicators like ‘cell balancing efficiency’, all data are transferred into monetary values and combined to a static total cost comparison model. The paper closes with a validation on industrial parts and a sensitivity analysis of the results achieved. (21 refs, 9 figs, 1 table) (AA)

110804 Capacity adjustment based on reconfigurable machine tools – Harmonising throughput time in job-shop manufacturing
Scholz-Reiter, Bernd; Lappe, Dennis; Grundstein, Sebastian [CIRP Annals, v 64, n 1, 2015, Starting Page 403, Pages 4] Manufacturing companies are confronted with increasing market volatility. They have to cope with rapidly changing customer demands concerning product types, quantities and delivery dates. Production planning and control must compensate the resulting fluctuations in capacity demand. In this context, capacity control is an effective measure to ensure the adherence to delivery dates and thus strengthens companies’ competitiveness. Most approaches of capacity control focus on labour-oriented activities. This paper presents a novel approach of capacity control considering the potential of reconfigurable machine tools. The simulation results substantiate the often disregarded potential of reconfigurable machine tools. (23 refs, 4 figs) (AA)

DIGITAL MANUFACTURING SYSTEMS

110806 Virtual factory approach for in situ simulation to support production and maintenance planning
Terkaj, Walter; Tolio, Tullio; Urgo, Marcello [CIRP Annals, v 64, n 1, 2015, Starting Page 451, Pages 4] Structured methodologies and tools for the tailored design of factories are more and more adopted by suppliers of manufacturing systems but usually discontinued after the design phase. The use of an ontology-based virtual factory, continuously synchronized with the real plant, is proposed to guarantee digital continuity and enable in situ simulation during the operating phase of a factory. This digital counterpart of the system can be used for integrated shop-floor simulations to assess future impact of production and maintenance planning decisions. An industrial application is provided in the context of roll shops, i.e., systems devoted to the grinding of cylinders.
VIRTUAL FACTORY

110807 Methodology for exploiting potentials of remanufacturing by reducing complexity for original equipment manufacturers

Widera, Henry; Seliger, Gunther [CIRP Annals, v 64, n 1, 2015, Starting Page 463, Pages 4]

Despite significant advantages from manufacturer, consumer and societal perspectives, the share of remanufactured products is still low in most industries. Commitment of original equipment manufacturers (OEMs) is limited due to the manifold barriers and challenges that were hitherto unknown in the traditional production environment. Based on the Business Model Canvas, a methodology identifying feasible options for competitive remanufacturing by evaluating case-specific barriers and challenges in order to cope with the corresponding complexity has been developed. Product-service systems are systematically utilized to exploit the potentials of remanufacturing. The methodology is demonstrated for OEM-oriented remanufacturing in medical technology, specifically an insulin pump. (43 refs, 6 figs, 1 table) (AA)

MEASUREMENT TESTING

110808 Systems for locally resolved measurements of physical loads in manufacturing processes

Tausendfreund, A; Stobener, D; Dumstorff, G; Sarma, M; Heinzel, C; Lang, W; Goch, G [CIRP Annals, v 64, n 1, 2015, Starting Page 495, Pages 4]

The generation of desired surface layer properties by a certain manufacturing process requires a comprehensive knowledge of the physical loads during the process and their influences on the workpiece material. This paper presents the setup and results of two in-process measurement systems, which are specifically designed to locally determine temperature and strain in several processes (in this case: grinding and deep rolling). One measuring system is based on speckle interference effects (speckle photography) detecting the deformation distribution of the workpiece surface and the other applies resistance deviation measurements of integrated thin films inside the near-surface layer to determine temperature and strain variations. (18 refs, 7 figs) (AA)

PLANT ENGINEERING

110809 Uncalibrated cylindrical indigenous artefact for measuring inter-axis errors of a five-axis machine tool

Mayer, JRR; Rahman, Md. Mizanur; Los, Anna [CIRP Annals, v 64, n 1, 2015, Starting Page 487, Pages 4]

Ever simpler means of monitoring the geometry of five-axis machine tools are required to support automated production lines. This paper investigates the automated probing of the indigenous uncalibrated cylindrical machine table of a five-axis machine tool for estimating its inter-axis error parameters, i.e. the position and orientation errors of its axes. The uncertainties on the estimated errors are calculated from pooled covariance considering the correlation amongst input probing results as obtained from a specially designed series of repeated five daily cycles to distinguish between machine and measurement process variability. (12 refs, 9 figs, 3 tables) (AA)

NANO TECHNOLOGY

110810 Nanoscale 3D printing process using aerodynamically focused nanoparticle (AFN) printing, micro-machining, and focused ion beam (FIB)

Ahn, Sung-Hoon; Yoon, Hae-Sung; Jang, Ki-Hwan; Kim, Eun-Seob; Lee, Hyun-Taek; Lee, Gil-Yong; Kim, Chung-Soo; Cha, Suk-Won [CIRP Annals, v 64, n 1, 2015, Starting Page 523, Pages 4]

A novel nanoscale 3D printing process was developed by integrating nanoparticle printing, micro-machining, and focused ion beam technology. Aerodynamically focused nanoparticle (AFN) printing, a room-temperature direct printing technique using shock-induced aerosol generation,
was adopted for material formation, and focused ion beam (FIB) was used for profiling the positioned material. Micro-machining was used to assist and bridge these two processes at different scales, using tools with diameters of 30 mm. Various 2.5D and 3D structures were printed using metal/ceramic nanoparticles with no solvent or post-treatment technique. Some applications are shown in the range from sub-micron to hundreds of micrometers. (10 refs, 7 figs, 1 table) (AA)

**110811 Novel end-fly-cutting-servo system for deterministic generation of hierarchical micro–nanostructures**

To, Suet; Zhu, Zhiwei; Zeng, Wenhan [CIRP Annals, v 64, n 1, 2015, Starting Page 133, Pages 4] This paper reports on the diamond cutting based generation of hierarchical micro–nanostructures, which are conventionally difficult for both mechanical and non-mechanical methods to achieve. A novel end-fly-cutting-servo (EFCS) system, with four-axis servomotions that combine the concepts of fast/slow tool servo and end-face fly-cutting, is proposed and investigated. In the EFCS system, an intricately shaped primary surface is generated by material removal, while the desired secondary nanostructures are simultaneously constructed using residual tool marks by actively controlling tool loci. The potential of the EFCS system is demonstrated firstly by fabricating a nanostructured F-theta freeform surface and a nanostructured micro-aspheric array. (16 refs, 5 figs) (AA)

**110812 Ultra-precision machining of radial Fresnel lens on roller moulds**

Huang, Rui; Zhang, Xin; Quan, Rahman; Mustafizur; Senthil Kumar, A; Liu, Kui [CIRP Annals, v 64, n 1, 2015, Starting Page 121, Pages 4] In Roll-to-Roll manufacturing of optical films, direct diamond turning of radial Fresnel lens structures on a roller mould was considered infeasible, due to the inability to cut steep circular grooves on the outer cylindrical surface using conventional approach. This paper presents a novel solution to this problem. A four-axis interactive tool–workpiece motion is designed to precisely fabricate the complex microstructures. The tool path is generated from geometrical calculations considering the lens design, tool geometries and roller parameters. This process is experimentally verified with qualified profile quality and surface finish, thus making direct machining of radial Fresnel lens possible. (8 refs, 8 figs) (AA)

**110813 On the ultra-precision diamond machining of chalcogenide glass**

Owen, JD; Davies, MA; Schmidt, D; Urruti, EH [CIRP Annals, v 64, n 1, 2015, Starting Page 113, Pages 4] Chalcogenide glasses are important materials for components in thermal imaging systems (IR-optics). While suitable for molding, the machining characteristics of these brittle materials are largely unknown. In this paper, ultra-precision machining data for a common chalcogenide glass (As40Se60) is presented. Data acquired from orthogonal cutting experiments show a transition in cutting mechanics at an uncut chip thickness of approximately one micrometer. This data is used to identify parameters for high-speed milling, and results are used to produce a thermal imaging lens. This paper demonstrates that the milling process is suitable for prototyping and low-batch production of IR-optics in this glass. (15 refs, 9 figs) (AA)

**110814 Method to improve integrated product service offerings based on life cycle costing**

Sakao, Tomohiko; Lindahl, Mattias [CIRP Annals, v 64, n 1, 2015, Starting Page 33, Pages 4] Although a few papers have reported on life cycle cost (LCC) analysis of integrated product service offerings (IPSOs), insight on how to improve IPSOs based on LCC analysis is missing. This paper presents a method and an Excel and MATLAB-based tool that support IPSO design by employing LCC analysis, both from the provider
Abstracts

and customer perspectives. This method takes advantage of exchangeability between products and services, being enabled within IPSO design. The method has been applied to an existing IPSO and potential improvements have been identified, e.g. one cheap component causing high LCC that could be reduced significantly by redesign. (14 refs, 4 figs, 1 table) (AA)

110815 Online-control of assembly processes in paced production lines
Tracht, Kirsten; Funke, Lars; Schottmayer, Michael [CIRP Annals, v 64, n 1, 2015, Starting Page 395, Pages 4] Production of complex and large-dimensioned goods in small lot sizes is a demanding task. In order to react to varying customer demand and changing product specifications assembly tasks are executed manually by skilled workers that provide an adequate level of flexibility. Although the task of controlling these assembly processes gets more complex, only little support is given to foreman and production planers in this regard. Existing procedures focus on production planning rather than control of processes. Thus, an assembly control procedure is developed that enables the integration of workers in control of paced assembly processes and a situation specific reallocation of personnel. Foreman and production planers are relieved from time consuming tasks of operational assembly control. The paper describes the approach and experimental results of its application. (17 refs, 4 figs) (AA)

110816 Energy-efficient scheduling of multiple manufacturing factories under real-time electricity pricing
Zhang, Hao; Zhao, Fu; Sutherland, John W [CIRP Annals, v 64, n 1, 2015, Starting Page 41, Pages 4] Manufacturing scheduling for reduced energy costs is attracting increased interest. Energy-efficient scheduling of a manufacturing factory subject to real-time electricity pricing, such as is the case with a smart grid, represents an important but challenging situation. In this paper, multiple manufacturing factories served by one utility are investigated. The total electricity cost as a function of manufacturing schedule is minimized using a distributed optimization approach, where each facility seeks to minimize its electricity cost and exchange information with the grid. Results suggest that electricity cost of the system can be reduced, and also individual electricity costs are lowered. (10 refs, 5 figs, 5 tables) (AA)

110817 Variety-oriented design of rotary production systems
Battaıa, Olga; Brissaud, Daniel; Dolgui, Alexandre; Guschinsky, Nikolai [CIRP Annals, v 64, n 1, 2015, Starting Page 411, Pages 4] The variety oriented design problem for rotary production systems is considered. Given the multiple parts to be produced, the problem is to determine the feasible configurations of the machining system with minimum cost. This problem is modelled as a combinatorial optimization problem. Constraints related to the design of machining units as well as to the precedence and compatibility of operations are taken into account. The optimization methods developed to solve the problem are based on its MIP formulation. An industrial example is presented. (12 refs, 2 figs, 2 tables) (AA)

110818 Supporting multi-level and robust production planning and execution
Stricker, Nicole; Pfeiffer, Andras; Moser, Emanuel; Kadar, Botond; Lanza, Gisela; Monostori, Laszlo´ [CIRP Annals, v 64, n 1, 2015, Starting Page 415, Pages 4] Operating current production systems influenced by the factors of increasing dynamics and volatility poses a need for robustness. Among different enablers for robustness the appropriate ones for specific production systems have to be identified and evaluated. In this cooperative paper multi-objective decision support models will be presented evaluating the best enablers for the levels of production network, plant and shop-floor. The suggested models for the stabilization of the production system’s performance under volatile environment use analytical and simulation based approaches on the regarded levels. (19 refs, 5 figs, 1 table) (AA)

110819 Products-manufacturing systems Co-platforming
ElMaraghy, Hoda; Abbas, Mohamed [CIRP Annals, v 64, n 1, 2015, Starting Page 407, Pages 4] A new Co-platforming methodology is introduced for mapping product features platform and corresponding manufacturing system machines platform. A cluster of platform and non-platform
系统机器是通过矩阵公式和操作导出的。目标是通过在部件系统中实现可合成系统的映射，以适应产品变体的持续变化而无需显著改变平台机器。这延长了制造系统的使用寿命并降低了重新设计的成本。汽车气缸体的制造用于演示和验证。[16 引用，3 图，3 表] (AA)

## TOOLS & TOOLING

### 110820 金属切削实验和建模用于提高通过红外热成像确定刀具/工件接触温度

Arrazola, Pedro-J; Aristimuno, Patxi; Soler, Daniel; Childs, Tom [CIRP Annals, v 64, n 1, 2015, Starting Page 57, Pages 4] 温度测量在金属切削中对于刀具和工件接触是至关重要的。红外热成像在正交切削中经常用于确定刀具侧表面的温度。本实验和建模研究了 AISI 4140 钢和 Ti6A14V 钛合金分别由 P 和 K 级硬质合金工具在实践切削速度和进给速度下，刀具-切削接触面和工件的温度之间的关系，以及红外热成像方法的更准确使用。[12 引用，13 图] (AA)

### 110822 磁悬浮六自由度旋转平台

Lu, Xiaodong; Dyck, Mark; Altintas, Yusuf [CIRP Annals, v 64, n 1, 2015, Starting Page 353, Pages 4] 该论文介绍了一个新型的六自由度磁悬浮旋转平台。磁悬浮的益处包括无摩擦运动，允许高精度的运动，以及 6 轴运动误差的实时矫正能力。6DOF 伺服器包括一个圆形的 Halbach 磁铁阵列附在移动的平台上和一个安装在定子上的平放线圈。通过定子的电流与固定线圈的磁场相互作用生成力。位置反馈通过四个电容探头和四个光编码器实现。该平台已经制造出来，每个轴的控制器已经被设计出来。位置精度为 55 nm (RMS)。[11 引用，6 图，1 表] (AA)