

ICAM2016 CYTTA2016

Proceedings

2016/12/16-19

*Sun Moon Lake
Taiwan*

2016 International Conference on Advanced Manufacturing

collocated with

2016 6th Chiuan-Yan Technology Thesis Award



inventions

Inventions (ISSN 2411-5134) is an open access, peer-reviewed journal, published by MDPI AG, Basel, Switzerland, which publishes original scientific research of significance concerning innovation/invention, or patent-based/extended/reviewed research papers in all fields of science, engineering and product development processes. This journal has been chosen as one of the publication platforms of selected papers presented at The 2nd International Conference on Inventions (ICI 2016).

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Special Issue

Selected Papers from the 2016 International Conference on Advanced Manufacturing (ICAM 2016)

Guest Editor:

Prof. Dr. Gou-Jen Wang
Department of Mechanical
Engineering,
National Chung-Hsing
University, Taichung 40227,
Taiwan
gjwang@dragon.nchu.edu.tw

*Deadline for manuscript
submissions:*
31 January 2017

Message from the Guest Editor

Dear Colleagues,

The 2016 International Conference on Advanced Manufacturing (ICAM 2016) will be held in Sun Moon Lake, Nantou, Taiwan, 16–19 December 2016. This conference is a platform for researchers from academia, research institutes and industry to present and discuss the new developments and emerging technologies in advanced manufacturing. This Special Issue will collect selected papers submitted to the ICAM 2016. The papers will be again refereed, following the usual refereeing process in force at *Applied Sciences*. For the participants, it is an exciting opportunity to promote their research and professional work.

Prof. Dr. Gou-Jen Wang
Guest Editor

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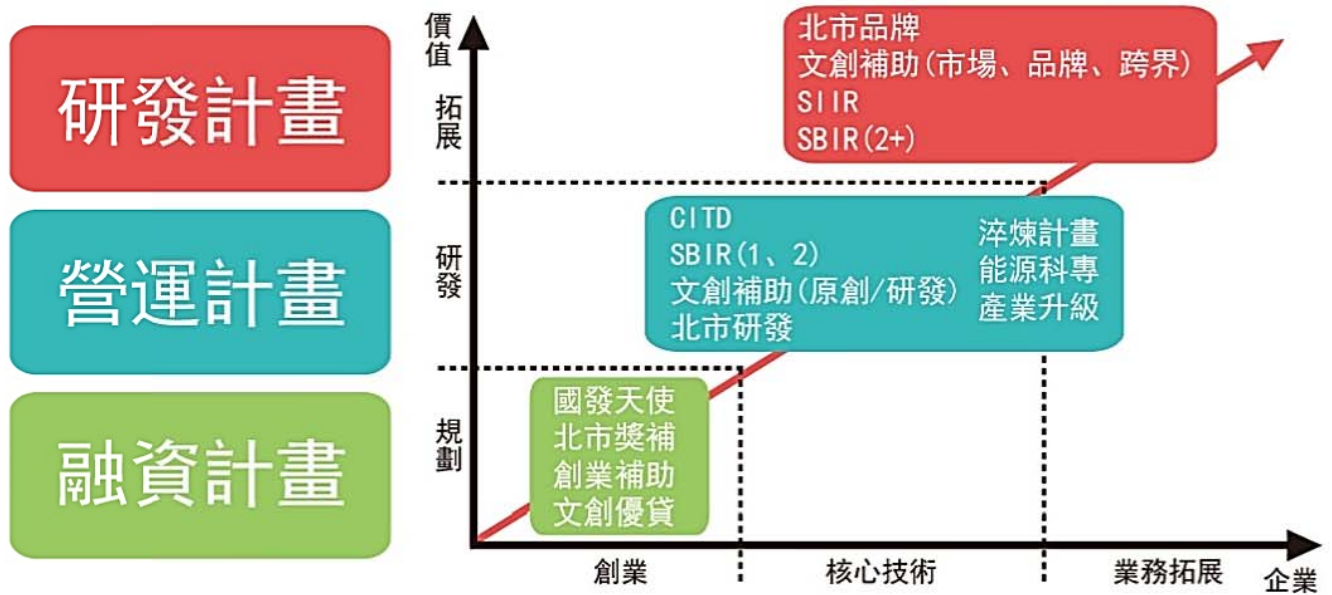
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Agenda

ICAM For All Chiuan-Yan

Day 1: Friday, December 16th, 2016

09:00 – Venue Layout & Author Presentation Practice

15:00  Teachers' Hostel & The Lalu Hotel

15:00 – Registration

18:00  Teachers' Hostel – Ying-Bin Building 1F Lobby

Day 2: Saturday, December 17th, 2016

09:00 – Registration –ICAM / Chiuan-Yan

10:00  Teachers' Hostel – Ying-Bin Building 1F Lobby

10:00 – Opening Ceremony

10:30  Teachers' Hostel – Conference Building 3F Assembly Hall

Keynote Speech I

Title: Formation of the optical transparency micro-patterned pad for the chemical mechanical polishing

10:30 –

11:10 Speaker: Prof. Keisuke Suzuki

Chairman: Prof. Chao-Chang Arthur Chen

 Teachers' Hostel – Conference Building 3F Assembly Hall

Keynote Speech II

Title: Wafer Manufacturing and Shaping of Crystalline Wafers

11:10 –

Speaker: Prof. Imin Kao

11:50

Chairman: Prof. Chun-Hui Chung

 Teachers' Hostel – Conference Building 3F Assembly Hall

12:00 – Lunch

13:30  The Lalu Hotel-B1 The Oriental Brasseries

13:30 – Session A1

 2F Room A

Session B1

 1F Room B

Session C1

 1F Room C

Poster 1&2

 1F Corridor

Chiuan-Yan –

Thesis Competition

15:45

 1F Recreation Center

15:45 – Tea Break

16:00  Teachers' Hostel-1F Recreation Center Square

Keynote Speech III

Title: Applying AVM & AMCoT for Industry 4.1

16:00 –

Speaker: Prof. Fan-Tien Cheng

16:40

Chairman: Prof. Gou-Jen Wang

 Teachers' Hostel – Conference Building 3F Assembly Hall

Invited Speech

Title: INDUSTRIE 4.0 – German Perspective on Digital Transformation of Industry

16:40 –

Speaker: Dipl.-Ing. Martin Schleef

17:20

Chairman: Prof. Kuang-Jau Fann

 Teachers' Hostel – Conference Building 3F Assembly Hall

17:20 – Group Photo





17:40  Teachers' Hostel – Conference Building 3F Assembly Hall

18:00 – Banquet & Chiuan-Yan Award Ceremony

20:00  The Lalu Hotel – 1F Lalu Garden





Day 3: Sunday, December 18th, 2016

Full Paper & Poster Show

09:30 – 11:30	Session A1  2F Room A	Session B1  1F Room B	Session C1  1F Room C	Poster 1  3F Assembly Hall
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12:00 – Lunch

13:30  The Lalu Hotel-B1 The Oriental Brasseries

14:30 – 15:30	Session A2  2F Room A	Session B2  1F Room B	Session C2  1F Room C	Poster 2  3F Assembly Hall
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Day 4: Monday, December 19th, 2016

09:00 –
18:00 Technical Visit & Communication

Forewords



With greatest success and wide attention received in the previous International Conference on Advanced Manufacturing (ICAM), the Society of Manufacturing Engineers (SME, Taipei Chapter 242) and National Chung-Hsing University are jointly hosting the sixth ICAM conference at Sun Moon Lake. ICAM is a bi-annual international conference with the main sponsorship from the Ministry of Science and Technology. As the Chairman of the SME Taipei Chapter, I take a great pleasure to welcome you at this significant event.

With the booming economic development in Asia, the leading manufacturing industries, particularly from auto-mobile, machinery, computer, communication, flat panel display to semiconductor and micro/nano areas, with their key technologies have attracted intense attention among universities, research institutions and many industrial corporations. Modern manufacturing processes, solutions and strategies hold the key for a continuing success. As a result the theme of the Conference was set on smart manufacturing, focusing on new and rapid emerging technologies. Papers with innovative idea or research results in all aspects of smart manufacturing were solicited. This Conference is providing a suitable platform for strong interactions among researchers to disseminate their quality results.

ICAM 2016 has accepted a total of 78 papers to be included in the conference program. Distinguished academics are invited to deliver one keynote speech, and three invited speeches. Participants of ICAM 2016 account 6 different countries. There will be three parallel oral sessions and two poster sessions. Besides, a thesis competition will be held by Chiuan-Yan Technology Co., Ltd. over the course of the conference. Finally, we have planned a free tour and a technical visit to make the Conference a memorable occasion.

I hope and expect that you will find much to interest you in the following program, and in the discussions you will have during the Conference with your colleagues from the various countries represented. Let us share a truly exciting time.

A handwritten signature in black ink, appearing to be 'H. Y. J.', written in a cursive style.

Program Chairman of ICAM2016 &
Chairman of SME Taipei Chapter

Forewords



On behalf of the organizing committee, we are pleased to welcome you to the 2016 International Conference on Advanced Manufacturing (ICAM 2016). The conference will be held at the most famous Sun Moon Lake, Nantou, Taiwan. The conference is sponsored by the Society of Manufacturing Engineering (SME, Taipei Chapter) and organized by the National Chung Hsing University this year.

The recently worldwide vigorous development of Industry 4.0, which is the current trend of automation and data exchange in manufacturing technologies, has attracted intense attention among universities, research institutions and industrial corporations. ICAM 2016 aims to provide a broad forum for international researchers, engineers, and professionals working in the current trend of manufacturing to discuss and exchange their recent scientific findings, technological advancements and management insights. Topics of interest include, but not limited to, the following areas: Advanced Machining and Forming Processes, Bio-medical Manufacturing, Micro- and Nano-Fabrication, Tribology for Manufacturing, Gears Manufacturing, Bio-medical Manufacturing, Precision Engineering Measurement, Robotics and Automation, Additive Manufacturing Technology, Smart Manufacturing Technology for Industry 4.0, and Manufacturing Management, E-manufacturing and E-business Integration

We are honored to have four noted scholars and experts Prof. Imin Kao (Stony Brook University, USA), Prof. Fan-Tien Cheng (National Cheng Kung University, Taiwan), Dipl.-Ing. Schleef, Martin Ulrich (Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Germany), and Prof. Keisuke Suzuki (Kyushu Institute of Technology, Japan) as our Invited Speakers to share their advanced achievements in Industry 4.0 related areas.

We would like to invite you to Taiwan for a fruitful ICAM 2016 and enjoy the beautiful scenery of Sun Moon Lake.

A handwritten signature in black ink that reads "Gou-Jen Wang". The signature is written in a cursive, flowing style.

Program Chairman of ICAM2016

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ICAM 2016 Speakers

Saturday, 16th December Keynote Speech I

“Formation of the optical transparency micro-patterned pad for the chemical mechanical polishing”



Prof. Keisuke Suzuki

Mechanical Information Science and Technology
Faculty of Computer Science and System Engineering,
Kyushu Institute of Technology, Japan

We develop the transparency micro-patterned pad with low refractive index equivalent to water to observe fine particles in the slurry during chemical Mechanical polishing (CMP). A special observation system with optical microscope of the fine particle in the slurry can be monitored the movement the particles between the transparency micro-patterned pad and the glass substrate under several. As results, we can be observed the particles movement and it is found that the range of particle movement speed is wider with the linear speed increases. In this case, direction of the fine particles movement in the slurry become random and its speeds are not uniform at high linear speed region.

Experience

- 2016 - Present : Professor, Kyushu Institute of Technology
- 2010 - 2015 : Associate Professor, Kyushu Institute of Technology
- 2009 - 2010 : Kanazawa University, Kanazawa
- 2012 - 2013 : Secretary of Kyushu Branch, The Japan Society for Precision Engineering (JSPE)
- 2012 - 2013 : Secretary of Kyushu Branch, The Optical Society of Japan
- 2014 - Present : Secretary of Manufacturing and Machine Tool Division, The Japan Society of Mechanical Engineers (JSME)
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Main Research Activities

- Nano-micro Engineering
- Chemical Mechanical Polishing
- Ultra Precision Machining
- Nano Carbon fine particle
- Material Science

Saturday, 16th December Keynote Speech II

“Wafer Manufacturing and Shaping of Crystalline Wafers”



Prof. Imin Kao

Stony Brook University, State University of New York

In everyday life, many objects with which we are associated today have either semiconductor devices built in or have been manufactured with a machine or equipment that contains in-built semiconductor devices. In the last several decades, semiconductor technology has grown in leaps and bounds, partly driven by consumerism generated by telecommunication, wireless internet, and information technology and partly by the need for automation catering to mass or batch production and manufacturing of technologically sophisticated products, in large quantities at lower costs.

Semiconductor materials, such as silicon, III-V and II-VI compounds, at the heart of modern technology and consumer products, are first grown using various crystal growth techniques. After that, the crystalline ingots are sliced, lapped, ground, polished to make prime wafers ready for microelectronics fabrication. In this talk, the manufacturing and shaping of crystalline wafers used for semiconductor, photovoltaic, and other industries are discussed, along with the trends of wafer technology and their benefits, as well as the fundamental machining mechanisms with comparisons for ductile machining and brittle machining in wafer manufacturing. Various topics in the presentation include: generalized processes flow of wafer manufacturing, manufacturing process modeling, wafer slicing using modern slurry wiresaws or diamond wire saws, material characteristics, lapping, grinding, CMP, surface cleaning, wafer metrology using optical techniques, and other relevant technology in wafer manufacturing.

Experience

- 2016/02 - Present : *Associate Vice President of Economic Development* — Working with the VPED, responsible for various activities of economic development, including the two Centers of Excellence of the State of New York, three Centers of Advanced Technology,

Strategic Program for Industrial Resurgence (SPIR), and high-tech incubators; leveraging trilateral collaboration of academia-government-industry for research and economic development

- 2014/09 - Present : *Director, SUNY Korea Academic Degree Programs (at Stony Brook University, New York)*— Responsible for all academic degree programs at SUNY Korea, a global campus of Stony Brook University; plan and manage budget and academic operations; responsible for both undergraduate and graduate degree programs of Stony Brook University (Stony Brook, NY), Fashion Institute of Technology (Manhattan, NY), and Binghamton University (Binghamton, NY); prepare proposals to Korean Ministry of Education to establish new degree programs at SUNY Korea; plan and implement academic degrees and affairs; coordinate all academia-government-industry collaboration
- 2006/09 - Present : *Professor, Department of Mechanical Engineering, SUNY at Stony Brook, New York*
- 2011/07 - Present : Responsible for the CEAS academic degree programs in SUNY Korea in Incheon Free Economic Zone (IFEZ) in South Korea; SUNY Korea is a global campus of Stony Brook University offering Stony Brook degrees with first class of students entering in spring 2012
- 2014/09 – 2015/08 : *Interim Dean, International Academic Programs and Service (IAPS), Stony Brook University (SBU), New York* — Responsible for all international academic programs and exchange at SBU, as well as all visa and immigration services for students and faculty at SBU; responsible for all degree collaboration with international partners
- 2002/08 – 2005/08 : *Faculty Director of the Undergraduate College in Information and Technology Studies (ITS College), Stony Brook University*

Main Research Activities

- Biomedical research in orthopedic resection with aids for removal of cancer-infected bone sections
- Optimal fusion angles of arthrodesis surgery using kinematic modeling
- Intelligent fault detection and diagnosis (iFDD) and prognosis of systems
- Modeling and control of wiresaw manufacturing technology
- Manufacturing process and modeling of Free Abrasive Manufacturing (FAM)
- Grasping manipulation and control of robotics research
- Soft contacts
- Modeling and analysis of human grasping behaviors using robotics theory

Saturday, 16th December Keynote Speech III

“Applying AVM & AMCoT for Industry 4.1”



Prof. Fan-Tien Cheng

e-Manufacturing Research Center
Institute of Manufacturing Information and Systems,
National Cheng Kung University

Virtual Metrology (VM) is a method to conjecture manufacturing quality of a process tool based on data sensed from the process tool and without physical metrology operation. In other words, VM can convert sampling inspection with metrology delay into real-time and on-line total inspection. This talk would first introduce the theories and functions of Automatic Virtual Metrology (AVM) system and then demonstrate how to apply AVM to high-tech (semiconductor, TFT-LCD, etc.) and traditional machine tool (automobile wheel machining, and aviation engine casing, etc.) industries.

Advanced technologies such as Internet of Things (IoT), Big Data Analysis, Cloud Manufacturing (CM), and Cyber Physical Systems (CPS) can be applied to realize an intelligent manufacturing system of high-degree vertical integration. In this way, not only unexpected machine tool failure and maintenance cost can be reduced, but product yield and quality can also be enhanced for improving factories' productivity and efficiency. This talk then focuses on how to utilize IoT, Big Data Analysis, CM along with the AVM technology to develop an Advanced Manufacturing Cloud of Things (AMCoT), as well as the ways to apply it to the high-tech (semiconductor, TFT-LCD, and solar cell) and traditional (machine tool, aerospace) industries.

The current Industry 4.0 platform can only keep the faith of achieving nearly Zero Defects (ZD) state without realizing this goal. The key reason for this inability is the lack of an affordable online and real-time total inspection system. ZD state can be achieved by adopting the AVM system due to its capability of providing all product total inspection data. As the AVM system is integrated with the Industry 4.0 platform, the goal of ZD can be accomplished, which is defined as “Industry 4.1.”

Experience

- 2009 - Present : Chair Professor of National Cheng Kung University (NCKU)

- 2008 - Present : Director of e-Manufacturing Research Center, NCKU
- 2006 - 2009 : Convener & Director of Automation Engineering Program, National Science Council
- 2003 - 2009 : Distinguished Professor of Institute of Manufacturing Engineering, NCKU
- 1998 - 2001 : Director of Institute of Manufacturing Engineering, NCKU
- 1990 - 1995 : Director of Project Office of Electronics Systems Division, Chung-Shan Institute of Science and Technology (CSIST)
- 1994 - 1995 : Senior Scientist of Electronics Systems Division, CSIST

Main Research Activities

- e-Manufacturing (Industry 4.0)
- Semiconductor Manufacturing Automation
- Virtual Metrology
- Predictive Maintenance
- Intelligent Machinery
- Intelligent Manufacturing Systems

Saturday, 16th December Invited Speech

“INDUSTRIE 4.0 – German Perspective on Digital Transformation of Industry”



Dipl.-Ing. Schleef, Martin Ulrich

Fraunhofer Institute for Manufacturing Engineering and Automation IPA, Stuttgart, Germany

Fraunhofer IPA is specialized on the development and the transfer of innovative solutions into the application in industry. For Industrie 4.0, Fraunhofer has taken the lead regarding development of concepts and the roll-out of test beds which are necessary to transform the current way of production into a more flexible, more personalized- and more resource-efficient one. The presentation explains the approach to Industrie 4.0, it describes the concepts, and gives several examples of applications and best practices. The benefits of the Digital Transformation through Industrie 4.0 are summarized. An outlook on how to realize the approach for institutes and companies in Taiwan is given.

Experience

- 2015 - Present : Head of Business Unit Machinery and Equipment Industry at Fraunhofer IPA, Stuttgart, Germany. Furthermore Head of Business Unit Electronics and Microsystems at IPA.
- 2008 - 2015 : Head of Department for Factory Planning and Facility Systems (Buildings, Logistics, Environmental, High Purity Processes) at M+W Group, Stuttgart, Germany. Engineering for design & build of turnkey projects for electronics industry (Semiconductor, TFT, Photovoltaics, Data Centers, etc.)
- 2007 - 2015 : Parallel to the function of Head of Department: Project Manager at M+W Group, Stuttgart, Germany. Assignments for multiple projects, e.g. in Norway (REC), Italy (ST Microelectronics), Malaysia (First Solar), Belgium (IMEC), and Germany (First Solar)
- 2002 - 2007 : Design Lead & Project Coordinator at M+W Group, Hsinchu, Taiwan. Design of buildings and facility systems for several TFT- and Semiconductor facilities (e.g. AUO Longtan, AUO Taichung, TSMC). Construction- & Project Management assignments on construction sites, e.g. AUO Taichung and TSMC 14-2 in Tainan.

- 1999 - 2002 : Project Engineer at M+W Group, Stuttgart, Germany. Design of facility systems for Semiconductor facilities. Construction- & Project Management assignments on construction sites in Germany (e.g. Infineon)

Main Research Activities

- Fraunhofer Institute for Manufacturing Engineering and Automation IPA focusses on the development of technologies and transfer of knowledge with the target to innovate the products and their production, as well as improve the competitiveness of our industry partners.
- As Head of Business Unit Machinery and Equipment Industry at Fraunhofer IPA, M. Schleef is bundling the competences of Fraunhofer IPA for companies who transfer developments and innovative production concepts onto the shopfloor, into production. He is also supporting research projects funded by the German government, by federal states of Germany, and by the European Union.

Guidelines

1. Official Language

The official language of ICAM2016 is English. All presentations including Q&A will be delivered in English.

2. Guideline for Participants

2.1. Conference Venue

Sun Moon Lake Teachers' Hostel

2.2. Registration

Time of Registration: 15:00PM ~ 18:00PM, Friday, Dec. 16th, 2016 (1F-Lobby)

09:00AM~ 17:00PM, Saturday, Dec. 17th, 2016 (1F-Lobby)

09:00AM~ 17:00PM, Sunday, Dec. 18th, 2016 (1F-Lobby)

2.3. Internet Service and International Telephone

Computers with Internet Service at Conference Center are provided by Sun Moon Lake Teachers' Hostel. Wireless is also free to use around the hostel.

2.4. Conference Kit

A conference kit, which contains a conference proceedings, a name badge, tickets for lunches and banquet, a Sun Moon Lake ship ticket, and an official receipt, will be provided to participants during the period from Friday, Dec. 16th to Sunday, Dec. 18th at the Registration/Information Desk.

3. Guideline for Presenters

[1] The presenters and session chairs are asked to keep to the paper sequence as shown in the Final Program. By following this predefined schedule, participants can switch between sessions without missing the particular papers of interest.

[2] The presentation time for each presenter is 15 minutes including Q&A. The session chairs should allow the presenter for a 12minutes presentation and leave 3 minutes for discussions. All presenters are requested to report their attendance to the session chair 10 minutes before the session begins. If there are only 4-5 presenters in a session, then the session chair should allow the presenter for a 15minutes presentation and leave 3minutes for discussions.

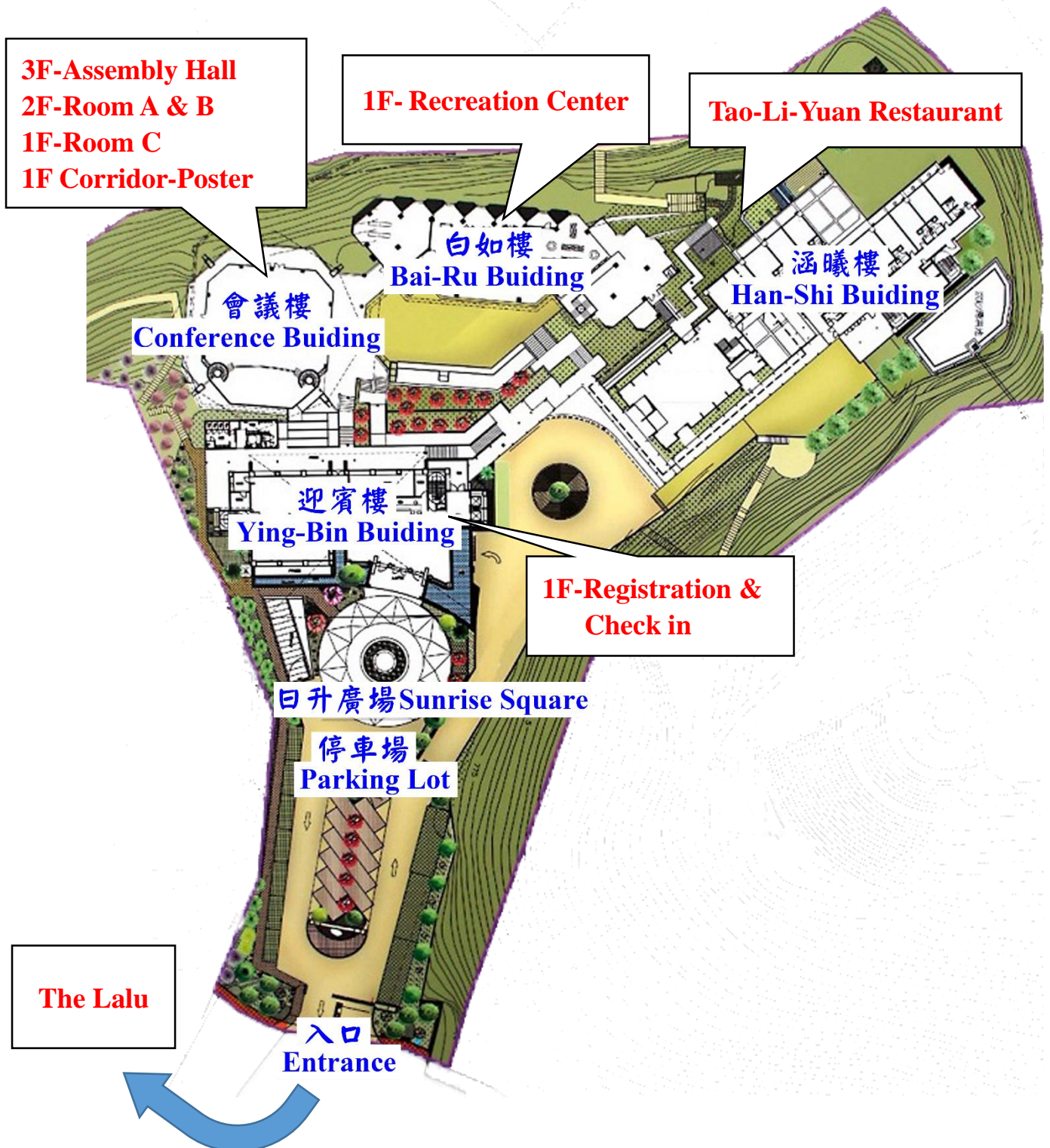
[3] Notebook PCs and LCD projectors will be available in every session room. Presenters are encouraged to prepare their files in MS PowerPoint format on a USB and copy into the PC at session room before the session begins. Our session aids will assist the presenters to copy the file. If you wish to use your own notebook PC, please open the file before your presentation.

[4] For unexpected events that cannot be handled on the spot, you may request through session chairs, session aids or make a direct notification to the Conference Secretary Desk.

4. Guideline for Posters

Standard Poster Size: 50 cm (width) X 90 cm (length)

Sun Moon Lake Teachers' Hostel - Symposium Floor Plan

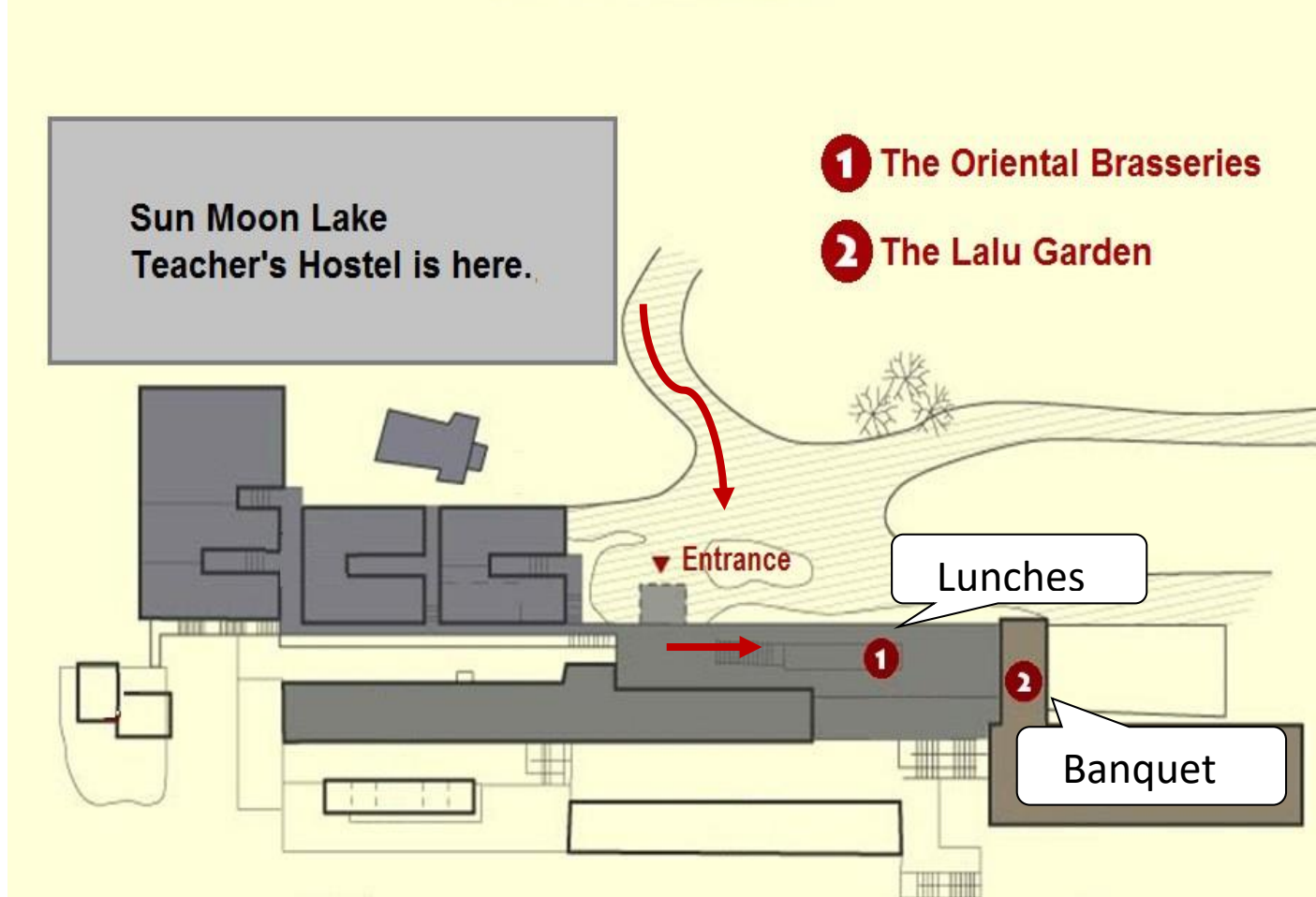


Note: Breakfast and lunch on 18th Dec. would be serviced in the Tao-Li Yuan Restaurant. Lunch on 17th Dec. and banquet would be serviced in the Lulu. Please see the next page for the direction.

The Lalu - Symposium Floor Plan

The Lalu Services & Facilities Guide

涵碧樓設施配置圖





Transportation & Direction

☞ Arrive at Sungshan International Airport

Route 1 Taipei Mass Rapid Transit (MRT) → Kuo-Kuang Motor Transport

1. Please transfer to Taipei Main Station by taking Taipei Mass Rapid Transit (MRT).
 - ✓ MRT ticket: NT\$ 25
2. Go to Taipei Bus Station to take Kuo-Kuang Motor Transport No.1833.
 - ✓ Kuo-Kuang Bus single ticket: NT\$ 460
 - ✓ The journey by Kuo-Kuang Motor Transport No.1833 from Taipei to Sun Moon Lake takes approximately 4 hours.

Route 2 Taipei Mass Rapid Transit (MRT) → Taiwan High Speed Rail (THSR) → Nantou Bus or Sun Moon Lake Route Taiwan Tourist Shuttle Bus

1. Take Taiwan High Speed Rail (THSR) from Taipei Station to Taichung Station
2. Go from THSR Taichung Station Hall No.5 or No.6 Exit Escalator to 1F Bus Station
3. Go to No. 5 Exit, No. 3 Bus Platform and take Nantou Bus No. 6670 or The Taiwan Tourist Shuttle Service: Sun Moon Lake Route.
 - ✓ Nantou Bus single ticket: NT\$ 189
 - ✓ The Taiwan Tourist Shuttle Service ticket: NT\$ 189/ one way, NT\$ 340 / round trip
 - ✓ The journey from Taichung to Sun Moon Lake takes approximately 90 minutes.

☞ Arrive at Taoyuan International Airport

Route Ubus → Taiwan High Speed Rail (THSR) → Nantou Bus or Sun Moon Lake Route Taiwan Tourist Shuttle Bus

1. Please transfer to THSR Taoyuan Station by taking Ubus
 - ✓ Ubus ticket: NT\$ 30
 - ✓ Intervals: 5 - 10 minutes intervals during peak times
 - ✓ Trip length: 25 minutes
2. Take Taiwan High Speed Rail (THSR) from Taoyuan Station to Taichung Station
3. Take Nantou Bus No. 6670 or Taiwan Tourist Shuttle Service: Sun Moon Lake Route.

➡ **Arrive at Kaohsiung International Airport**

Route Kaohsiung Mass Rapid Transit (MRT) → Taiwan High Speed Rail (THSR) → Nantou Bus or Sun Moon Lake Route Taiwan Tourist Shuttle Bus

1. Please transfer to THSR Zuoying Station by taking Kaohsiung Mass Rapid Transit (MRT)
 - ✓ MRT ticket: NT\$ 50
2. Take Nantou Bus No. 6670 or Taiwan Tourist Shuttle Service: Sun Moon Lake Route.

Schedule-at-a-Glance

Friday, December 16th	
09:00~15:00	Venue Layout & Author Presentation Practice
15:00~18:00	Registration

Saturday, December 17th	
09:00~10:00	Registration
10:00~10:30	Opening
10:30~11:10	Keynote Speech I
11:10~11:50	Keynote Speech II
12:00~13:30	Lunch
13:30~15:45	Session A1-C1
	Poster 1-2
	Chiuan-Yan - Thesis Competition
15:45~16:00	Tea Break
16:00~16:40	Keynote Speech III
16:40~17:20	Invited Speech
17:20~17:40	Group Photo
18:00~20:00	Banquet

Sunday, December 18th	
09:00~12:00	Full Paper & Poster Show Session A1-C1 & Poster 1
12:00~13:30	Lunch
13:30~18:00	Full Paper & Poster Show Session A2-C2 & Poster 2

Monday, December 19th Social Event	
9:00~12:00	Bike to Xiangshan Visitor Center
12:00~13:30	Lunch at Jindu Restaurant
14:00~17:00	Visit to Chung Tai Chan Monastery
17:00~18:00	THSR Taichung Station

➤ **Time for each presentation** (Including the question-and-answer period)

- ✓ Keynote Speech: 40 minutes
- ✓ Presentation: 15 minutes

Saturday, December 17th

Oral Session A1 📍 Room A
13:30-15:45

A. Advanced Machining and Forming Processes Measurement
H. Additive Manufacturing Technology
I. Smart Manufacturing Technology for Industry 4.0

Chairman: Hsi-Fu Shih

-National Chung Hsing University

Chairman: Kuang-Jau Fann

- National Chung Hsing University

A1-1. 13:30

A-9185. Study on Grain Coarsening in Aluminum Alloy 6061 by Using Ring Compression Test

Kuang-Jau Fann, Chun-Chi Chen

A1-2. 13:45

H-8559. The Development of Tank Swapping for Powder Bed Additive Manufacturing

Jia-Chang Wang, Chia-Chen Wang, Wei-An Tsai

A1-3. 14:00

H-8560. Development of a customized assistive bite-pen for disabled people by using additive manufacturing

Jia-Chang Wang, Hsiang Hsieh, Yen-Hsun Lin

A1-4. 14:15

H-8562. The Development of Hybrid Manufacturing Systems for Skeleton Surface Object

Jia-Chang Wang, Mon-Lin Wu, Shao-Wei Chen

A1-5. 14:30

H-8563. The development of Slurry-based Ceramic Additive Manufacturing system with no solvent

Jia-Chang Wang, Yi-Min Jiang, Tsung-Han Wu

A1-6. 14:45

H-8567. The Design and Implementation of a FDM Type Additive Manufacturing System

Jia-Chang Wang, Ming-Qian Jiang, Sih-Hao Lin

A1-7. 15:00

H-8656. Ontology-Based Service Process and Patent Informatics for Collaborative Service Innovation: The Case of Orthodontic 3D Printing

Amy J.C. Trappey, Tong-Mei Wang, Charles V. Trappey, Jasmine T.C. Tung, Mark Y.L. Tang

A1-8. 15:15

H-9137. Fabrication of Zirconia Ceramic parts using Solvent Based Slurry by Stereolithography & Sintering process

Jia-Chang Wang, Hitesh Dommati

Saturday, December 17th

Oral Session B1 ♥ Room B
13:30-15:45

**F. Precision Engineering
Measurement**

K. Others

**L. Military-civilian dual-use
technologies (invited session)**

Chairman: Jeich Mar

-Yuan-Ze University

Chairman: Sergei Alexandrov

*- Institute for Problems in Mechanics,
Moscow, Russia*

B1-1. 13:30

F-8457. Channel Parameter Measurements of Indoor LTE System for the Industrial Internet of Things

Jeich Mar, Guan-Yi Liu, Tsung-Yu Chang, Yu-Jie Wang, Yung-Chun Chiang

B1-2. 13:45

F-9820. Development of image processing setup for an auto-scraping machine

Szu-Lin Liu, Chun-Yuan Yeh, Po-Chun Chi, Shih-Chieh Lin

B1-3. 14:00

K-8952. A new method of finding stress solutions in plastically compressible solids

Sergei Alexandrov

B1-4. 14:15

K-9093. Multi Power Bank

Wei Bin Yang, Guan-Yu Chen

B1-5. 14:30

K-9124. A parameter identification method for structural systems using moving window Fourier Transform

Wenlung Li, Kuo-Ching Liu, You-Rong Lin

B1-6. 14:45

K-9734. An Adjustable Liquid-Liquid Extraction device for the Extraction of Pharmaceutical Compounds

Yu-Lung Chang, Chen-Han Chuang, Ya-Yu Chiang

B1-7. 15:00

L-8461. Applications of energy storage for family and community

Chih-Hsien Chung, Gwo-Huei You, Kuo-Sheng Fu, Kuo-Kuang Jen, Chien-Hao Chen, Chi-Sheng Wu, Shu-Hsien Wen, Wei-Min Hsiao, Tsung-Jung Wu, King Chen, Chen-Ho Huang

B1-8. 15:15

L-8485. Synthesis of Egg-shell Pd catalyst supported on Al₂O₃

Shu-Jen Chiang, Yu-Wen Chen

B1-9. 15:30

L-8551. Material analysis and electrical properties of nanostructured vanadium oxide (VO_x) thin films for microbolometer

Hsin-Chang Chen

Saturday, December 17th

Oral Session C1 ♥ Room C
13:30-15:45

B. Micro- and Nano-Fabrication
C. Tribology for Manufacturing
E. Bio-medical Manufacturing
G. Robotics and Automation

Chairman: Wen-Cheng Kuo

*- National Kaohsiung First University of
Science and Technology*

Chairman: Albert Wen-Jeng Hsue

*- National Kaohsiung University of Applied
Sciences*

C1-1. 13:30

B-8540. Accelerated-Lifetime-Soak-Test of flexible 3D wireless implantable biomedical system

Wen-Cheng Kuo, Huei-Jun Wang, Wei-Ching Wang, Kuan-Chiao Cheng

C1-2. 13:45

B-8700. Maskless Lithography Realized by Digital Projection Optics and Point Array Oblique Scanning Method

Hung-Liang Chien, Yung-Chun Lee

C1-3. 14:00

B-9041. Structural coloration polymer labels based on photonic crystal grating

Chang-Yi Peng, Ching-Wen Li, Che-Wei Hsu, Chien-Chung Jeng, Cheng-Chung Chang, Gou-Jen Wang

C1-4. 14:15

B-9953. Fabrication of floating image devices using a 3-D printer

Cheng-Yu Li, Hsi-Fu Shih

C1-5. 14:30

C-8570. Discharge Coating on Mold Steel Surface through Wire-EDM by Nickel-coated Wire and Conventional Brass Wire

Albert Wen-Jeng Hsue, Sheng-Hsuan Chiu, Yang-Lei Lin

C1-6. 14:45

C-9954. Friction Characteristics for Sliding Blocks with Micro Grooves

Hsin-Chih Wang, Jhy-Cherng Tsai, Pin-Lun Huang, Jhy-Ming Chen

C1-7. 15:00

E-8608. Study on Brain phantom in Surgical Training

Kuan-Ting Liu, Fu-Ren Xiao, Hong-Tsu Young, Chao-Yang Huang

C1-8. 15:15

G-8602. Robotic Surgical Assistant for minimally invasive cranial surgery

Ding-Yuan Chen, Fu-Ren Xiao, Hong-Tsu Young, Chao-Yang Huang

C1-9. 15:30

E-8932. Surface Treatment on Physical Properties and Biocompatibility of Orthodontic Power Chains

H. C. Cheng, W. T. Lin, Y. K. Shen, Y. H. Wang

Saturday, December 17th

Poster 1 ♥ 1F Corridor
13:30-14:30

Poster 1-1.

L-8131. The multi functional kitchenware with integrated wireless networking technology

Ming-Hung Lin, Tsung-Hao Yang, Jung-Chieh Chang

Poster 1-2.

A-8200. Production of Stainless Steel 316L Powder for Additive Manufacturing by Gas Atomization Processes

M. R. Wang, K. L. Lai, W. C. Tseng

Poster 1-3.

L-8466. Application of Vacuum Assisted Resin Transfer Molding in Highly Loaded Structures of Composite Bridge

Kuo-Wei Wu, Chih-Chia Chen, Tseng-Chung Ko

Poster 1-4.

L-8475. The thermal reliability analysis of metallized AlN substrate

C. T. Wu, Y. K. Kuo, P. S. Huang, C. H. Lin, M. Y. Tsai

Poster 1-5.

F-8480. Measuring and Compensating Methods for Spatial Positioning Accuracy of a Six-Axis Industrial Robot

Chien-Hung Liu

Poster 1-6.

G-8502. Investigations of the Force and Contour Tracking Control of the Robot Arm

in Polishing Operations

Liang-Kuang Chen, Ssu-Hsien Kuo

Poster 1-7.

I-8514. IEC 61499 Application in Leveling Production Line

Yi-Chih Fan, Cheng-Chen Yang, Jen-Yuan (James) Chang

Poster 1-8.

I-8522. Intelligent Coil Leveling Machine Development through Cyber-Physical Systems Integration

Brian Chen, Jen-Yuan (James) Chang

Poster 1-9.

H-8538. Impact test of 3D-printing photopolymer specimens

F.C. Hsieh, P.H. Lin, H.P. Pan, C.S. Yu, C.M. Chang

Poster 1-10.

I-8541. Intelligent Coil Leveling System based on Deep Learning methods

Sung-Yu Tsai, Jen-Yuan (James) Chang

Poster 1-11.

F-8543. The development and optimization of an optical autofocus system by adopting the dual-confocal configuration

Chien-Sheng Liu, Chia-Ming Jan, Jyun-Yi Yang

Poster 1-12.

B-8547. Self-Adjusting Blade Coating for Large-Sized Polymeric Light Emitting Diode Lighting

J.-W. John Cheng, Yo-Han Wu, Tzu-Ching Yang, Chuang-Hung Chiu, Yen-Yu Huang, Yeh-Min Lin, Chang-Pen Chen

Poster 1-13.

A-8590. An Investigation on Vibration-Assisted Glass Cutting

Jhy-Cherng Tsai, Yuan-Hung Tsai

Poster 1-14.

I-8625. Smart Manufacturing Study of the Innovative Mushroom Production Line

Rong-Yuan Jou, Trung-Hung Nguyen

Poster 1-15.

H-8646. Evaluation of the physico-mechanical properties of activated-carbon enhanced recycled polyethylene/polypropylene filament for 3D printing

Siewhui Chong, Guan-Ting Pan, Thomas C.-K. Yang, Yi-Fan Chen, Jaron Keng

Poster 1-16.

B-8688. Fabrication of Transparent Thin Film Transistor with Zinc Indium Tin Oxide Channel Layer

Sheng-Po Chang, Yi-Shiang Hsiao, Wen-Chen Hua, Jun-Yi Li

Saturday, December 17th

Poster 2  1F Corridor

14:30-15:45

Poster 1-1.

A-8885. Sidewall Curl Reduction Using Active Drawbead with Advanced High Strength Steel

Yu-Ting Yeh, Sin-Liang Lin, Kai-Chieh Hsu, Kuan-Ming Li, Fuh-Kuo Chen, Yi-Kai Lin

Poster 1-2.

B-8913. Performances of nanostructures within InGaN-based Multiquantum-well Light-emitting Devices

Ya-Fen Wu, Jiunn-Chyi Lee

Poster 1-3.

K-8976. Impact Deformation Behaviour and Microstructural Evolution of AZ80 Magnesium Alloy under Different Temperatures

Woei-Shyan Lee, Cheng-Wen Chou, Ming-Chi Lu

Poster 1-4.

K-8982. Wireless Power Collection Using Radio Frequency Identification System

Chun-Hsi Su, Shih-I Huang

Poster 1-5.

D-9076. A Study on Maximum Effective Face Width without Tooth Pointing of Curvilinear Gears Generated by Male Fly Cutters

Yi-Cheng Chen, Zhi-Wei Li, Chien-Cheng Lo, Zhi-Gen Wang, Chien-Sheng Liu

Poster 1-6.

K-9095. Optimum Design of Bipod Flexures on a Spaceborn Primary Mirror under Different Conditions

Chia-Yen Chan, Shenq-Tsong Chang, Yi-Kai Huang, Ting-Ming Huang

Poster 1-7.

A-9106. The optimal blank shape of the oil pan deep drawing

Yen-Liang Yeh, Hsien-Jung Hsu, Ming-Jyi Jang, Hung-Pu Yeh

Poster 1-8.

E-9190. The Study of Optimal Parameters on Metal Surgical Guide Tubes Structure Design for Spinal Fusion Surgery

Chia-Hung Yeh, Fuh-Yu Chang, Yi-Tse Chang, Hong-Tsu Young

Poster 1-9.

A-9193. Countersunk Studs Hot Forged in Core-Shell Type Metal Composite

Kuang-Jau Fann, Wei-Ang Lai

Poster 1-10.

K-9254. Development of a Safe and Energy Efficiency Water Heater by Induction Heating

Huy-Tien Bui, Sheng-Jye Hwang, Huei-Huang Lee, Durn-Yuan Huang, Zen-Jie Wang

Poster 1-11.

A-9303. Reduction of Sidewall Curl in Sheet Metal Forming of Advanced High Strength Steels via Blank Holder Force

Meng-Chieh Wang, Sin-Liang Lin, Chun-Kai Hsu, Kuan-Ming Li, Fuh-Kuo Chen, Yi-Kai Lin

Poster 1-12.

F-9426. Development of A Computer-Aided Analysis System for Assembly Precision of A Machine Tool

Zing-Ping Liu, Jhy-Cherng Tsai, Chun-Jung Su

Poster 1-13.

K-9510. Tolerance and Motion Analysis of Antenna Mast

Jau-Liang Chen, Ming-Hong Shih, Chen-Yang Hong, Xun-Yao Lin, Chih-Wei Chao, Jhy-Cherng Tsai, Chi-Hang Lin

Poster 1-14.

F-9714. Fiber Bragg Grating Interrogation System for Angular Velocity Measurement

Ming-Chang Shih, Ying-Hong Lin, Ying-Hong Lin, Ming-Chang Shih

Poster 1-15.

K-9740. EEG Coherence of Recognition Memory: Inter Hemispheric Connectivity Analysis

Li-Pen Chao, Jiin-Po Wu

Poster 1-16.

K-9744. Simulation on Geological CO₂ Storage in the Western Taiwan Basin

Neng-Chuan Tien, Cai Li, Keni Zhang, Chun-Ping Jen

Poster 1-17.

I-9053. Analysis of Workpiece-Clamp AE Signals for Tool Wear Monitoring System in the Milling of Inconel 718

Chen-Yu Liang, Ming-Chyuan Lu

Saturday, December 17th

Chiuan-Yan Thesis Award

◆ 1F-Recreation Center

13:30-15:45

Poster 01.

Z-T 平台之驅動暨應用於熱沉之動態熱傳量測

作者：呂祈旻、楊博堯、李宏銘

指導教授：曾憲中、鄭澤明

Poster 02.

運用數位影像相關法量測 XXY 精密對位平台的運動軌跡並開發即時追跡技術

作者：王盛儀、黃右年

指導教授：馬劍清、張敬源

Poster 03.

精密對位雷射誘發大氣電漿透明導電薄膜成形系統

作者：陳文凱、黃佩君、藍辰睿

指導教授：莊嘉揚、李明蒼

Poster 04.

自動孔徑檢測校正平台

作者：江韋勳、吳俊陞、陳宏輔

指導教授：陳俊仁

Poster 05.

雙自由度雷射光學尺量測技術

作者：孫柏彥、李柏緯

指導教授：謝宏麟

Poster 06.

應用 XXY 平台於影像檢測方法之研究-以 IC 焊接於 PCB 之品質檢測為例

作者：李孟軒、李冠德

指導教授：蕭瑛星

Poster 07.

磁共振耦合之無線電能傳輸暨其迴圈共振天線之效率改善研究

作者：劉俊呈、巫德彥

指導教授：陳華明、林憶芳

Poster 08.

不同退火溫度對 $Ag_{0.6}Pb_{18}Sb_5Te_{20}$ 之熱電性能與微觀結構之影響

作者：曾廷揚

指導教授：陳道星

Poster 09.

鋁元素對銅基金屬玻璃之機械性質與微觀結構影響

作者：林宜君

指導教授：陳道星

Poster 10.

應用立體數位影像相關法於結構承受動態加載的三維變形量測與損傷檢測

作者：陳亮至

指導教授：馬劍清、張敬源

Poster 11.

大行程精密平台之定位控制

作者：王國安、彭奕愷

指導教授：王富正

Poster 12.

Nano-imprinting of structural coloration polymers

作者：彭長毅、李靜雯

指導教授：王國禎、鄭建宗

Poster 13.

自適應模糊滑模 PI 控制在 XY 平台軌跡應用

作者：林庭煥、劉冠佑

指導教授：毛偉龍

Poster 14.

應用 XXY 對位平台發展高效率六軸微陣
列晶片點印平台
作者：莊凱文、楊孟晨、賴仁斌
指導教授：陳瑄易

Poster 15.

應用位置感測器於 XXY 平台閉迴路控制
作者：蔡秉桓、胡瑋倫、鄭亦翔
指導教授：劉晉嘉

Poster 16.

光強比對式平板對位裝置
作者：劉翰揚、蔡朥懊、陳雅君
指導教授：林瑞璋、王永成

Poster 17.

地震儀應用於平台震動量測
作者：蕭宇傑、許俊智
指導教授：李朱育

Poster 18.

新式泛用撓性陣列夾具之設計與夾持穩固
度分析驗證
作者：曾一中、林洋磊
指導教授：許文政

ICAM2016 Full Paper & Poster Show

Sunday, December 18th

Full Paper Show Session A1  Room A

A. Advanced Machining and Forming Processes Measurement

H. Additive Manufacturing Technology

I. Smart Manufacturing Technology for Industry 4.0

09:30-11:30

A-9185. Study on Grain Coarsening in Aluminum Alloy 6061 by Using Ring Compression Test
Kuang-Jau Fann, Chun-Chi Chen

H-8559. The Development of Tank Swapping for Powder Bed Additive Manufacturing
Jia-Chang Wang, Chia-Chen Wang, Wei-An Tsai

H-8560. Development of a customized assistive bite-pen for disabled people by using additive manufacturing
Jia-Chang Wang, Hsiang Hsieh, Yen-Hsun Lin

H-8562. The Development of Hybrid Manufacturing Systems for Skeleton Surface Object
Jia-Chang Wang, Mon-Lin Wu, Shao-Wei Chen

14:30-15:30

H-8563. The development of Slurry-based Ceramic Additive Manufacturing system with no solvent
Jia-Chang Wang, Yi-Min Jiang, Tsung-Han Wu

H-8567. The Design and Implementation of a FDM Type Additive Manufacturing System
Jia-Chang Wang, Ming-Qian Jiang, Sih-Hao Lin

H-8656. Ontology-Based Service Process and Patent Informatics for Collaborative Service Innovation: The Case of Orthodontic 3D Printing
Amy J.C. Trappey, Tong-Mei Wang, Charles V. Trappey, Jasmine T.C. Tung, Mark Y.L. Tang

H-9137. Fabrication of Zirconia Ceramic parts using Solvent Based Slurry by Stereolithography & Sintering process
Jia-Chang Wang, Hitesh Dommati

Sunday, December 18th

Full Paper Show Session B1 Room B

F. Precision Engineering Measurement

K. Others

L. Military-civilian dual-use technologies (invited session)

09:30-11:30

F-8457. Channel Parameter Measurements of Indoor LTE System for the Industrial Internet of Things

Jeich Mar, Guan-Yi Liu, Tsung-Yu Chang, Yu-Jie Wang, Yung-Chun Chiang

F-9820. Development of image processing setup for an auto-scraping machine

Szu-Lin Liu, Chun-Yuan Yeh, Po-Chun Chi, Shih-Chieh Lin

K-8952. A new method of finding stress solutions in plastically compressible solids

Sergei Alexandrov

K-9093. Multi Power Bank

Wei Bin Yang, Guan-Yu Chen

K-9124. A parameter identification method for structural systems using moving window Fourier Transform

Wenlung Li, Kuo-Ching Liu, You-Rong Lin

14:30-15:30

K-9734. An Adjustable Liquid-Liquid Extraction device for the Extraction of Pharmaceutical Compounds

Yu-Lung Chang, Chen-Han Chuang, Ya-Yu Chiang

L-8461. Applications of energy storage for family and community

Chih-Hsien Chung, Gwo-Huei You, Kuo-Sheng Fu, Kuo-Kuang Jen, Chien-Hao Chen, Chi-Sheng Wu, Shu-Hsien Wen, Wei-Min Hsiao, Tsung-Jung Wu, King Chen, Chen-Ho Huang

L-8485. Synthesis of Egg-shell Pd catalyst supported on Al₂O₃

Shu-Jen Chiang, Yu-Wen Chen

L-8551. Material analysis and electrical properties of nanostructured vanadium oxide (VO_x) thin films for microbolometer

Hsin-Chang Chen

Sunday, December 18th

Full Paper Show Session C1 📍 Room C

B. Micro- and Nano-Fabrication

C. Tribology for Manufacturing

E. Bio-medical Manufacturing

G. Robotics and Automation

09:30-11:30

B-8540. Accelerated-Lifetime-Soak-Test of flexible 3D wireless implantable biomedical system

Wen-Cheng Kuo, Huei-Jun Wang, Wei-Ching Wang, Kuan-Chiao Cheng

B-8700. Maskless Lithography Realized by Digital Projection Optics and Point Array Oblique Scanning Method

Hung-Liang Chien, Yung-Chun Lee

B-9041. Structural coloration polymer labels based on photonic crystal grating

Chang-Yi Peng, Ching-Wen Li, Che-Wei Hsu, Chien-Chung Jeng, Cheng-Chung Chang, Gou-Jen Wang

B-9953. Fabrication of floating image devices using a 3-D printer

Cheng-Yu Li, Hsi-Fu Shih

C-8570. Discharge Coating on Mold Steel Surface through Wire-EDM by Nickel-coated Wire and Conventional Brass Wire

Albert Wen-Jeng Hsue, Sheng-Hsuan Chiu, Yang-Lei Lin

14:30-15:30

C-9954. Friction Characteristics for Sliding Blocks with Micro Grooves

Hsin-Chih Wang, Jhy-Cherng Tsai, Pin-Lun Huang, Jhy-Ming Chen

E-8608. Study on Brain phantom in Surgical Training

Kuan-Ting Liu, Fu-Ren Xiao, Hong-Tsu Young, Chao-Yang Huang

G-8602. Robotic Surgical Assistant for minimally invasive cranial surgery

Ding-Yuan Chen, Fu-Ren Xiao, Hong-Tsu Young, Chao-Yang Huang

E-8932. Surface Treatment on Physical Properties and Biocompatibility of Orthodontic Power Chains

H. C. Cheng, W. T. Lin, Y. K. Shen, Y. H. Wang

Sunday, December 18th

Poster Show 1 09:30-11:30 📍 3F Assembly Hall

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L-8131. The multi functional kitchenware with integrated wireless networking technology <i>Ming-Hung Lin, Tsung-Hao Yang, Jung-Chieh Chang</i>	H-8538. Impact test of 3D-printing photopolymer specimens <i>F.C. Hsieh, P.H. Lin, H.P. Pan, C.S. Yu, C.M. Chang</i>
Poster 1-2.	Poster 1-10.
A-8200. Production of Stainless Steel 316L Powder for Additive Manufacturing by Gas Atomization Processes <i>M. R. Wang, K. L. Lai, W. C. Tseng</i>	I-8541. Intelligent Coil Leveling System based on Deep Learning methods <i>Sung-Yu Tsai, Jen-Yuan (James) Chang</i>
Poster 1-3.	Poster 1-11.
L-8466. Application of Vacuum Assisted Resin Transfer Molding in Highly Loaded Structures of Composite Bridge <i>Kuo-Wei Wu, Chih-Chia Chen, Tseng-Chung Ko</i>	F-8543. The development and optimization of an optical autofocus system by adopting the dual-confocal configuration <i>Chien-Sheng Liu, Chia-Ming Jan, Jyun-Yi Yang</i>
Poster 1-4.	Poster 1-12.
L-8475. The thermal reliability analysis of metallized AlN substrate <i>C. T. Wu, Y. K. Kuo, P. S. Huang, C. H. Lin, M. Y. Tsai</i>	B-8547. Self-Adjusting Blade Coating for Large-Sized Polymeric Light Emitting Diode Lighting <i>J.-W. John Cheng, Yo-Han Wu, Tzu-Ching Yang, Chuang-Hung Chiu, Yen-Yu Huang, Yeh-Min Lin, Chang-Pen Chen</i>
Poster 1-5.	Poster 1-13.
F-8480. Measuring and Compensating Methods for Spatial Positioning Accuracy of a Six-Axis Industrial Robot <i>Chien-Hung Liu</i>	A-8590. An Investigation on Vibration-Assisted Glass Cutting <i>Jhy-Cherng Tsai, Yuan-Hung Tsai</i>
Poster 1-6.	Poster 1-14.
G-8502. Investigations of the Force and Contour Tracking Control of the Robot Arm in Polishing Operations <i>Liang-Kuang Chen, Ssu-Hsien Kuo</i>	I-8625. Smart Manufacturing Study of the Innovative Mushroom Production Line <i>Rong-Yuan Jou, Trung-Hung Nguyen</i>

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I-8514. IEC 61499 Application in Leveling Production Line <i>Yi-Chih Fan, Cheng-Chen Yang, Jen-Yuan (James) Chang</i>	H-8646. Evaluation of the physico-mechanical properties of activated-carbon enhanced recycled polyethylene/polypropylene filament for 3D printing <i>Siewhui Chong, Guan-Ting Pan, Thomas C.-K. Yang, Yi-Fan Chen, Jaron Keng</i>
Poster 1-8.	Poster 1-16.
I-8522. Intelligent Coil Leveling Machine Development through Cyber-Physical Systems Integration <i>Brian Chen, Jen-Yuan (James) Chang</i>	B-8688. Fabrication of Transparent Thin Film Transistor with Zinc Indium Tin Oxide Channel Layer <i>Sheng-Po Chang, Yi-Shiang Hsiao, Wen-Chen Hua, Jun-Yi Li</i>

Sunday, December 18th

Poster Show 2 14:30-15:30 📍 3F Assembly Hall

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Poster 2-2.	Poster 2-10.
B-8913. Performances of nanostructures within InGaN-based Multiquantum-well Light-emitting Devices <i>Ya-Fen Wu, Jiunn-Chyi Lee</i>	K-9254. Development of a Safe and Energy Efficiency Water Heater by Induction Heating <i>Huy-Tien Bui, Sheng-Jye Hwang, Huei-Huang Lee, Durn-Yuan Huang, Zen-Jie Wang</i>
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K-8976. Impact Deformation Behaviour and Microstructural Evolution of AZ80 Magnesium Alloy under Different Temperatures <i>Woei-Shyan Lee, Cheng-Wen Chou, Ming-Chi Lu</i>	A-9303. Reduction of Sidewall Curl in Sheet Metal Forming of Advanced High Strength Steels via Blank Holder Force <i>Meng-Chieh Wang, Sin-Liang Lin, Chun-Kai Hsu, Kuan-Ming Li, Fuh-Kuo Chen, Yi-Kai Lin</i>

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K-8982. Wireless Power Collection Using Radio Frequency Identification System <i>Chun-Hsi Su, Shih-I Huang</i>	F-9426. Development of A Computer-Aided Analysis System for Assembly Precision of A Machine Tool <i>Zing-Ping Liu, Jhy-Cherng Tsai, Chun-Jung Su</i>
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K-9095. Optimum Design of Bipod Flexures on a Spaceborn Primary Mirror under Different Conditions <i>Chia-Yen Chan, Shenq-Tsong Chang, Yi-Kai Huang, Ting-Ming Huang</i>	F-9714. Fiber Bragg Grating Interrogation System for Angular Velocity Measurement <i>Ming-Chang Shih, Ying-Hong Lin, Ying-Hong Lin, Ming-Chang Shih</i>
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A-9106. The optimal blank shape of the oil pan deep drawing <i>Yen-Liang Yeh, Hsien-Jung Hsu, Ming-Jyi Jang, Hung-Pu Yeh</i>	K-9740. EEG Coherence of Recognition Memory: Inter Hemispheric Connectivity Analysis <i>Li-Pen Chao, Jiin-Po Wu</i>
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E-9190. The Study of Optimal Parameters on Metal Surgical Guide Tubes Structure Design for Spinal Fusion Surgery <i>Chia-Hung Yeh, Fuh-Yu Chang, Yi-Tse Chang, Hong-Tsu Young</i>	K-9744. Simulation on Geological CO ₂ Storage in the Western Taiwan Basin <i>Neng-Chuan Tien, Cai Li, Keni Zhang, Chun-Ping Jen</i>
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A8200

Production of Stainless Steel 316L Powder for Additive Manufacturing by Gas Atomization Processes

M. R. Wang¹, K. L. Lai¹ and W. C. Tseng¹

¹ *Institute of Aeronautics & Astronautics, National Cheng Kung University*

Abstract

There are numerous manufacturing processes used in metal powder production. Metal powder have been widely utilized in various industry applications, such as additive manufacturing, powder metallurgy, metal injection molding and shot penning etc. Although additive manufacturing has been recognized as having the highest value in metallurgical industry and thus become the key development projects in the world. However, there are rigorous requirements for the metal powder used in additive manufacture, such as particle size, particle size distribution, powder shape, powder flow ability and oxygen content etc. In this research, powder of stainless steel was produced by high pressure gas atomization because of the advantages as high sphericity and high fluidity, low oxygen content and fine particle size with narrow distribution. Since the metal powder was produced through the high temperature melting and then fast-curing process, it is expected that the metal powder could appear the state of fine microstructure. In this study, experimental equipment including four parts, which are melting, atomization, cooling and classification in sequence. In addition, we using supersonic nozzle with external mixing mechanism and through different operating parameters, like gas atomization pressure, protrusion length of deliver tubes, orifice diameter of deliver tube and nozzle apex angles. Result shows that the average particle size (D_{v50}) of stainless steel 316L is 35 μm . Furthermore, yield ratio is 76% when the particle size distribution is between 10 to 63 μm which is known as the most suitable powder size range for additive manufacturing so far. The micrograph of the metal powder by the scanning electron microscopy (SEM) show that the particle shape is approximately sphere and also show the fine microstructure in the surface morphology. The dendritic microstructure of the metal powder is associated with the cooling rate during the processes. The particle size of stainless steel 316L powder which is under 30 μm has part of inconspicuous dendrites. The above results are observed in the surface morphology and crystallization patterns. In addition, we speculate the reason why hardness of stainless steel 316L powder is three times higher as compared with raw materials, due to the fine microstructure achieved by the gas atomization process. It is concluded that the process in this study can be used to produce the fine metal powder for additive manufacturing applications.

Keywords: Stainless Steel 316L 1, Metal powder 2, Additive Manufacturing 3, Gas atomization 4, Particle size 5

A8590

An Investigation on Vibration-Assisted Glass Cutting

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¹*Department of Mechanical Engineering, National Chung Hsing University*

²*Taiwan Railway Administration, Ministry of Transportation and Communications*

Abstract

Glass has been widely employed in consumer products due to its excellent physical and chemical characteristics such as corrosion-resisting and transparency. Glass, however, is hard to cut and easy to fracture because of its brittleness. This study investigated the brittle characteristics of glass and developed a vibration-assisted glass cutting device that can be mounted on the spindle of a vertical CNC machining center. Vibration is driven by a piezoelectric (PZT) actuator and transmits to the cutter to generate the required vibration for cutting. The resonance frequency of the cutter is 17.5kHz, measured by a laser Doppler meter, though the output force vs input voltage is nonlinear. Depth of micro cracks with different cutting forces and vibration amplitudes are tested and measured such that an optimal cutting condition is determined. The cutter is further testified against the quality of glass based on the defects on the cut edges. The results showed that the defects of cut edges are highly reduced with this cutter compared to that by regular cutters.

Keywords: Glass cutting, Micro cracks, Vibration-assisted cutting

A8885

Sidewall Curl Reduction Using Active Drawbead with Advanced High Strength Steel

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¹*Department of Mechanical Engineering, National Taiwan University*

²*Steel & Iron Research & Development Department, China Steel Corporation*

Abstract

Advanced high strength steels (AHSS) have been widely used in automobile structural parts. However, as the strength of steels increase, stamping defects such as sidewall curl and distortion become worse. In order to reduce stamping defects of AHSS, drawbeads are often used in stamping processes. In order to design drawbeads quickly and properly in stamping processes, this research investigates the feasibility of active drawbeads in sheet metal forming process. This research also investigates the difference between physical drawbeads and equivalent drawbeads in CAE simulation because Baushinger effect is much stronger in AHSS than in low strength steels. According to the simulation, physical drawbeads can correctly take Baushinger effect into account in stamping process. In addition, using active drawbeads can reduce sidewall curl more effective than traditional drawbeads. It shows that sidewall curl of blank can be significantly diminished. Radius of sidewall curl of NUMISHEET 2011 Benchmark is higher than 1000mm in DP780 and DP1180 by using active drawbeads.

Keywords: Advanced high strength steel, Sidewall curl, Finite element analysis, Active drawbead

A9106

The optimal blank shape of the oil pan deep drawingYen-Liang Yeh¹, Hsien-Jung Hsu¹, Ming-Jyi Jang¹ and Hung-Pu Yeh²¹ *Department of the automation and control engineering, Far East University*² *Department of the mechanical engineering, Far East University***Abstract**

This paper considers the optimal blank shape of the oil pan deep drawing. This paper uses the scattering modeling method to construct the blank contour. The oil pan is the step shape. This cannot get the optimal shape directly. This paper considers the variable blank holder force. From the analysis result, this can be getting that the variable blank holder force can increase the thickness of the final forming product. In order to get the optimal blank shape, this paper uses the iteration method by using the analysis result and modified initial blank shape. The contour error calculates by using the Geometric Shape Error (GSE). The contour error can reduce to the 0.12mm on the sixth iteration. The convergence velocity of the optimal blank shape is very fast.

Keywords: Drawing, Optimum, Blank, Oil pan

A9185

Study on Grain Coarsening in Aluminum Alloy 6061 by Using Ring Compression Test

Kuang-Jau Fann¹ and Chun-Chi Chen¹¹ *Department of the Mechanical Engineering, National Chung Hsing University*

Abstract

To respond to the global climate dramatically changed by greenhouse effect, using lightweight structures is one of measures reducing carbon emission. Producing structures in metal composites not only can make parts lighter but also keep the outstanding characteristics of individual materials. Under this consideration, this study attempted to create a hot forging process making metal composite part in core-shell type. As an example, a countersunk stud was formed with a shell socket of aluminum 6061 filled with a core rod of aluminum 7075 or steel 1045 in a die within one stroke of a punch. To investigate the feasibility of the process proposed by this study, the distance between the top ends of the shell and the core metal, the forging temperature, the wall thickness of the shell socket, and the frictional boundary condition between the dies and the shell metal are set as the process parameters for this study. As a result from Finite Element analysis with the commercial code DEFORM, a countersunk stud having a nominal diameter of 16 mm could be successfully forged with lubricant graphite and under the settings having top end distance in 9 mm and shell thickness in 3 mm at either 450°C or 500°C. However, the core from medium carbon steel 1045 was barely deformed, while the core from aluminum alloy 7075 had a higher top center at higher temperature. If a lower top end distance was set or a longer core rod was used, the top end of the shell socket could not fully be encapsulated, so that a hole could be found there and the core metal could be revealed through the hole. A similar result could be found if a thin shell socket was used. Furthermore, if no lubricant was applied to the outer surface of the shell metal, not only the top center of the shell metal might be not fully encapsulated but also the countersink would not be completely filled with the shell metal.

Keywords: Metal composite bulk, Core-shell type, Aluminum alloy, Forging, Countersunk stud

A9193

Countersunk Studs Hot Forged in Core-Shell Type Metal CompositeKuang-Jau Fann¹ and Wei-Ang Lai¹¹ *Department of the Mechanical Engineering, National Chung Hsing University***Abstract**

To respond to the global climate dramatically changed by greenhouse effect, using lightweight structures is one of measures reducing carbon emission. Producing structures in metal composites not only can make parts lighter but also keep the outstanding characteristics of individual materials. Under this consideration, this study attempted to create a hot forging process making metal composite part in core-shell type. As an example, a countersunk stud was formed with a shell socket of aluminum 6061 filled with a core rod of aluminum 7075 or steel 1045 in a die within one stroke of a punch. To investigate the feasibility of the process proposed by this study, the distance between the top ends of the shell and the core metal, the forging temperature, the wall thickness of the shell socket, and the frictional boundary condition between the dies and the shell metal are set as the process parameters for this study. As a result from Finite Element analysis with the commercial code DEFORM, a countersunk stud having a nominal diameter of 16 mm could be successfully forged with lubricant graphite and under the settings having top end distance in 9 mm and shell thickness in 3 mm at either 450°C or 500°C. However, the core from medium carbon steel 1045 was barely deformed, while the core from aluminum alloy 7075 had a higher top center at higher temperature. If a lower top end distance was set or a longer core rod was used, the top end of the shell socket could not fully be encapsulated, so that a hole could be found there and the core metal could be revealed through the hole. A similar result could be found if a thin shell socket was used. Furthermore, if no lubricant was applied to the outer surface of the shell metal, not only the top center of the shell metal might be not fully encapsulated but also the countersink would not be completely filled with the shell metal.

Keywords: Metal composite bulk, Core-shell type, Aluminum alloy, Forging, Countersunk stud

A9303

Reduction of Sidewall Curl in Sheet Metal Forming of Advanced High Strength Steels via Blank Holder Force

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Abstract

Due to the goal of reducing emission of CO₂, lightweight design of automobiles has become a major goal for vehicle manufacturers in recent years. It results in the tendency towards the study of sheet metal forming using advanced high strength steels (AHSS). This research aims at reducing of sidewall curl effect after the sheet metal forming process of AHSS via controlling the blank holder force. So far, there is no reference of maximum blank holder force in sheet metal forming. Therefore, this research establishes the maximum blank holder force per unit area for U-hat drawing with AHSS DP590、DP780、DP980 and DP1180 for the future mold design.

Keywords: Advanced high strength steel, Blank holder force, Finite element analysis

B8540

Accelerated-lifetime soak test of a flexible 3D wireless implantable biomedical system

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Abstract

In this study, a flexible 3D wireless implantable biomedical system was developed by integrating a three-dimensional system with packaging technology, and an accelerated-lifetime-soak-test was performed. The developed system can be attached to the skin or implanted in the body. For system integration, parylene was used as the flexible substrate, and the contact pads and connections between the coil and the chip were created using gold deposition; therefore, the chip and the coil can be integrated into a single biocompatible system. After applying the accelerated-lifetime soak test, the resistance variation in the samples was observed daily to verify the time to failure. The mean time to failure at 77 and 90 °C of the samples without heat treatment were 69 and 44 hours, respectively, whereas that of the samples heated to 200 °C exceeded 250 and 70 days, respectively. This result demonstrated that heat treatment lengthens the life time of the samples. The water vapor transmission rate of the system was determined through the MOCON process was found to be approximately 8×10^{-2} g/m²/day.

Keywords: Parylene, Implantable device, Flexible electronic device

B8547

Self-Adjusting Blade Coating for Large-Sized Polymeric Light Emitting Diode Lighting

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Abstract

With thickness variations about ± 10 μm for commercial plastic substrates, deposition of functional materials with about 100 nm thickness in dry, or correspondingly about 10 μm in wet presents a challenge to blade and slot coating for flexible electronics. To address the challenge, a new approach called the self-adjusting blade coating is proposed. Conventional blade coaters place the blade at a fixed height. A self-adjusting blade coater employs a hinged blade. Initially, the blade is placed on the substrate. As the ink flows beneath the coater, the blade is swung up by the hydraulic pressure and shear stress and reaches an equilibrium distance above the substrate when the hydraulic torque and the gravitational torque of the blade becomes balanced. High quality large-area coating results were obtained on glass: conductive polymer PEDOT:PSS in 250 mm x 40 mm with thickness 27.7 ± 1.63 nm and semiconductive polymer P3HT in 200 mm x 60 mm with thickness 18.1 ± 0.95 nm. Furthermore, a 250 mm x 60 mm polymeric light emitting diode (PLED) lighting device with a ~ 28 nm thick hole transport layer of PEDOT:PSS and a ~ 70 nm thick light emitting layer of PFO on an ITO-coated glass was successfully demonstrated.

Keywords: Self-adjusting blade coating, Polymeric light emitting diode, Flexible electronics

B8688

Fabrication of Transparent Thin Film Transistor with Zinc Indium Tin Oxide Channel Layer

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Abstract

We report the fabrication and performance characteristics of amorphous oxide transparent thin film transistors that use radio frequency (RF) magnetron sputter techniques to deposit indium zinc oxide at low oxygen potential for gate-contact metallization and ITO for source and drain. At higher oxygen partial pressures, we deposit zinc indium tin oxide (ZITO) for the semi-conducting channel. The devices used in this study were processed at room temperature, except for a 300-°C plasma-enhanced chemical vapor deposition step used to deposit a 200 nm-thick SiO_x gate dielectric. The average transmittance is 83.78% in visible light for the multi-films. The devices operate in the depletion mode with a threshold voltage of 1.44 V, mobility of 2.83 cm²/V s, an on-off ratio of 10⁴, and a sub-threshold slope of 0.834 V/decade. In addition, we also report the persistent photoconductivity in the channel region of these devices when exposed to UV illumination.

Keywords: Zinc Indium Tin Oxide, Thin-Film Transistor, Phototransistor, UV illumination

B8700

Maskless Lithography Realized by Digital Projection Optics and Point Array Oblique Scanning Method

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Abstract

This study develops a maskless lithography system based on an array of ultraviolet (UV) light spots along with an obliquely scanning method. A 405 nm UV light emitting diode (LED) is used as the UV light source. A digital micromirror device (DMD) acts as an array of switches for the UV light. UV Light reflected by the DMD pixels is projected to a microlens array and focused into a pinhole array which acts as a spatial filter array. After the pinhole array, the DMD-switched UV light is projected by an image projection lens system onto a photo-resist layer deposited on a substrate. The substrate is carried by a servo-controlled XY stage for carrying out maskless lithography along with a synchronized DMD controller. The size of arrayed UV spots points is 204 by 153 with an actual area size of 13.89 x 10.4 mm². A software is developed for controlling the oblique scanning movement and synchronizing with transmitting image files to DMD controller. To achieve high resolution and fast patterning speed, a new algorithm is developed and implemented experimentally. High sensitivity positive photoresist (S1813) with a thickness of 1 μm is used. The UV spot size is 16.2 μm (FWHM). Finally, this study successfully exposure arbitrary graphics with large area on a 4" substrate. The minimum line width is 14 μm with a pattern resolution of 1.5 μm. As an example, a printed circuit board (PCB) with complicated circuit design is successfully completed by this maskless lithography system. Further improvements on smallest line-width, patterning resolution, and patterning speed are under way.

Keywords: UV spot point array, Oblique scanning, Maskless lithography, DMD (digital micromirror device)

B8913

Performances of nanostructures within InGaN-based Multiquantum-well Light-emitting DevicesYa-Fen Wu¹ and Jiunn-Chyi Lee²¹ *Department of Electronic Engineering, Ming Chi University of Technology*² *Department of Electrical Engineering, Taipei City University of Science and Technology***Abstract**

We introduce multiquantum-barrier (MQB) nanostructures into the barrier layers of InGaN/GaN multiquantum-well (MQW) heterostructures to improve the operation characteristics of the light-emitting devices. The electroluminescence (EL) spectra were examined over a broad range of temperatures for the samples. According to the experimental results, we observe the inhibited carrier leakage for the sample with MQB nanostructures. Greater inhomogeneity of nanocrystallites size and stronger localization effect are also obtained for the sample. To interpret this phenomenon, the high-resolution X-ray diffraction curves were measured and analyzed by the Warren-Averbach model. Besides, the external quantum efficiency as a function of temperature is also evaluated. The calculation results coincide with the inference given by the EL measurements. It is found that the performance of the light-emitting devices is enhanced by the MQB nanostructures within InGaN/GaN MQWs.

Keywords: Nanostructures, Multiquantum-well, Electroluminescence, Efficiency

B8932

Surface Treatment on Physical Properties and Biocompatibility of Orthodontic Power Chains

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Abstract

The conventional orthodontic power chain, often composed of polymer materials, has drawbacks such as a reduction of elasticity owing to water absorption as well as surface discoloration and staining resulting from food or beverages consumed by the patient. The goal of this study was to develop a surface treatment (nanoimprinting) for orthodontic power chains and to alleviate their shortcomings. In this study, a concave template was fabricated using pure anodized aluminum by employing the nanoimprinting process. Convex nanopillars were produced on the surface of orthodontic power chains, resulting in surface treatment. Distinct parameters of the nanoimprinting process (e.g., imprinting temperature, imprinting pressure, imprinting time, and demolding temperature) were used to fabricate nanopillars on the surface of orthodontic power chains. This research analyzed the differences in the properties of orthodontic power chains (e.g., surface properties, water absorption, and color stain) before and after the surface treatment. The results of this study showed that the contact angle of the power chains became larger after surface treatment. In addition, the power chains changed from hydrophilic to hydrophobic. The power chain before surface treatment without water absorption had a water absorption rate of approximately 4%, where as a modified chain had a water absorption rate of approximately 2%–4%. Furthermore, the color adhesion of the orthodontic power chains after surface modification was less than that before surface modification.

Keywords: Orthodontic power chain, Anodic alumina, Surface treatment, Nanoimprinting, Biocompatibility, Physical properties

B9041

Structural coloration polymer labels based on photonic crystal grating

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Abstract

The main purpose of this study is to develop a mold with nano concave hemisphere structure for the production of structural coloration polymer labels. The sequential fabrication processes are anodic aluminum oxide (AAO) fabrication, nano-electroforming, and nano-imprinting. A nano photonic crystal structure of AAO barrier layers was generalized using anodization process, followed by sputtering a thin gold film onto the barrier layer surface as the electrode for nickel nano-electroforming. The electroforming of nickel transferred structures from AAO barrier layers to nickel forming a nickel mold with nano concave hemisphere array. Finally, mass production of structural coloration polymer labels can be performed by nano-imprinting using the fabricated nickel mold. The nanostructured surface appears a bright structural coloration with a multicolor spectrum, which strongly depends on the angle of the reflected light. The more importantly was that the nano structures on nickel mold and resin were also observed the structural coloration with different reflective angles.

Keywords: Nano-imprinting of polymers, Anodic aluminum oxide, Structural coloration, Nano-electroforming

B9953

Fabrication of floating image devices using a 3-D printerHsi-Fu Shih¹ and Cheng-Yu Li¹¹ *Department of Mechanical Engineering, National Chung Hsing University***Abstract**

This paper proposes novel methods for fabricating the dihedral corner reflector array (DCRA) and the roof mirror array (RMA). Compared with conventional projection systems needing a screen, the DCRA and RMA are new optical devices which can project images in the air, called floating images. The structure of DCRA consists of square through holes with specular walls. It makes the incident light reflected by the internal walls twice. The RMA structure is simpler than DCRA. It is composed of groove arrays with mirror surfaces.

In the former researches, DCRA elements were usually produced by electric discharge machining or deep X-ray lithography for high aspect ratio micromachining and high mirror accuracy. The RMA elements were often produced by optical injection molding of high precision. All fabrication methods for both devices were complex and challenging. In these years, the 3-D printing technology is emerging and getting matured. Therefore, we investigate the feasibility of fabricating the DCRA and RMA devices by using the 3-D printing method in the study. With a 3-D printer of UV-curing, we can shorten the development time, simplify the producing processes, and decrease the manufacturing cost for both devices.

First, the optical models of devices were built and simulated by using the optical software ZEMAX. With the simulation, the device structures were created by mechanical design tool SolidWorks. They were sent to a high resolution 3-D printer of UV-curing for fabrication. After the printing, secondary curing was conducted to confirm the strength of devices. In order to make specular walls inside the holes, the electroplating was performed to coat a metal film on the surfaces. Finally, the fabricated devices were tested for the capability of projecting floating images. Experimental results will be presented to the conference.

Keywords: Dihedral corner reflector array (DCRA), Roof mirror array (RMA), Floating image, 3-D printing

C8548

Friction and wear behavior of H13 steel at high temperature processed by laser surface remelting grating

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Abstract

AISI H13 steel is the most commonly used hot work tool steel for die casting and forging dies. Friction, wear behavior and thermal fatigue properties are important factors which influence the service life of dies. In this paper, quenched and tempered AISI H13 tool steel was selected as the substrate. Specimens with different laser track spacings were processed by laser surface remelting using an Nd:YAG laser and were prepared to study the friction and wear behavior at 300°C. The microstructure and microhardness of the laser remelted area were presented. The results of dry sliding wear tests indicated that the wear resistance of specimens processed by laser remelting has a remarkable improvement in comparison to the untreated specimen. The improvement in wear resistance at high temperature is directly related to the ratio of the laser remelted area. The friction coefficient of the specimen also increases with the ratio of the laser remelted area.

Keywords: Laser surface melting, Friction and wear behavior, H13, Microstructure

C8570

Discharge Coating on Mold Steel Surface through Wire-EDM by Nickel-coated Wire and Conventional Brass Wire

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Abstract

The research adopted nickel-electroplated copper wire and M333 steel workpiece are used. The effects of machining parameters for wire electrical discharge machining (wire-EDM) coating such as open-voltage, on-time feed-rate are investigated, respectively. It is found that the relatively optimal operation conditions for surface modification are open-voltage 105V, on-time 0.1 μ s, off-time 25 μ s, and the fixed feed-rate of 0.5mm/min. Under such a combination of operating condition, the most uniformly distributed and abundant alloy layer through Wire-EDM coating, or cladding, was obtained. Comparison on the mechanical properties revealed that the workpiece conducted through brass wire preserved a little stronger anti-bending strength before the yield point, but once going to plastic deformation, the nickel cladding workpiece revealed much higher stress.

Keywords: Wire electrical discharge machining, Nickel-electroplated copper, Recast layer, Coating, Cladding, Mechanical property

C9954

Friction Characteristics for Sliding Blocks with Micro GroovesHsin-Chih Wang¹, Jhy-Cherng Tsai¹, Pin-Lun Huang¹ and Jhy-Ming Chen¹¹ *Department of the Mechanical Engineering, National Chung Hsing University***Abstract**

Sliding mechanisms have been widely employed in mechanical systems. It is a crucial issue for the performance of a machine to control the friction characteristics of sliding blocks. While the sliding block is often manually scraped to improve its tribological properties, the quality is not stable nor the control of the performance. This study is aimed to investigate the influences of geometries on the frictional characteristics of a sliding block with micro-scale grooves through theoretical analysis and numeric simulations. The study analyzed the frictional characteristics of micro grooves with circumferential, stepped, crossed, and wedged shapes. Initial findings suggested that wedged micro grooves provide best performance for the sliding block. An in-depth analysis indicated that the sliding block with micro-scale wedged grooves was uplifted when it slides, thus reduced the sliding friction. Moreover, as the amount of lubricant collected on the grooves increased, resulting in a thicker lubrication film, the friction force decreased with time and approached a stable condition.

Keywords: Micro groove, Sliding block, Tribological properties, Friction characteristics

D9076

A Study on Maximum Effective Face Width without Tooth Pointing of Curvilinear Gears Generated by Male Fly Cutters

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Abstract

This study explored the influence of design parameters on the effective face width and tooth pointing of curvilinear gear generated by a male fly cutter with a circular-arc normal section. The maximum effective face width of curvilinear gear was limited by the occurrence of tooth pointing. Tooth pointing occurred when the left-side and right-side tooth flanks intersected and the top land of the tooth was vanished. The tooth pointing of curvilinear gear should be avoided when manufacturing curvilinear gears. In this article, firstly, the mathematical of the curvilinear gear was developed based on the theory of gearing and the generating mechanism composed of fly-cutters. The conditions of tooth pointing was derived in mathematical equations and these equations were solved numerically by our developed computer program. In addition, several numerical examples were given to illustrate the influences of design parameters, including the number of teeth, nominal radius of fly-cutter disk, and normal module, on the resulting maximum effective face width of the curvilinear gear without the occurrence of tooth pointing. The results presented in this study was helpful for gear designers to choose proper design parameters when manufacturing curvilinear gears.

Keywords: Effective tooth width, Tooth pointing, Curvilinear gear

E8608

Study on Brain phantom in Surgical Training

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Abstract

Hydrocephalus is a disease that usually occurs in older adults. It is a condition that there is too much cerebrospinal fluid in the brain. The increase of brain pressure may cause patient faint or to death. VP-shunt is the common surgical way that treats hydrocephalus. It uses external ventricular drain to make excessive cerebrospinal fluid absorb by peritoneal. However, the accuracy of this surgery could be improved because most surgeons performed free hand, relying on the landmark of the patient face. Recently, image-guide surgery is generally used in neurosurgical procedures. Before performing surgery, surgeons use CT scans to check the target. With the help of the navigation system, the occurrence of surgical error will decrease. Meanwhile, residents should be proficient in their training, so some researcher developed a simulator allows the surgeons to get a feel for texture of brain. Therefore, this research focuses on the development of the brain phantom for surgical training. The phantom includes skull, brain tissue and ventricles. The 3D-printed skull has been firstly drilled hole where surgeons usually puncture. Meanwhile, we took gellan gum, gelatin, and jelly t powder, mixing with different concentrations to make mimic brain phantom. Finally, we measure its hardness, density, to confirm which brain phantom is most similar with human brain.

Keywords: VP shunt, Robotic image-guide surgery, Brain phantom

E9190

The Study of Optimal Parameters on Metal Surgical Guide Tubes Structure Design for Spinal Fusion Surgery

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Abstract

Due to modern people's prolonged working hours, improper posture, aging, and other factors, back pain, spinal function degradation, or even disc herniation in serious cases may result. Many surgical approaches for spine treatment are available. In this study, spinal fusion (spondylodesis) was targeted to discuss additive manufacturing technology in assistive surgery. Take a spinal surgery guide tube for example; additive manufacturing materials still cannot permanently stay in the body. When the guide tube is drilled, there is concern that the debris may enter the body. Since the guide is not made of biocompatible material, adverse post-surgical effects may result. In order to reduce risks during and after surgery, the original design of the material form has been changed, while the lightweight structural design has been adopted to improve the guide tube. Through the design of experiment (DOE) and response surface methodology (RSM) in this study, coupled with finite element software ANSYS, lightweight guide tube simulations and analyses were carried out to obtain the best design parameters. The parameter design factors include: the geometric side, tube wall thickness, lead angle, and chamfer of the guide tube. Simulated results show that three factors and some of the interactions possess significance ($p < 0.05$). All the design and metal material array combinations consisted of 27 independent models. The model with the least volume obtained is the best solution in this study. The design material is Ti-6Al-4V, six squares for every row. The best solution underwent physical verification, and mechanical performance test was carried out by means of additive manufacturing to verify optimization. The results are within the range of the simulated standard results.

Keywords: Spinal fusion surgery, Surgical guide tubes, Additive manufacturing, Finite element method, Response surface methodology

F8457

Channel Parameter Measurements of Indoor LTE System for the Industrial Internet of Things

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Abstract

This paper aims at channel parameter measurements of indoor LTE System for the deployment of base station to have a good coverage and system reliability. For the purpose of determining the path loss (PL) exponent and the standard deviation of the received shadow fading signal in the factory environments, the power measurement of small cell is performed in the laboratory. A small cell experimental platform is built in a laboratory, which contains an evolved node B (eNB) and user equipment (UE). Finally, based on the experimental results, the precise formula of the PL model and the calculated fade margin (FM) for 90% service probability are exploited to predict the coverage range of the small cell base station deployed in the factory optimally. The measured PL channel models are compared with ITU PL channel model.

Keywords: Industrial internet of things, Long term evolution-advanced system, Path loss model, Fade margin, System reliability

F8480

Measuring and Compensating Methods for Spatial Positioning Accuracy of a Six-Axis Industrial Robot

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Abstract

For improving the spatial positioning accuracy of the industrial robot, this paper proposed the modeling and compensating methods of positional errors of the end-effector of a six-axis industrial robot arm. The compensation model and a new measuring device (RP-Checker) were developed to compensate the angular errors of the five joints. Specifications of the RP-Checker are measurable range of 360 degrees, measurement accuracy of ± 1 arcsec and repeatability of 0.6 arcsec. According to compensation model and the forward kinematic model with the joint parameters in Denavit–Hartenberg (DH) Matrix, the compensated joint angular errors measured by the RP-Checker can sufficiently improve the spatial positioning accuracy of end-effector of the robot arm at least one order accuracy.

Keywords: Robot arm, Joint angle error, Calibration, Spatial position measurement, Compensation

F8543

The development and optimization of an optical autofocus system by adopting the dual-confocal configuration

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Abstract

This paper described the optimizing of an optic-base autofocus system by utilizing a convention dual-confocal configuration, which included the front and rare focal points in the system. It could easily indicate the real-time position by obtaining the response signal (e.g. intensity) where the focal points are located. There is a new and systematic design strategy to have a chance to obtain the key characteristics exactly and experimentally, even to be a golden guideline of optimizing. We certainly constructed a physical optical system based on dual-confocal configuration to make sure its optimization be valid. The total optical difference from 150mm to 400mm significantly affected the effective volume of our designed autofocus system, then needed to be well considered while integrating the module into the whole system. We discovered that sensitivity of the autofocus system greater affected by the position of rare focal point sensitively than the position of front focal point. The final optimizing setup indicated that the rare focal length is 200mm, and the front focal length is 100mm, respectively. Furthermore, the characteristic curve between focus error signal (FES) and its position can successfully define as a polynomial equation of 6th order when comparing with the complete simulation.

Keywords: Dual-confocal, Confocal, Autofocusing, Optical optimization

F9426

Development of A Computer-Aided Analysis System for Assembly Precision of A Machine Tool

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² *Precision Machinery Research Center*

Abstract

Assembly precision plays an important role in precision machinery industry, in particular for machine tool industry, to ensure product quality and market competition. While current practice emphasizes on measurement of assembled precision, there is an urgent need to estimate the volumetric precision of the machine abased on measured data. This research is aimed to develop algorithms for two major functions: (1) calculating the volumetric error of the machined tool based on the measured straightness and parallelism or perpendicularity data of each axis of motion; and (2) estimating the flatness of a planar surface based on measured height of each point and predicting the final flatness of the surface when certain high points are scraped/machined to a lower height. The developed software calculates the location and amount of scraping as well as volumetric error of the machine tool before and after scraping. It provides a handy tool for manual scraping and improves the quality and efficiency of scraping.

Keywords: Assembled precision, Volumetric error, Machine tool, Scraping

F9714

Fiber Bragg Grating Interrogation System for Angular Velocity Measurement

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Abstract

We demonstrated a fiber sensing system which combined with fiber Bragg grating (FBG) sensor and fiber optic gyroscope (FOG) in a fiber loop to achieve the ability of angular velocity measurement and mechanical sensing of an object at the same time. The FBG gyroscope system is consisted with a fiber ring laser source pumped by an erbium doped fiber amplifier (EDFA) and a FBG element for the filtering of the laser wavelength which can be perturbed by the physical vibration of the FBG element. The principle of the angular velocity measurement is based on Sagnac effect to form the interference signal due to two counter-propagating propagation along the fiber loops. Stable and good linearity of the angular velocity measurement with a minimum angular velocity of 0.105 rad/s has been achieved, and it is able to apply this FBG interrogation system for monitoring vibrational and rotational motion of a large scale civil engineering structure within the same time.

Keywords: Fiber Sensing, Velocity Measurement, Fiber Bragg grating

F9820

Development of image processing setup for an auto-scraping machineSzu-Lin Liu¹, Chun-Yuan Yeh¹, Po-Chun Chi¹ and Shih-Chieh Lin¹¹ *Department of Power Mechanical Engineering, National Tsing Hua University***Abstract**

Scraping is a fundamental techniques for precision machine tools. Scraping was used to maintain machine tool accuracy and to develop proper oil pockets for slider. However, scraping is a time consuming process. In order to improve the productivity of scraping process, it is of interest to develop an auto-scraping system. The developed system includes a machine vision system and a 3 DOF linear motion system for scraping. The image of the work surface captured by the vision system was processed and analyzed to identify areas where scraping is needed. The scraping mechanism is then directed to the desired area for scraping automatically.

Keywords: Scraping, Machine tool, Image processing

G8502

Investigations of the Force and Contour Tracking Control of the Robot Arm in Polishing Operations

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Abstract

The objective of this research is to investigate the force and contour tracking control of the robot arm, which may be conflicting, during the polishing operations. The first task is to derive the cutter locations, which will be used as the tracking command for the robot end-effector, from the CAD/CAM software based on the workpiece geometry to obtain the simulated cutting path. Further, the location of the cutting tool, i.e., the polishing pad, is obtained using the teaching panel of the robot. The desired trajectory of the end effector can then be calculated which avoids the time-consuming task to obtain the end effector trajectory manually. The second task is to include the force feedback and control to the robot command during the polishing operations. Two different polishing layout plannings have been compared in this research, and the polishing results are evaluated using the white light interferometry. The evaluation results indicate that using the hybrid force/impedance control, if the polishing point is maintained at a constant point and orientation, can yield better force control performance and surface roughness results.

Keywords: Industry Robot, Polishing, Cutter Location, Force Control

G8602

Robotic Surgical Assistant for minimally invasive cranial surgeryDing-Yuan Chen¹, Fu-Ren Xiao², Hong-Tsu Young¹ and Chao-Yang Huang¹¹ *Department of Mechanical Engineering, National Taiwan University*² *Department of Medicine, National Taiwan University***Abstract**

Many of the current clinical surgery are still operated by doctors' own experiences only, which accompany with high risks and uncertainties, the research is about to develop a Robotic Navigation System for surgical assistance, planning an accurate path for the operation, to upgrade the safety and convenience of the surgery. The research aims at planning a process to assist the operation called "VP Shunt", to cure the patients suffered from Hydrocephalus. Combing the Industrial Robot Arm with the Laser Pointer, and the images being read by the software: 3D Slicer, we do the 3D-Rendering and registration, catching the point coordinate information, then we design a Matlab GUI project to do the calculation and data communication, plans for a suitable position and path to insert for the doctor, making the operation completed rapidly and safely. Also, we put a self-made head-like phantom into the system, including the fake brain, which provides the intern surgeons a convenient operation practice system, after a lot of experiments and cross-validation, the system's precision and accuracy has been verified, we hope that the system could be put onto clinical use as soon as possible, playing goods for the patients suffered from brain diseases.

Keywords: Surgical Assistant, Surgery Planning, Robotic Navigation System, Hydrocephalus, VP Shunt, Matlab GUI, 3D Slicer, ABB Robot Arm

G9527

Optimization study on expansion energy used air-powered vehicle with pneumatic-hydraulic transmission

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² *Pneumatic and Thermodynamic energy storage and supply Beijing Key Laboratory*

Abstract

As an important part of power system of sustainable energy vehicle, pneumatic-hydraulic transmission is widely applied to pump hydraulic oil, which the dynamic characteristics directly reflect the working quality of the vehicle. In this paper, a late-model air-powered vehicle using expansion energy is proposed which can boost energy through a pneumatic-hydraulic transmission. The dynamic characteristics of the air-powered vehicle is modeled and verified by conducting experiment. In addition, the influence of the key parameters of the air-powered vehicle is researched for the optimization of the system performance. Through the results, the author got the conclusion that, firstly, comparison of the results of model and experiment proves the built model to be effective; secondly, input air pressure as the power source should be set according to the request of the practical loads; thirdly, as a key structure parameter of the air-powered vehicle, ratio of the areas is considered to be set to approximate 8; what's more, a bigger orifice with a limit will promote the system dynamic characteristic property; last but not the least, not too farther position of the rings will increase the quality of output dynamic characteristics. This paper can be a reference for system design of air-powered vehicle and dynamic improvement.

Keywords: Air-powered vehicle, Expansion energy, Pneumatic-hydraulic transmission, Output dynamic characteristics

H8538

Impact test of 3D-printing photopolymer specimensF.C. Hsieh¹, P.H. Lin¹, H.P. Pan¹, C.S. Yu¹ and C.M. Chang¹¹ *Instrument Technology Research Center***Abstract**

Additive manufacturing has been widely used in personal users, educations, and industries. An issue for 3D-printing material is the ability to endure the break energy through impact testing. In the present study, we use multi-jet technology and UV-light curing to fabricate photopolymer. Besides, the impact characteristics of photopolymer were tested according to ASTM D256-10. The impact break energy looks similar for non-transparent and transparent photopolymers. The results indicate that the impact resistance of non-transparent photopolymer is about 17.4 J/m. However, the impact resistance is 16.3 J/m for transparent photopolymer. The impact strength for transparent photopolymer is higher than non-transparent photopolymer. We speculated that the intrinsic property of photopolymers could affect the impact characteristics. Future work is needed to investigate the microstructures of photopolymers.

Keywords: Impact, 3D-printing, Photopolymer, Additive manufacturing

H8559

The Development of Tank Swapping for Powder Bed Additive Manufacturing

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Abstract

The conventional Powder Bed Fusion (PBF) system consists of a material tank and the model tank in a fixed position. In such machines, once the manufacturing process completes, it will necessary to wait to let the parts cool down before taking them out. This makes machine keep occupied from the next job. This paper suggests a development in designing a new PBF system with a replaceable material tank & the model tank. It will significantly shorten the waiting time to cool down the parts and powder refilling time. The user can easily load and unload tanks through the mechanism developed in this paper. Thermoplastic polyurethane (TPU) powder is used as the raw material. Both roller paving and blade paving has been tested in this new system. The results showed that the powder density of the roller paving is 3% greater than the blade paving.

Keywords: Additive Manufacturing, Paving system, Tank Swapping, Powder Bed Fusion

H8560

Development of a customized assistive bite-pen for disabled people by using additive manufacturing

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Abstract

In the world, there are around 720 million of people with different types of disability who eventually will need assistive technologies (AT) in order to improve their functional capabilities, independence, and quality of life.

Actually, in the market there are several types of assistive devices such as speech synthesizers, talking spell checkers, word prediction words, and others. However, many patients who are suffering from rare diseases do not have access at those tools due to economic issues. With 3D printing technology, it is possible to develop cheap as well as customized instruments for those people with uncommon disorders.

In order to help people who are not able to use their hands for writing requirements, the development of a mouth-write assistive-device (bite pen) is discussed in this paper. With this goal in mind, some patients were interviewed to understand their requirements as the first step. Moreover, this survey helped to know the side effects of using common pens such as: displacement tooth, malocclusion, and others.

Based on the information taken from patients and using software Atos 3D scanning, a 3D drawing file of a customized occluding model was obtained by applying Reverse Engineering. Afterwards, it was printed by using Vat Photopolymerization process. Finally, the material extrusion technology as Fused Depositions Modeling was used to print all the elements of the assistive device.

Keywords: 3D printing, 3D scanning, Assistive technology, Reverse engineering, Writing assistive technology

H8562

The Development of Hybrid Manufacturing Systems for Skeleton Surface Object

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Abstract

The current hybrid manufacturing system is based upon the Direct Energy Deposition (DED) [1] and Powder Bed Fusion (PBF) [2] additive manufacturing process and integrating with subtractive manufacturing process. The available systems in market which works on similar process are not able to manufacture parts with smooth inner surface and skeleton elastic structures.

This paper proposes a new concept of the manufacturing process by changing the sequence of “additive first and subtractive later” to “subtractive first and additive later”. For this purpose, a new system has been developed. It includes machine design, system control, and the CAD/CAM software development. PE and TPU materials are used as the raw material in this study. The working volume of the new system is 100* 200mm in length & breadth. The resulting parts shows the ability with smoother inner surfaces and skeleton elastic structures. The results of the development show the possibility to manufacture personal assistive device like kneepad brace.

Keywords: Subtractive manufacturing, Additive Manufacturing, Powder Bed Fusion (PBF), Directed Energy Deposition (DED), Elastic material, Hybrid manufacturing

H8563

The development of Slurry-based Ceramic Additive Manufacturing system with no solvent

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Abstract

High performance ceramics (HPCs) are a group of ceramics that characterizes this age. HPC's possess exceptional mechanical properties in many aspects. They are very light in weight, have high tensile strength, high melting points and are non-corrosive. Such, HPC's have vast applications in Aerospace, Military, Electronics, etc. In this paper, we discuss about manufacturing of HPC's using an Additive Manufacturing (AM) Technique. The Non-solvent Slurry Stereolithography (SL) process is similar to any other Stereolithography process. The slurry formulation & the solidification process plays an important role to build complex models of HPC's accurately and easily. This process decreases the manufacturing cost very much. The lead-time to produce a part using this process is also very less. It does not require any sophisticated work conditions. In this process, the slurry is recyclable so there will not be any wastage of the raw material. Using this process we can build the parts with a resolution of 40 μ m/pixel, build volume of 76.8mm \times 43.2mm area size, the layer thickness is 50 μ m, and the cycle is 30 to 15 seconds.

Keywords: Slurry with no solvent, Additive Manufacturing, Ceramic, Stereolithography

H8567

The Design and Implementation of a FDM Type Additive Manufacturing System

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Abstract

In the contemporary world, the demand for 3D printing is increasing rapidly in many sectors. In this paper, we discuss about design and development of an easy to assemble Delta type 3D printer, which can meet the goals of education sector. This system uses an open source hardware and software controls and gives the results equivalent to an Industrial based 3D printer. Also providing an easily operable Graphical Interface for the purpose of Filament extrusion, temperature control, Build plate calibration, Slicing tool and tool path generation so the user can easily operate the machine in spite of any age and requires no technical skills. The current system can 3D print an object with a maximum size of 180*180*200mm. It can achieve a layer resolution of 0.1mm & the printing speed up to 150mm/s. This system consists of many mechanical parts, which may increase the price of the machine. By producing few parts in huge quantity, using injection molding the machine's price could be reduced drastically.

Keywords: Additive Manufacturing, Fused Filament Fabrication, Fused Deposition Modelling

H8646

Evaluation of the physico-mechanical properties of activated-carbon enhanced recycled polyethylene/polypropylene filament for 3D printing

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Abstract

With the increasing adoption of household 3D printers, many concerns have arisen on how to increase the quality of the printed products and thus widen their applications. It would be interesting to employ the use of recycled high-density polyethylene (HDPE) and polypropylene (PP) polymer as the 3D printing feedstock due to the abundant amount of recycled HDPE and PP products, but its quality is poor for its application. In this study, with the use of an in-house extruder, the recycled polymer feedstock was added with different percentages of activated carbon (AC) made from coconut fiber waste - 0, 2, 4, 6, and 8%. The melting temperatures of the recycled HDPE and HDPE/PP filaments are 113 and 170°C respectively. The addition of AC improved the thermal stability of the recycled filaments up to 28%. XRD, Raman and SEM show that the addition of AC decreases the crystallinity of the filament produced, resulting in more uniform surface with less crazing. However, incompatibility of the recycled polymers and AC can be observed. With the addition of 8% AC, the elongation at break of the recycled HDPE/PP reached 54.2%, about 10 times higher than that without AC, at the expense of lower tensile strength, which could be due to the partial compatibility and better interfacial bonding with the recycled HDPE/PP matrix. The physico-mechanical properties evaluated in this paper demonstrate that the recycled HDPE, or HDPE/PP materials, reinforced by coconut fiber activated carbon, is a viable and environmentally friendly feedstock for filament extrusion and 3D printing.

Keywords: Polyethylene, Recycling, 3D Printing, Plastics, Activated carbon, Extrusion, Filament

H8656

Ontology-Based Service Process and Patent Informatics for Collaborative Service Innovation: The case of Orthodontic 3D Printing

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Abstract

An ontology based patent informatics methodology is developed to analyze technology trends for a collaborative services delivery platform. Two concepts are considered when studying the collaborative service industry where inventive technologies are critical. One approach is to analyze the key elements of collaborative service processes using business process analytics and the other is to map and organize the key technology trends using patent analytics. This research develops an innovative approach bridging business and technology analyses. The innovative processes of the service domain are used for building the basic ontology. The patent key phrases extracted enhance the ontology and provide details for the structured analysis of relevant patents. These related patents are systematically linked to the service processes. The research discovers the related process oriented patent portfolios that exist among global competitors. The methodology allows integrated views of innovative patent creation that are critically linked to business development of collaborative services. The case of orthodontic collaborative service delivery and the patent portfolios are studied and the industry leaders are benchmarked with respect to these portfolios. Hence, the proposed methodology and the practical value for collaborative dental services are demonstrated in the research.

Keywords: Additive manufacturing, Orthodontic services, Service delivery platform, Ontology, Patent informatics, E-discovery

H9137

Fabrication of Zirconia Ceramic parts using Solvent Based Slurry by Stereolithography & Sintering process

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Abstract

This paper discusses about an efficient method of fabricating High Performance Ceramic (HPC) parts using Stereolithography & Sintering process. The following materials are being investigated to form a slurry: Zirconia as a structure material, methyl alcohol as a solvent and dispersant, a visible light curable resin as an organic binder. The slurry is photo cured by visible light projector layer by layer in an enclosed chamber to form a three dimensional object. The obtained 3D object is sintered at high temperature (up to 1600° C) to solidify. Thus a HPC part can be produced which can possess high material strength and tensile strength. A complete system is being developed which can produce complex ceramic parts at high precision to bring very fine detail of the shape (less than 40µm).

Keywords: Additive manufacturing, Ceramics, Slurry, Zirconia, Stereolithography

I8501

Build an intelligent decision supporting system based on machine learning to enhance shop-floor managing capability: A case of error rate reduction

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Abstract

In this work, we describe an ongoing real case (called S company for anonymous purpose) about how to apply machine learning to pursue a shop-floor problem via building an intelligent decision supporting system. Our major contribution is to coach people in S company, introduces right concepts; tools, and skills of data mining to them. We point out several possible problems of S company's alarm system. Based on the problems we identified, we also construct a two phases solution for S company.

Keywords: Machine learning, Neural network, Data mining, Decision supporting system

I8514

IEC 61499 Application in Leveling Production LineYi-Chih Fan¹, Cheng-Chen Yang¹ and Jen-Yuan (James) Chang²¹ *Industrial Technology Research Institute*² *Department of Power Mechanical Engineering, National Tsing Hua University***Abstract**

This paper introduces a distributed control application using IEC 61499 on a leveling machine line. Nowadays, programmable logic controller (PLC) remains widely used in automation. However, in this research, a different approach was conducted using the engineering tool named “nxtStudio” by nxtControl to develop control programs compliant with IEC 61499 Class 0 and Class 2. Control programs were developed through function blocks on a legacy PLC and a novel distributed PLC. Simulation results showed that the legacy PLC can achieve Class 0 control ability using Modbus communication while an IEC 61499 compliant Beckhoff PLC can reach full system control capability of Class 2. The results also showed that the program running in a Class 2 device can be split into two programs and deployed into two Class 2 devices to achieve co-operation without modification to the original program. This method has great potential implications that will fundamentally change the world of automation with its key features, i.e., portability, interoperability and reconfigurability.

Keywords: IEC 61499, Distributed Control, Function Block, Reconfigurable

I8522

Intelligent Coil Leveling Machine Development through Cyber-Physical Systems Integration

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Abstract

Cyber-physical systems (CPS) are key technologies in paving the way to the next industrial revolution in smart manufacturing by combining virtual and physical worlds together to create a new industrial age. In smart manufacturing, machines are needed to communicate and interact cooperatively to improve manufacturing productivity, efficiency, and flexibility. This integrated development work is aimed to develop a smart and intelligent coil leveling machine through implementation of cyber-physical systems. Intelligent sensor network embedded in the machine allows real-time monitoring through cloud network and feedback controlled system to ensure optimal machine setting in maintaining manufacturing quality. Integration of sensor network of the coil leveling machine such as coil feeding speed, leveling roller indentation, and leveling force has been completed. Preliminary real-time monitoring and intelligent adjustment of the coil leveling machine through cloud network have been achieved which demonstrate the feasibility and potential of the implementation of the cyber-physical systems. Through this integrated development, traditional leveling machine can be transformed in which machine setting adjustments are allowed to be tested in CPS virtual simulations and quickly implemented to production line even in large scale configuration to maintain customer's requirements and to enhance manufacturing efficiency in smart manufacturing of sheet metal coil.

Keywords: Smart Manufacturing, Coil Leveling, Leveling Roller, Sheet Metal Coil, Cyber-Physical System, Real-Time Monitoring, Cloud Network

I8541

Intelligent Coil Leveling System based on Deep Learning methods

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Abstract

Deep learning based on multilayer neural network algorithm which emerged in recent years as the industry 4.0 has focused on linking real objects with information processing, and is a new area of machine learning research. In addition, deep learning algorithms are based on distributed representations which mean the observed data are generated by the interactions of factors organized in multiple processing layers. In conventional coil leveling system, the machine settings are often tuned by the experienced technicians with many years of experiences. However, as industry 4.0 focused on information process through real objects, it is required to digitize the experience through deep learning method. This paper is aimed to describe and develop the deep learning algorithm with application based on coil leveling system. Finally, through this study and experiment verification, this paper analyzes research directions and future prospects of deep learning.

Keywords: Smart Manufacturing, Coil Leveling, Leveling Roller, Sheet Metal Coil, Deep learning, Machine Learning, Neural network

I8625

Smart Manufacturing Study of the Innovative Mushroom Production Line

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Abstract

This study establishes and solves the mechanization and automation problem in the mushroom cultivation process with two objectives. The first objective is to design an innovative automated manufacturing process started from packing substrate stage to “ready to breed” bags stage. The production line applies to the manufacture of mushrooms which grown in plastic bags. Tradition handwork stages are replaced by automated modules. By constructing a virtual plant environment (simulation software) to implement integration between process planning and manufacturing execution, the plant layout problem has been solved on customer requirement. The second objective is to implement the Industry 4.0 technology to mushroom production line design and to integrate the functional automation modules inside a production line to implement a flexible and reconfigurable smart manufacturing system. This study presents a communication framework that incorporates supervisory control terminal, individual automation module, and the internet through supervisory control and data acquisition control system allowed remote control and data acquisition.

Keywords: Mushroom cultivation, Automation system, Industry 4.0, Plant layout

I9053

Analysis of Workpiece-Clamp AE Signals for Tool Wear Monitoring System in the Milling of Inconel 718

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Abstract

The Acoustic Emission (AE) signals obtained from the workpiece clamp was analyzed for the development of the tool wear monitoring system in this study for the milling of Inconel 718. The class-mean scatter criteria was adopted to verify the correlation between the AE signal features and the tool wear condition, and a system based on the back propagation neural network was developed as well to verify the capability of selected AE signal features for monitoring the tool condition in Inconel 718 machining. To analyze the signals and develop the AE based monitoring system, an experiment was conducted first on a three axis machining center to collect AE signals during machining. After the development of the system, an evaluation experiment was conducted to evaluating the performance of developed system. The results show that selected frequency domain feature of AE signal provide a close relationship with the tool wear, and more than 90% classification rate can be obtained in the evaluation test for clamp-AE signal based system.

Keywords: Tool wear monitoring, Acoustic Emission, Inconel 718, Clamp

J8545

Design the Knowledge-Based System of Subcontract work - A case study of Machine Tool

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Abstract

The processing provider takes a significant part doing the third party partner for the mechanical equipment manufacturers. In spite of that, the traditional methodologies to grow the processing suppliers, such like telephone interviews or official websites browsers, are incapable of providing immediately and efficiently manufacturing information for the processing vendors. In order to resolve this problem, it is required the platform which speedy get the information processing suppliers and cover genuine suggestion mechanism for customers. The machining knowledge database collects the relevant information through manufacturers and customer orders, such as monitoring possible customer behavior analysis, behavioral analysis of vendor, platform profitability analysis system. The customer can immediately search for the right processing suppliers and orders directly from the mechanical equipment manufacturers marketing platform. It can ameliorate the efficiency of selecting suppliers, reduce the discussion time, the manufacturing time, and delivery time which cause lower production costs, henceforth, highlighting the competitiveness of the production of industrial equipment.

Keywords: Machining knowledge database, Production cost, Selecting supplier

K8952

A new method of finding stress solutions in plastically compressible solids

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Abstract

The method of moving coordinates is widely used for determining characteristic nets and, as a result, stress fields in plane strain problems of classical plasticity of rigid plastic incompressible material. This method is efficient for certain boundary value problems, for example for constructing the characteristic net in the vicinity of a traction free surface. The present paper extends this method to plastically compressible materials that obeys a singular yield criterion and its associated flow rule. The corresponding yield surface has the shape of two pyramids. The problem is reduced to the equation of telegraphy in characteristic coordinates. This equation can be solved by the method of Riemann. Then, the mapping between the characteristic and Cartesian coordinates is given by simple integration.

Keywords: Method of moving coordinates, Characteristic nets, Telegraph equation, Riemann method, Plastically compressible solids

K8976

Impact Deformation Behaviour and Microstructural Evolution of AZ80 Magnesium Alloy under Different Temperatures

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Abstract

The impact deformation behaviour and dislocation substructure of AZ80 magnesium alloy are investigated at strain rates of $8 \times 10^2 \text{ s}^{-1}$, $1.5 \times 10^3 \text{ s}^{-1}$ and $2.2 \times 10^3 \text{ s}^{-1}$ and temperatures of -100°C , 25°C and 300°C using a compressive split-Hopkinson pressure bar system. The flow stress, work hardening coefficient, strain rate sensitivity and temperature sensitivity all increase with increasing strain rate or decreasing temperature. Moreover, the dynamic deformation behaviour is well described by the Zerilli-Armstrong hcp constitutive equation. Transmission electron microscopy observations show that the dislocation density increases with a higher strain rate or a lower temperature. Finally, the flow stress varies linearly with the square root of the dislocation density in accordance with the Bailey-Hirsch model.

Keywords: AZ80 magnesium alloy, Flow behaviour, Dynamic deformation, Strain rate effect, Dislocation density

K8982

Wireless Power Collection Using Radio Frequency Identification System

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Abstract

A wireless power collection (WPC) system is proposed to harvest excess electromagnetic energies in space that are reflected and not received by target antennas. The RFID (Radio Frequency Identification) system was utilized to demonstrate WPC. The power was transmitted between the reader and tags, and the rectenna (rectified antenna) was used to collect energy in our WPC system. The rectenna includes UHF RFID tags. When the distance between the rectenna and the reader was 10 cm, the maximum voltages of a single rectenna and four rectennas in series were measured to be nearly 1.5 V and 5.7 V, respectively. This WPC system can be used to supply power to charge batteries or other electronic products. A WPC tree consisted of four sets of rectenna arrays provided a charging current of approximately 0.203 mA to a set of four AAA NiMH batteries.

Keywords: Wireless power collection, Radio frequency identification, Rectenna, Rectifier

K9093

Multi Power Bank

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Abstract

This thesis elaborates "Multi Power Bank". The multi power bank mainly consists of three major components, which are a front-end voltage-boost circuit, a flyback converter and a charger-boost circuit. The front-end voltage-boost circuit stabilizes the input voltage and boosts the voltage to 5 volts. The flyback converter directly uses the AC (Alternate Current) to charge the battery so as to improve the convenience of the power bank. The charger-boost circuit controls the charging behavior of the battery. Moreover, the ICs (Integrated Circuits) with charger and boost function are applied here in order to improve the convenience and decrease the volume of power bank.

Keywords: Power Bank, Green energy, Solar energy, Wind energy

K9095

Optimum Design of Bipod Flexures on a Spaceborn Primary Mirror under Different Conditions

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Abstract

In order to operate in the harsh environment of space, a remote sensing instrument (RSI), is required to pass the ground testing and payload launch phase. Therefore, an integrated system of computer-aided engineering and optomechanical optimization analysis has been developed. A lightweight ZERODUR® mirror with a diameter of 566 mm assembled with three bipod flexures for a spaceborne RSI has been taken as the design benchmark. The assembly model with the selected geometry variables of the bipod flexure has been constructed in the computer-aided design step and then calculated with the finite element analysis and transformed with the homemade optomechanical transfer program to obtain the Zernike polynomials on the reflective surface. Therefore optical aberrations will be treated as the objective function during optimization to across the gap between mechanics and optics. The design variables of the bipod flexure have been carried under selfweight and temperature changes respectively. The peak to valley wavefront errors for the mirror with the optimum design of the bipod flexures can be reduced from 239 nm to 60 nm under selfweight and from 2877 nm to 1972 nm under thermal boundary conditions separately.

Keywords: Remote sensing instrument, Bipod flexure, Optimum design, Finite element analysis

K9124

A parameter identification method for structural systems using moving window Fourier Transform

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Abstract

A novel method for identifying the physical parameters of structural systems has been proposed, unlike most existing methods are in terms of modal properties. The method was first theoretically derived by using an sdof system. The final expressions are independent of its input, though the present method requires an impulse to excite the system so the system responses can be acquired. Thus, the present method can be classified into as an “output-only” one. In fact, it is the amplitudes of decaying spectra, which are obtained by the moving window Fourier transform (mwFT) from the responses of an impulse, in the frequency domain are concerned. In addition to an impulse input, the method is also required to add a small but known amount of mass to the original structural system. By comparing the spectra of the signals from the two states, before and after adding this know mass, it is possible to obtain the all physical parameters. The added mass plays as a role of calibration in the process. Theoretically, the present method can be applied to systems with small and proportional structural damping. Depending on the accuracy required, however, it has been numerically verified that it is possible to identify modal damping ratios as high as ca. 15%. Nevertheless, the numerical examples have substantiated the validity of the present methods for identifying the physical properties of sdof systems.

Keywords: Parameter identification, Fourier transform, Added mass

K9254

Development of a Safe and Energy Efficiency Water Heater by Induction Heating

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Abstract

Water heaters are usually used to provide hot water in household and commercial usage. Typical domestic uses of hot water include bathing, cooking and cleaning. Safe operation and energy efficiency are two important factors of a water heater. Most water tanks use either a gas burner or an electric element to heat the water. Both of these methods are of low efficiency because heat is transferred to the environment. It can cause fire, burns or electric shock.

In this paper, induction heating method is used to heat water. Water heating tank part and electric part are separated so it is very safe. An induction heating power supply of 3.8 kW incorporating with an induction coil were designed and fabricated. Via PID controller, the output water temperature is automatically controlled. Overheat and overcurrent protections are also installed in the system. The output water temperature increases 3.7 °C when water flow rate is 182 mL/s. And the power efficiency is about 75%.

Keywords: Induction Heating, Water Heater, Half-Bridge Circuit

K9510

Tolerance and Motion Analysis of Antenna Mast

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Abstract

The purpose of this study is to analyze the effect of the tolerance variation to the movement of the antenna mast as it lifts from its origin position to the highest position. It is hope to solve the problem that the current overloading of the driving motor, owing to the inaccurate tolerance allocation and mistake made during assembly. Also to figure out if the mast will be damaged under the wind speed of 40 knots. According to the configuration of the mast and the structure of the mast and its construction parts, the product structure and the tolerance network of the mast are established. The variation of the mast under un-stress deformation is analyzed. It will then be used as the basis for the analysis of the overall structure under stress deformation. Using the motion analysis software, RecurDyn, the torque variation during the movement of the mast under the situations with/without tolerance was analyzed. From the analysis results it is found that the assembly error causes the torque fluctuation. It then caused the mast vibrated during lifting. While, the damage of the antenna mast still need further study.

Keywords: Antenna mast, Transmission module, Tolerance network, Tolerance path, Motion analysis

K9734

An Adjustable Liquid-Liquid Extraction device for the Extraction of Pharmaceutical Compounds

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Abstract

We present for the first time a adjustable liquid-liquid extraction (LLE) device concept that allows coaxial aqueous-organic extractions with various residence times. In current our device, a series of micro-structures placed in the extraction channel stabilizes the 2D parallel flowing immiscible streams, offering operation of the device both at high and at very low flow rates. This significantly enhances the applicability of microfluidic devices to investigate and achieve optimal extraction conditions. In this contribution, we demonstrate high extraction yields of acetophenone, an aromatic ketone which is used as a pharmaceutical intermediate for a diverse range of pharmaceuticals. Furthermore, we'll soon develop the prototype of adjustable pitch liquid-liquid extraction (LLE) device with regard to fluid properties, hydrodynamic and transport phenomena and discuss experimental extraction data. Such comprehensive understanding will in the future facilitate the process optimizations, and thus accelerate the uptake of microfluidic devices in the bioprocessing industry.

Keywords: Liquid-Liquid Extraction, Continuous Flow, Pinning Effect, Young-Laplace Pressure

K9740

EEG Coherence of Recognition Memory: Inter Hemispheric Connectivity Analysis

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Abstract

The relationships between learning and memory are used to explain how humans use recognition memory messages to make decisions when information present. The P3 amplitude is used to explain the brain activation of memory recognition. Recognition memory is based on awareness and context-related information retrieval experience, thus the recognition memory is a comprehensive response to brain activation, and for information processing and memory cognition in the brain activation process should be able to use different indicators to explain recognition memory in the brain activation. In this study, the oddball experiment was used to examine the state of the inter-hemispheric EEG coherence in the frequency domain of the rhythm band 0.1-4 Hz. 15 subjects were invited to participate in 4 week training. After two months they start to participate of the recognition memory test. The results shows the maximal amplitudes of P3 were in the prefrontal cortex of the AF3 and AF4, and rhythm was in the range of 0.1 to 2 Hz, and there also was significant inter-hemispheric EEG coherence.

Keywords: Recognition Memory, Coherence, EEG

K9744

Simulation on Geological CO₂ Storage in the Western Taiwan BasinNeng-Chuan Tien¹, Cai Li^{2,3}, Keni Zhang⁴ and Chun-Ping Jen⁵

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Abstract

Geological storage of CO₂ has been viewed as an effective means of reducing CO₂ emissions and mitigating the greenhouse effect. In the Taiwan area, the Western Taiwan Basin is suitable for million-ton-scale geological CO₂ storage. Numerical methods were used in this study to investigate reservoir performance under various injection pressures. Three formations in the basin, the Chingshui Formation, Kueichulin Formation and Nanchunag Formation, were modeled. Three different injection pressures (1.3, 1.5 and 1.7 times the initial pressure) were considered. The simulation results show that the cumulative injected CO₂ mass is proportional to the applied injection pressure and that the storage security increases over time. An annual injection rate of 5 Mt/year could be achieved by applying an injection pressure of 1.5 times the initial pressure at the injection well. The pressure accumulation in the system featured three stages. The over-pressurization effects associated with the injection in the system decrease, and the pressure in the system almost returns to the original pressure conditions after 50 years following cessation of injection. The CO₂ gas plumes simulated in this study also suggest that the modeled injection scenarios are safe in terms of CO₂ leakage from the vertical fault in this area.

Keywords: Geological storage, Simulation, Injection pressure, Fault

L8131

The multi functional kitchenware with integrated wireless networking technology

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Abstract

The multi functional kitchenware with integrated wireless networking technology composed the smart energy-saving stove, smart extractor hood, situational lighting control, environmental sensing technology, cloud decision-making, information relay station, remote user control platform, and moreover, through wireless (ZigBee / Wi-Fi) transmission it can achieve the purpose of interlocking control of the smoke sensor, energy-saving stove, extractor hood and wireless networking.

Keywords: Kitchenware, Energy-saving stoves, Smart extractor hood

L8461

Application of energy storage for families and community

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Abstract

Taiwan lacks domestic reserves of fossil fuel. Renewable energy is the top priority to energy independence and to build a sustainable environment. Solar energy is intermittent, and the time with peak output might not be the time power needed. Integrating excessive renewable energy into the grid might cause stability issues when the power becoming larger. Fifteen families of Shiaolin Village joined this demonstration project, each has a Home Energy Storage Systems (HESS) installed at their backyard, and photovoltaic (PV) panels installed at their roof top. The grid-connected HESS generates electricity for the family, and store the excessive energy into its storage module. The HESS would not feedback the power to the grid, and not to induce difficulty for the grid. The stored energy can reduce the loading to the grid during peak hours, even at the nighttime. Community Energy Storage System (CESS) monitors the operation of the fifteen HESS, and connects the power lines with the eight sets of HESS. The CESS will extract energy from the HESS, when its storage module is full, to completely use the capability of the PV panels.

Keywords: Renewable energy, Batteries, Home Energy Storage Systems, Community Energy Storage System

L8466

Application of Vacuum Assisted Resin Transfer Molding in Highly Loaded Structures of Composite Bridge

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Abstract

A vacuum assisted resin transfer molding (VARTM) method is using a bag sealed on a forming mold, in which the fiber fabrics are placed at right position and vacuumed by a vacuum pump. Then, the resin is vacuumed into the bag and wet fiber fabrics by the pressure drop between the atmosphere and the vacuumed bag until resin is vacuumed out and totally wet fibers. Shut down the vacuum pump and let resin cured. As the bag and other disposal materials are removed, the composite structure part is manufactured. In the study, an innovation for letting resin flow quickly is suggested by flow strips. The flow strips are embedded parallel and longitudinally in the laid fiber fabrics and let resin flow quickly from one side to the other side of molding mold. Because, the siphoned distance and wetted fiber fabrics for resin is only intervals of strips, and can be adjusted to shorten the processing time. There is a 1 m long composite bridge manufactured by the innovated VARTM with 12 cm distance of strip intervals. It is only 20 minutes needed for resin vacuumed in and out. In the following object, a 12 m long mobile composite bridge for a 15 tons car will be made by the same VARTM method. A static load test is executed to prove performance of the bridge, and shows the innovated VARTM is efficiently and fully developed for manufacturing highly loaded structures of composite bridge.

Keywords: VARTM, Resin flow strip, Highly loaded structure, Composite bridge

L8475

The thermal reliability analysis of metallized AlN substrateC. T. Wu¹, Y. K. Kuo¹, P. S. Huang², C. H. Lin² and M. Y. Tsai²¹ *Chemical Systems Research Division, National Chung-Shan Institute of Science and Technology*² *Department of Mechanical Engineering, Chang Gung University***Abstract**

The thermal reliability of high power module applications is strongly related with its heat dissipation capability. For the high power module applications, the metallized aluminum nitride (AlN) substrate with a high thermal conductivity can provide a good alternative to conventional aluminum oxide (Al₂O₃) substrate for better heat dissipation. Because of the higher thermal expansion coefficient mismatch with metal material, the metallized AlN substrate suffered the delamination failures between metal film and AlN substrate interface during thermal cycling. In this study, we used the physical vapor deposition and electroplating technique to fabricate the Cu film on the AlN substrate surface and filled into the substrate via. The analysis of thermal reliability of metallized AlN substrate has resolved the delamination interface problem of metallized AlN substrate during thermal reliability test.

Keywords: AlN, Metallize, Electroplating, Thermal reliability

L8485

Synthesis of Egg-shell Pd catalyst supported on Al₂O₃

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Abstract

Supported metal catalysts are the most important class of heterogeneous catalysts in industrial practice. The most synthesis route involves the impregnation of porous support with a solution of the metal salt followed by drying, calcinations, and reduction [1-6]. Although the practical execution is simple, the interaction between metal salt and support is very complex and more over limited. After drying the metal distribution is non-uniform along the catalyst particles. In some reaction conditions, pore-diffusion is limited and the metal located in egg-shell is preferred. In order to prepare an efficient industrial catalyst, it is not only important to control the dispersion of metal species, but also their location in the support body. Currently it is not completely understood how to control the metal distribution during the preparation. This is because many chemical and physical parameters are involved, e.g., pH, metal ion precursor, ionic strength and the surface properties of the support. In the present work we investigated the preparation of supported Pd on alumina. The catalyst with core-shell structure usually has high product selectivity and long life time. If the reaction is fast and pore-diffusion is limited, the metal inside the particles becomes of no use. Only the metals in the shell can be used in reaction. Pd@Al₂O₃ with core-shell structure was successfully prepared by impregnation method [4-6]. Pd@Al₂O₃ was prepared by impregnation technique. 0.1068 g Pd(CH₃COO)₂ was dissolved in 150 ml toluene. γ -Al₂O₃ was calcined at 1000 °C for 6 h. The particle size of alumina bead was 2-4 mm in spherical shape. Alumina support was then dipped into the above toluene solution for 3 h. The catalyst was then dried at 100 °C for 1 h, and then calcined at 350 °C for 6 h. The sample was analyzed by ICP-OES to measure the Pd metal loading. It showed that the Pd metal loading was 0.3 wt. %. The bulk density of this catalyst is 0.68 g/cm³, and the BET surface area is 60 m²/g. The particle size of alumina bead was 3 mm in spherical shape. Pd was located on the external shell with a thickness of 0.1 mm.

Keywords: Palladium catalyst, Egg-shell structure, Hydrogenation, Dicyclopentadiene

L8551

Material analysis and electrical properties of nanostructured vanadium oxide (VO_x) thin films for microbolometerHsin-Chang Chen¹

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Abstract

Nanostructure vanadium oxide (VO_x) thin film, one of the most commercial materials for making microbolometer, was prepared on SiN_x/Si substrate by reactive magnetron sputtering with different oxygen flow rate. During the VO_x thin film deposition, the flow ratio of oxygen/Ar mixed gas was controlled by plasma emission monitor (PEM). Also the temperature-dependent sheet resistance of VO_x thin films were investigated by four point probe in order to measure temperature coefficient of resistance (TCR), which is critical in making microbolometer with high responsivity and low noise equivalent differential temperature (NEDT). Furthermore, we investigated the crystal microstructure of non-annealed and annealed VO_x thin films which were compared by grazing incident XRD (GIXRD), FE-SEM, X-ray photoelectron spectroscopy (XPS) and HR-TEM.

Keywords:

MEMO



MEMO



MEMO



MEMO



