Program for International Workshop on Advanced Manufacturing and Automation (IWAMA2016)

10-11 November 2016

University of Manchester, Manchester, UK

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<td>08:50 – 09:05</td>
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<td>09:05 – 09:30</td>
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Keynote: 25min, Contribution papers: 10 min including Q and A
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<td>Chair: Prof. Jan Ola Strandhagen  NTNU, Norway</td>
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<td>09:05 – 9:30</td>
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<td>Resilient Smart Structures: challenges and future</td>
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<td>directions in the RFID supply chain</td>
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<td>Chair: Prof. Jorge Munilla  University of Málaga, Spain</td>
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<td>09:30 – 09:55</td>
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<td>Polymer Composites in Aerospace: Achievements and</td>
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<td>Chair: Prof. Constantinos Soutis  University of</td>
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<td>09:55 – 10:20</td>
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<td>Technology Architecture of Intelligent Remanufacturing</td>
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<td>Chair: Prof. Guohong Dai  Changshu Institute of</td>
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<td>Introduction to School of Materials</td>
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<td>Chair: Prof. Martin Schroder  University of Manchester,</td>
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<td>Logistics 4.0 and emerging sustainable business models</td>
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<td>Chair: Prof. Jan Ola Strandhagen  Norwegian University</td>
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<td>11:35 – 12:00</td>
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<td>Research on Manufacturing Processes and Dynamic Balance</td>
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<td>Test of Motorized Spindle Shaft</td>
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<td>Chair: Prof. Yafei He  Shanghai Polytechnic University,</td>
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<td>12:15 – 13:45</td>
<td>Lunch (Restaurant in the city center)</td>
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<td>14:05 – 16:30</td>
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<td>Session 1: Industry 4.0 &amp; Session 6: Fashion Management</td>
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<td>Session 2: Logistics 4.0 &amp; Session 5: Production</td>
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<td>Session 3: Manufacturing Technology &amp; Session 4:</td>
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<td>Manufacturing Systems</td>
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<td>16:30 – 16:45</td>
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<td>18:30 – 20:30</td>
<td>Dinner (Restaurant in the city center)</td>
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11 November, 2016

09:30 – 10:30  Laboratory Visiting, Graphene Center, UM Or Others
## Session 1: Industry 4.0 & Session 6: Fashion Management

10 November, 2016

**Chair:** Per Schjølberg and Jinghui Yang  
**Location:** ROOM1

**14:05 – 14:15**  
Logistics 4.0 Solution: New Challenges and Opportunities  
*Kesheng Wang*

**14:15 – 14:25**  
An IoT-based Occupational Safety Management System in Cold Storage Facilities  
*Y.P. Tsang, K.L. Choy*

**14:25 – 14:35**  
Applying Sequential Pattern Mining to Portable RFID System Data  
*Heikki Sjöman, Martin Steinert*

**14:35 – 14:45**  
Data-driven Predictive Maintenance for Green Manufacturing  
*Harald Rødseth, Per Schjølberg*

**14:45 – 14:55**  
Intelligent Predictive Maintenance (IPdM) for Elevator Service-Through CPS, IOT&S and Data Mining  
*Kesheng Wang*

**14:55 – 15:05**  
Smart Maintenance - Industry 4.0 and Smart Maintenance: from Manufacturing to Subsea Production Systems  
*Andreas Marhaug, Per Schjølberg*

**15:05 – 15:15**  
Beyond Agile Methodologies-a Conceptual Analysis for Software Process Pipeline in the Industry 4.0  
*Lapo Chirici, Kesheng Wang*

**15:15 – 15:25**  
Applying Built-in Virtual Personal Assistant for Educational Equipment  
*Jinghui Yang, Yavor Stefanov, Zhe Li and Kesheng Wang*

**15:25 – 15:35**  
Development of an Industrial Internet of Things Suite for Smart Factory towards Re-industrialization in Hong Kong  
*C.K.M. Lee*, S.Z. Zhang

**15:35 – 15:45**  
3D Body Scanning: Towards Shared Protocols for Data Collection- Addressing the needs of the body scanning community for ensuring comparable data collection  
*Simeon Gill, Steven Hayes, Christopher J. Parker*
Session 2: Logistics 4.0 & Session 5: Production Management

10 November, 2016

Chair: Wei Deng Solvang and Erland Alfnes
Location: ROOM2

14:05 – 14:15 A Goal Programming Approach for Green Supply Chain Network Optimization
Hao Yu, Wei Deng Solvang, Bjørn Solvang

14:15 – 14:25 Conceptual Approach to Managing Technological Processes of Industrial IoT Workshop
Pavel Drobintsev, Vsevolod Kotlyarov, Igor Chernorutsky, Nikita Voinov

14:25 – 14:35 Efficient Cloud Resource Scheduling for Stochastic Demand with Heterogeneous Cost Models
Wei Wei, Yang Liu

14:35 – 14:45 A Simulation Enhanced VSM Approach for high-Mix Manufacturing Environment
Quan Yu, Erlend Alfnes, Håvard Gjengstø Brekken and Mats Moen Eide

14:45 – 14:55 Vendor Consolidation for a Small Appliance Company
Fred C.C. Yuen, K.L. Choy, H.Y. Lam

14:55 – 15:05 Importance of Production Environments When Applying Industry 4.0 to Production Logistics – A Multiple Case Study
Jo Wessel Strandhagen, Erlend Alfnes, Jan Ola Strandhagen, Natalia Swahn

15:05 – 15:15 Technology Transfer as Driver for Innovation and Automation in SMEs
Leif Anders Estensen, Terje Bakken and Anandasivakumar Ekambaram

15:15 – 15:25 Manufacture and Delivery Scheduling for Multiple Customers on a Single Machine with Availability Constraint
Jing Fan

15:25 – 15:35 The Role of Cultural Characteristics in Industrial Manufacturers Performance - Implications of locating production in Norway
Natalia Swahn, Marco Semini, Jan Ola Strandhagen
# Session 3: Manufacturing Technology & Session 4: Manufacturing Systems

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<td><em>Ina D. Nikolova &amp; Dimitrinka S. Dahterova &amp; Hirpa G. Lemu</em></td>
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<td><em>Ina D. Nikolova &amp; Dimitrinka S. Dahterova &amp; Hirpa G. Lemu</em></td>
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<td>14:25 – 14:35</td>
<td>Beyond Rapid Prototyping: Study of prospects and challenges of 3D printing in functional part fabrication</td>
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<td><em>Hirpa G. Lemu</em></td>
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<td>14:35 – 14:45</td>
<td>Comparative Analysis of Computational Methods in Fluid-Structure Interaction: Temporal discretization and coupling techniques</td>
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<td>Research on Manufacturing Processes and Dynamic Balance Test of Motorized Spindle Shaft</td>
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<td><em>Chilan Cai, Yafei He, Jian Wei, Ning Li, Hongfeng Zhu</em></td>
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<td>14:55 – 15:05</td>
<td>Additive Manufacturing for Enhanced Cooling in Moulds for Casting</td>
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<td><em>Even Wilberg Hovig, Vegard Brøstan, Knut Sørby</em></td>
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<td>15:05 – 15:15</td>
<td>Friction and Wear Characteristics of 30CrMnSi—LD10-CS Under Constant Pressure</td>
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<td><em>Jian Wu, Te Li, Deli Liu and Lanzhong Guo</em></td>
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<td><em>Ragnhild J. Eleftheriadis, Odd Myklebust</em></td>
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<td><em>Vishal S. Sharma, Knut Sørby</em></td>
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<td>15:35 – 15:45</td>
<td>Time Integration Schemes in Dynamic Problems</td>
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<td><em>Ashish Aerana, Hirpa G. Lemu</em></td>
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<td>15:45 – 15:55</td>
<td>Multibody Dynamics Simulation of ROV Manipulator Designed for Student Competition</td>
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<td><em>Benjamin Øygarden, Mathias Bruset, Hirpa G. Lemu</em></td>
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Preface

IWAMA – International Workshop on Advanced Manufacturing and Automation – aims at providing a common platform for academics, researchers, practicing professionals and experts from industries to interact, discuss trends and advances, and share ideas and perspectives in the areas of manufacturing and automation.

IWAMA began in Shanghai University 2010. In 2012 and 2013 it was held at the Norwegian University of Science and Technology, in 2014 at Shanghai University again and 2015 at Shanghai Polytechnic University. The sponsors organizing the IWAMA series has expanded to many universities throughout the world; including Manchester University, Shanghai University, Shanghai Polytechnic University, Xiamen University of Science and Technology, Tonje University, University of Malaga, University of Firenze, Stavanger University, Narvik University College, Shandong Agriculture, University, China University of Mining and Technology, Indian National Institute of Technology, Donghua University, Shanghai Jiao Tong University, Changshu Institute of Technology, Dalian University, St. Petersburg Polytechnic University, and Hong Kong Polytechnic University. As IWAMA becomes an annual event, we are expecting that more sponsors from universities and industries will participate the international workshop as co-organizers.

Manufacturing and automation have assumed paramount importance and are vital factors for the economy of a nation and the quality of life. The field of manufacturing and automation is advancing at a rapid pace and new technologies are also emerging in the field. The challenges faced by today’s engineers are forcing them to keep on top of the emerging trends through continuous research and development.

IWAMA 2016 takes place in Manchester, UK, 10-11th November 2016, organized by The University of Manchester, Norwegian University of Science and Technology and Shanghai Polytechnic University. The program is designed to improve manufacturing and automation technologies for the next generation through discussion of the most recent advances and future perspectives, and to engage the worldwide community in a collective effort to solve problems in manufacturing and automation.

Manufacturing research includes a focus on the transformation of present factories, towards re-usable, flexible, modular, intelligent, digital, virtual, affordable, easy-to-adapt, easy-to-operate, easy-to-maintain and highly reliable “smart factories”. Therefore, IWAMA 2016 has mainly covered 6 chapters in manufacturing engineering:


All papers submitted to the workshop have been subjected to strict peer-review by at least 2 expert referees. Finally, 61 papers have been selected to be included in the proceedings after a revision process. We hope that the proceedings will not only give the readers a broad overview of the latest advances, and a summary of the event, but also provide researchers with a valuable reference in this field.

On behalf of the organization committee and the international scientific committee of IWAMA 2016, I would like to take this opportunity to express my appreciation for all the kind support, from the contributors of high-quality keynotes and papers, and all the participants. My thanks are extended to all the workshop organizers and paper reviewers, to SHU, NTNU and SFI Norman for the financial support, and to co-sponsors for their generous contribution. Thanks are also given to Shewei Wang, Haishu Ma, Zhe Li, Natalia Swahn and Jinghui Yang for their hard editorial work of the proceedings and arrangement of the workshop.

Yi Wang

Yi Wang, PhD. Lecturer,
Chair of IWAMA 2016,
The University of Manchester, UK
Organized and Sponsored by
UM (University of Manchester)
NTNU (Norwegian University of Science and Technology)
SPU (Shanghai Polytechnic University)
CIT (Changshu Institute of Technology)

Honorary Chairs
Minglun Fang and Kesheng Wang

General Chairs
Yi Wang, Tao Yu and Jan Ola Strandhagen

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Yi Wang (Chair), Chris Parker, Eleanor Trimble, Cynancia Raras Mardziah Kamal, Feiran Qing, Shangshang Li, Alice Lu, Jinhui Yang.

Program Committee
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Kesheng Wang, Norway  Guy Doumeingts, France  Jin Yuan, China
Asbjørn Rolstadås, Norway  Van Houten, Netherlands  Yongyi He, China
Per Schjølberg, Norway  Peter Bernus, Australia  Shili Tan, China
Knut Sørby, Norway  Janis Grundspenkis, Latvia  Ming Li, China
Erlend Alfnes, Norway  George L. Kovacs, Hungary  Chao Dong Li, China
Heidi Dreyer, Norway  Rinaldo Rinaldi, Italy  Cuilian Zhao, China
Torgeir Welo, Norway  Gaetano Aiello, Italy  Chuanhong Zhou, China
Leif Estensen, Norway  Romeo Bandinelli, Italy  Jianqing Cao, China
Hirpa L. Gelgele, Norway  Yafei He, China  Yau Huang, China
Wei D. Solvang, Norway  Jiawei Bai, China  Shiron Ge, China
Yi Wang, UK  Jinhui Yang, China  Jianjun Wu, China
Chris Parker, UK  Dawei Tu, China  Guijuan Lin, China
Jorge M. Fajardo, Spain  Ming-lun Fang, China  Shangming Luo, China
Torsten Kjellberg, Sweden  Binheng Lu, China  Dong Yang, China
Fumihiko Kimura, Japan  Xiaoqien Tang, China  Zumin Wang, China
Gustav J. Olling, USA  Ming Chen, China  Guohong Dai, China
Michael Wozny, USA  Xinguo Ming, China  Sarbjit Singh, India
Byoung K. Choi, Korea  Keith C. Chan, China  Vishal S. Sharma, India

Workshop Secretariat
Eleanor Trimble  Jinghui Yang  Natalia Swahn
eleanor.trimble@manchester.ac.uk  jhyang@sppu.edu.cn  Natalia.swahn@ntnu.no
Keynote Presentation List of IWAMA2016

1. Jorge Munilla, Spain

Resilient Smart Structures: Challenges and Future Directions in the RFID Supply Chain.

Abstract: Smart structures are highly inter-connected adaptive systems that are coordinated by cyber systems to optimize specific system objectives. This talk reviews the challenges for securing smart structures. We use a threat model that allows for untrusted behavior to capture realistic IoT scenarios, and discuss vulnerabilities, exploits and attack vectors. Resilience is defined in terms of stability, resistance to damage and self-healing. To illustrate the challenges of capturing resilience we consider supply chain logistics. This involves scanning RFID tagged objects in pallets. An untrusted RFID reader is given a one-time authenticator to inspect a pallet and identify any missing objects; and, if there are no missing objects, compile a proof of integrity. The reader should not be able to trace objects via unauthorized inspections (privacy).

Jorge Munilla works as an Associate Professor for the Engineering Department of the University of Málaga (Spain). He has been guest researcher in the IAIK Krypto Group of the University of Graz, Austria, in 2006, and visiting faculty member in the Florida State University, USA, in 2009, 2011 and 2015, and the University of Wollongong, Australia, in 2012 and 2014. His fields of interest include Image and Speech Processing, Security in power-constrained devices and the computer aided early diagnosis of Alzheimer's disease using image analysis. He is co-author of 2 book chapters, more than 15 papers in international journals and 30 conference participations. His works have been cited more than 100 times according to the Web of Knowledge and more than 500 times according to Google Scholar.

2. Costas Soutis Freng, UK

Manufacturing of Advanced Composite Materials

Abstract: Modern composites, made up of carbon fibres and toughened epoxy resins, are lighter/stiffer/stronger and increase fuel efficiency in aircraft, compared with the aluminium currently used. They have been used in the Airbus A380 super jumbo, the first fully double-decked passenger jet (with more than 550 seats, but certified for 853 passengers) that took its first commercial flight in 2007, the Boeing 787 ‘Dreamliner’ aircraft and the more recent A350 that came to service in early 2015. The primary structure, including the wing and fuselage, of the B787 200-seater passenger jet is built mostly from composite materials and is advertised to be 20% more fuel efficient than current commercial planes with almost 60% more cargo space than the Airbus A300-200. It is accepted that modern composite systems offer a variety of advantages, however, affordability (reduced acquisition and direct operating costs, while maintaining or enhancing safety) is the key to survival in aerospace manufacturing, whether civil or military. Therefore current research effort is devoted to analysis and computational simulation of the manufacturing and assembly process as well as the simulation of the performance of the structure, since these are intimately connected. In this talk, applications of modern composite systems will be presented and achievements, but also challenges of such material systems (technical and financial) will be discussed with some thoughts on future needs, developments and prospects for novel materials (3D woven architectures, graphene composites) and processes, structural health monitoring (SHM), maintenance, repair and recycling.

Professor Constantinos Soutis Freng is holding a Chair in Aerospace Engineering, and he is the Director of the Aerospace Research Institute and Director of the Northwest Composites Centre at the University of Manchester, UK. He is a leading authority in mechanics and failure of composites, with significant contributions on modelling damage mechanisms in open hole compression, impact and compression after impact, environmental effects on fibre microbuckling and structural health monitoring using low frequency Lamb waves techniques. His industrial research and engineering experience includes work with the Structural Materials Centre of the British Defence Evaluation & Research Agency (visiting research fellow, 1995-2001), QinetiQ (Trusted Expert, 2001-2003), Cambridge Consultants, Dowty Propellers, Cytec Materials Engineering and ABB Research in Switzerland. Professor Soutis is the author or co-author of over 400 archived articles, which include more than 250 ISI listed journal papers; some 30 PhD students have qualified under his supervision and guidance. Professor Soutis is the Deputy Editor of Applied Composite Materials Journal, an Associate Editor of the RAeS Aeronautical Journal and the International Journal of SHM.
3. Yi Wang, UK

Challenges and Opportunities in the Development of Graphene-based Products

Abstract: There has been significant progress in the development of graphene manufacturing methods, and graphene production is starting to experience the need or demand for quality, quantity, reliability and price, in other words standardization and industrialization. There are diverse methods to produce different types of graphene material. For conciseness, we will focus on three main types of graphene product and related production methods: graphene films, graphene oxide (GO) flakes and graphene nanoplatelets (GNPs). There are only a few graphene-based products that have reached the market, such as the tennis racket by Head, the battery strap by Vorbeck, the oil-drilling mud by Nanochem or the phone touch screen by Samsung. These products represent an initial market entry rather than the first, full commercial wave of graphene products. The size of the graphene market was estimated2 to be around US$12 million in 2013, indicating that so far we are still in a phase of research and development, in which the market is dominated by sales of raw graphene materials. This paper will discuss the promise and challenges in the development of graphene-based products.

Dr Yi Wang obtained his PhD from Manufacturing Engineering Center, Cardiff University in 2008. Hu is a lecturer in Fashion logistics in School of Materials, The University of Manchester, UK. Previously he worked in the department of Computer Science, Southampton University and at the Business School, Nottingham Trent University. He holds various visiting lecturership in several universities worldwide. Dr Wang has special research interests in supply chain management, logistics, operation management, culture management, information systems, game theory, data analysis, semantics and ontology analysis, and Neumarketing. Dr Wang has published 26 technical peer-reviewed papers in international journals and conferences. He co-authored two books: Operations Management for Business and Data Mining for Zero-defect Manufacturing.

4. Gouhong Dai, China

Technology Architecture of Intelligent Remanufacturing

Abstract: With the attention of world manufacturing paid to sustainable development, the social value of recycling and reusing waste products has been generally recognized. The disassembly and remanufacturing of waste products or parts are very important aspects. Only by improving the productivity of remanufacturing waste products can the effective recycling and reuse of waste products be guaranteed. In this study, the intelligent remanufacturing technical system is proposed by analyzing the remanufacturing process system, combined with the ideas and knowledge of intelligent manufacturing. Three aspects are demonstrated, including reverse supply chain, remanufacturing enterprise management, and the application method of artificial intelligence technology in remanufacturing equipment. The architecture and development of intelligent remanufacturing are generally demonstrated, and the issues related to intelligent remanufacturing are finally discussed.

Professor Guohong Dai is the vice president at Changshu Institute of Technology. He engages in teaching and research of CAD / CAPP / CAM technology, digital pre-assembly technology, advanced manufacturing technology. He participated and finished eight national projects, such as the national “863 Program”, the General Armament Department “fifteen” pre-research, science and technology research programs in Shanghai, Jiangsu Province, high-tech research program, Aerospace Industry Corporation project; coordinate and complete 6 fundamental university scientific researches in Jiangsu Province. He chaired or participated in the completion of the project by the outcome of the provincial-level appraisal 7. He received “Jiangsu provincial Science and Technology advances” awards, one for the second prize and one for third prize. He has hold one national patent and published more than 30 papers and 9 books.

5. Martin Schröder, UK

Introduction to the School of Materials

Professor Martin Schröder is an expert in materials chemistry applied to energy research, and joined University of Manchester on 1st June 2015 from the University of Nottingham, where he is currently Executive Dean of the Faculty of Science, responsible for leading the Faculty’s research and teaching strategies, infrastructure and financial planning. A Fellow of the Royal Society of Chemistry, he is also currently Principal Investigator for the EPSRC Programme Grant ‘Coordination Chemistry for Energy and our Sustainable Futures’ and has previously held an ERC Advanced Grant. He has
6. Jan Ola Strandhagen, Norway

Logistics 4.0 and Emerging Sustainable Business Models

Abstract: The drive towards Logistics 4.0 as an element of Industry 4.0 gives possibilities for new business models. Instant information exchange, automated solutions and real-time big data analysis are among the features of Logistics 4.0 paving the way for new business models. The role and importance of information is changing as we can see today. The demand for sustainability of business creates on the other hand new requirements to the operations of manufacturing and logistics. The key note will address these challenges and illustrate current trends and future possibilities by numerous case illustrations.

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7. Yafei He, China

Research on Manufacturing Processes and Dynamic Balance Test of Motorized Spindle Shaft

Abstract: The shaft is the core transmission part of the motorized spindle. Based on the mechanical performance requirements and assembly requirements with other parts, this paper did the structural analysis on the shaft, and developed a set of high efficient manufacturing processes, including processing steps, heat treatment technology and cutting tools selection, etc. This paper also verified the feasibility of these processes with real shaft processing, did the unbalance detection at the dynamic balancing machine, then reduced the dynamic unbalance with some improvement measures.

Prof. Yafei He holds a Master's degree in major of Solid Mechanics from Zhejiang University in 1989. He has been a supervisor of postgraduate of department of Mechanical and Power Engineering of Shanghai Jiaotong University since 2004. He is a professor of College of Engineering of Shanghai Polytechnic University at present. He was a committee member of Education Steering Committee of Vocational Electrical Equipment technology category of Ministry of Higher Education in 2005, and he also was an Academic Leader, major of “CNC equipment and tooling technology” in key discipline of “Mechanical manufacturing and Automation” from Shanghai Education Commission in 2009, he has been a deputy director and secretary general of advanced manufacturing technology professional committee of Shanghai Institute of Mechanical Engineering since 2008. Prof. He’s long-term engaged in areas are CNC machine tools, mechatronics, advanced manufacturing technology in teaching and research work.

8. Kesheng Wang, Norway

Logistics 4.0 Solution: New Challenges and Opportunities

Abstract: The fourth industrial revolution will fundamentally change logistics and its self-perception. Having the right product at the right time at the right place and in the right condition – these are the well-known requirements for logistics and transportation in general. But fulfilling these requirements is getting more and more complex in a dynamically changing logistic environment. Long-lasting business relationships are overrun by short-term business connections. The highly dynamic logistic markets and the advancing complexity of logistic networks require new methods, products and services. Today's consumer behavior leads to new logistics challenges and the concept of the “Cyber Physical System”, the “Internet of Things and
“Services” and the “Big Date and Data Mining” seems to be the probable solution for that. Its consequent implementation inevitably results in the necessity to reconsider some basic concepts of logistics. This presentation is to outline the vision of “Logistics 4.0” and give a definition and technical components of logistic 4.0. Additionally it emphasizes the question, which paradigm changes will emerge from the fourth industrial revolution and how to address them proactively.

Professor Kesheng Wang holds a PhD in production engineering from the Norwegian University of Science and Technology (NTNU), Norway. Since 1993 he has been appointed Professor at the Department of Production and Quality Engineering, NTNU. He is a director of the Knowledge Discovery Laboratory (KDL) at NTNU at present. He is also an active researcher and serves as a technical adviser in SINTEF. He was elected member of the Norwegian Academy of Technological Sciences in 2006. He has published 19 books, 10 book chapters and over 240 technical peer-reviewed papers in international journals and conferences. Professor Wang’s current areas of interest are intelligent manufacturing systems, applied computational intelligence, data mining and knowledge discovery, swarm intelligence, condition-based monitoring and structured light systems for 3D measurements and RFID, Predictive maintenance and Industry 4.0.
About the Editors of Proceedings of IWAMA2016

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Professor Tao Yu is the president of Shanghai Second Polytechnic University (SSPU), China and professor of Shanghai University (SHU). He received his PhD from SHU in 1997. Professor Yu is a member of the Group of Shanghai manufacturing information and a Committee member of the International Federation for Information Processing IFIP/TCS. He is also an executive vice president of Shanghai Science Volunteer Association, and executive director of Shanghai Science and Art Institute of Execution. He managed and perform about 20 national, Shanghai, enterprises commissioned projects. He has published hundreds of academic papers, of which about thirty were indexed by SCI, EI. His research interests are mechatronics, computer integrated manufacturing system (CIMS) and Grid Manufacturing.
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