2021 International Conference on Intelligent Manufacturing and Industrial Automation (CIMIA 2021)

26th -28th March 2021

Guilin Park Hotel, Guilin, China

ZOOM Conference ID：748 677 4340

Organizer

AEIC Academic Exchange Information Center

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Conference Schedule

Time: 26th -28th March 2021
Location: Guilin Park Hotel

Date	Time	Activity	Venue
26th March	13:00-17:00	Registration	Lobby
	18:00-20:00	Dinner	Xinghe Room (星河阁) 2nd Floor
27th March Morning	9:00-10:20	**Keynote Speeches**	Fengcai Room (风采厅) 2nd Floor
	10:20-10:35	Tea Break and Group Photo	
	10:35-11:55	**Keynote Speeches**	
	12:00-14:00	Lunch	Xinghe Room (星河阁) 2nd Floor
27th March Afternoon	**14:00-15:20**	**Keynote Speeches**	Fengcai Room (风采厅) 2nd Floor
	15:20-15:35	Tea Break	
	15:35-16:15	**Keynote Speeches**	
	16:15-18:00	Oral Presentation	
	18:00-20:00	Dinner	Xinghe Room (星河阁) 2nd Floor

Conference Agenda

Session I: Keynote Speeches

Fengcai Room (风采厅), 2nd Floor   **09:00-11:55, Saturday Morning, 27th March 2021**

Time	Title	Speaker	Affiliation
09:00-09:40	Research into Using Robots in Product Disassembly for Smart Remanufacturing	Prof. Duc Truong Pham	University of Birmingham, UK
09:40-10:20	Application of Agents in Intelligent Manufacturing and Industrial Automation	Prof. Weiming Shen	Huazhong University of Science and Technology, China
10:20-10:35	**Photography & Tea Break**		
10:35-11:15	Digital Twin in Industry	Prof. Fei Tao	Beihang University, China
11:15-11:55	Big data driven human-machine-material collaborative manufacturing in intelligent workshop	Prof. Jihong Yan	Harbin Institute of Technology, China

Session II: Keynote Speeches & Presentations

Fengcai Room (风采厅), 2nd Floor   **14:00-18:00, Saturday Afternoon, 27th March 2021**

Time	Title	Speaker	Affiliation
14:00-14:40	Artificial Intelligence Enabled Diagnosis and Prognosis in Manufacturing	Prof. Ruqiang Yan	Xi'an Jiaotong University, China
14:40-15:20	The recent development in Industry 4.0 for smart manufacturing, data analytics, AI and security	Prof. Victor Chang	Teesside University, UK
15:20-15:35	Tea Break		
15:35-16:15	Complex System of Systems Engineering Paradigm for Smart Cities	Prof. Mo Jamshidi	University of Texas, San Antonio, USA
16:15-18:00	Oral presentations		
Oral 1-1	Digital Twin Platform of All Elements for Discrete Manufacturing	Yueze Zhang	Beijing University of Technology, China
Oral 1-2	Trajectory tracking control method of robotic intra-oral treatment	Wenxiang Xu	Beijing University of Technology, China
Oral 1-3	Online porosity defect detection based on convolutional neural network for Al alloy laser welding	Deyuan Ma	Huazhong University of Science and Technology, China
Oral 1-4	An improved dynamic window approach for local trajectory planning in the environment with dense objects	Xiquan Mai	South China University of Technology, China
Oral 1-5	On-line monitoring of penetration state in laser-arc hybrid welding based on keyhole and arc features	Minghai Zhang	Huazhong University of Science and Technology, China
Oral 1-6	Evaluation of Normal Meshing Profile Deviation based on 3D Measurement	Baoya Zhao	Beijing University of Technology, China
Oral	Design of LQR Excitation Controller of	Hao Li	HoHai University

1-7	Synchronous Condenser in HVDC System		
Poster 2-1	Few-shot learning approach for 3D defect detection in lithium battery	Ke Wu	Chinese Academy of Sciences
Poster 2-2	Research on the Stability of an Air-to-Air Missile Compound Control System with a Pulse Modulator	Wang DongMei	Guilin University of Aerospace Technology
Poster 2-3	Quality by Design (QbD): Application of Comprehensive Risk Analysis in Blending Process for XLGB Capsule in Medicine Industry	Yamin Zuo	Hubei University of Medicine

Keynote Speeches

Keynote Speech 1: Research into Using Robots in Product Disassembly for Smart Remanufacturing

Speaker: Prof. Duc Truong Pham, University of Birmingham, UK
Time: 09:00 am - 09:40 am, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
Remanufacturing is the process where used products are returned to a good-as-new condition and with a guarantee of the same or a higher level than for new products. Activities in remanufacturing include sorting, disassembly, cleaning, inspection, and rebuilding. Product disassembly is usually the first step in remanufacturing and determines the efficiency and capability of remanufacturing. As it is complex, disassembly tends to be manually executed and is labor-intensive. Efforts have been spent on introducing collaborative robots in disassembly to make remanufacturing 'smarter'. Like other applications of Industry 4.0 automation technologies, this should lead to increased productivity, reduced failure rate, more resource-efficient operations, and improved product quality and working environment.

This presentation will cover research funded by the UK Engineering and Physical Sciences at the University of Birmingham into using robots in product disassembly for smart remanufacturing. The aim of the work, which investigates disassembly science and devises intelligent disassembly strategies and plans and develops human-robot collaborative disassembly techniques, is to allow disassembly to be reliably performed either with minimal human intervention or in a collaborative fashion by man and machine.

Keynote Speech 2: Application of Agents in Intelligent Manufacturing and Industrial Automation

Speaker: Prof. Weiming Shen, Huazhong University of Science and Technology (HUST), China
Time: 09:40 am -10:20 am, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
Agent technology represents a novel paradigm for developing intelligent manufacturing

and industrial automation systems. During the past 25 years, a significant number of researchers and practitioners have been trying to apply intelligent software agents in the areas of engineering design, collaborative intelligent manufacturing, supply chain management, and smart product services. Recent developments and fast advancements of Cloud/Fog/Edge Computing, Internet of Things, Cyber-Physical Systems, Digital Twins, Big Data, and Blockchains provide new opportunities for applications of intelligent software agents in intelligent manufacturing and industrial automation, but also bring a lot of new research challenges. This talk presents some first-hand experience in developing agent-based collaborative design and manufacturing technologies and systems and discusses future trends, R&D opportunities, and challenges.

Keynote Speech 3: Digital Twin in Industry

Speaker: Prof. Fei Tao, Beihang University (BUAA), China.
Time: 10:35 am -11:15 am, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
The global academic research of digital twin (DT) is first investigated, and a comparative analysis of digital twin research in USA, Germany, and China are then given out. Ten industry applications of digital twin are then introduced, especially the application of digital twin shop-floor. In order to better understand and use digital twin, some hot topics related to digital twin will be discussed, such as the concept of the digital twin, the applicable guideline of the digital twin, standards of the digital twin, and so on.

Keynote Speech 4: Big data driven human-machine-material collaborative manufacturing in intelligent workshop

Speaker: Prof. Jihong Yan, Harbin Institute of Technology, China
Time: 11:15 am -11:55 pm, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
Intelligent manufacturing has attracted intense attention due to the broad application of big data, artificial intelligence and information technology in manufacturing industry.

In 2013, Germany proposed Industry 4.0 which fosters the concept of "smart factory". Within modular structured smart factories, cyber-physical systems (CPS) which monitor physical processes, create a real-time virtual copy of the physical world and make decentralized decisions play an essential role during the innovation. Over the big data and Internet of Things, cyber-physical systems communicate and cooperate with each other and with humans both internally and across organizational services offered and used by participants of the value chain. The challenges and opportunities brought by big data in workshop and current research work on CPS in the aspect of human, industrial robots, machine tools, materials and so on done by Dr. Yan's team are given in this talk.

Keynote Speech 5: Artificial Intelligence Enabled Diagnosis and Prognosis in Manufacturing

Speaker: Prof. Ruqiang Yan, Xi'an Jiaotong University, China
Time: 14:00 pm -14:40 pm, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
The new generation AI technology, especially deep learning, has shown a great advantage in feature learning and knowledge mining, which provides a new way for intelligent diagnosis and prognosis in manufacturing. This talk first provides a brief overview of deep learning. Then applications of some typical deep network models in intelligent diagnosis and prognosis are discussed, followed by a new trend of deep learning theory and development.

Keynote Speech 6: The recent development in Industry 4.0 for smart manufacturing, data analytics, AI and security

Speaker: Prof. Victor Chang, Teesside University, UK
Time: 14:40 pm -15:20 pm, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract:
There are important elements to make Industry 4.0 successful, including the choice of advanced technologies and their interplay for different types of smart manufacturing.

This keynote is focused on the overview, discussion and detailed technologies on the recent development in Industry 4.0 for smart manufacturing, data analytics, AI and security. There are three parts to this talk. First, it will be on the overview and general understanding of the Industrial Internet of Things (IIoT) for the Supply Chain. Second, it will elaborate on the choice and use of different advanced technologies and examples. Third, future trends will be discussed. This keynote will describe how key aspects for each part, and explain their relation, and suitable examples and recommendations for each section, and the entire topic collectively. The interplay between smart manufacturing, data analytics, AI and security will be crucial for Industry 4.0 development.

Keynote Speech 7: Complex System of Systems Engineering Paradigm for Smart Cities

Speaker: Prof. Mo Jamshidi, the University of Texas, USA
Time: 15:35 pm -16:15 pm, 27th March 2021
Venue: Fengcai Room (风采厅), 2nd Floor, Guilin Park Hotel
Abstract

Large data has been accumulating in all aspects of our lives for quite some time. Advances in sensor technology, the Internet, wireless communication, and inexpensive memory have all contributed to an explosion of "Big Data". System of Systems (SoS) are integration of independent operatable and non-homogeneous legacy systems to achieve a higher goal than the sum of the parts. Today's SoS are also contributing to the existence of unmanageable "Big Data". Recent efforts have developed promising approach, called "Data Analytics", which uses machine learning tools from statistical and soft computing (SC) such as principal component analysis (PCA), clustering, fuzzy logic, neuro-computing, evolutionary computation, Bayesian networks, deep architectures and deep learning, etc. to reduce the size of "Big Data" to a manageable size and apply these tools to a) extract information, b) build a knowledge base using the derived data, and c) eventually develop a non-parametric model for the "Big Data". This keynote attempts to construct a bridge between SoS and Data Analytics to develop reliable models for such systems. A photovoltaic energy-forecasting problem of a micro grid SoS, traffic jams forecasting and a system of autonomous vehicles will be offered for case studies. These tools will be used to extract a nonlinear model for a SoS-generated BIG DATA. Videos for autonomous vehicles will be shown.

Oral Presentation

1-1

Title: Digital Twin Platform of All Elements for Discrete Manufacturing
Author: Yueze Zhang
Affiliation: Beijing University of Technology, China
Abstract: Compared with other production methods, multi-variety, small-batch production driven by order become a lot more sensitive to the disturbances of workshop environment, orders, and processing equipment. This makes a great impact on workshop scheduling. Aiming at this problem, this paper designs a real-time workshop digital twin scheduling platform for discrete manufacturing. It improves the flexibility of the intelligent workshop and the response processing speed after dynamic disturbance. The platform can real-time monitor of the physical workshop and track orders, products, equipment and other information. Further, the platform and visualization technology were explored to work together. Then, the true display of changes after production line decision

was displayed. It enables managers to carry out production scheduling verification in the virtual workshop, which reduces the repeated changes of physical workshop production scheduling. Finally, the platform was verified in a discrete manufacturing workshop. The scheduling platform based on digital twins helps manager to immersivity develop factory production strategies. The production efficiency was then enhanced. The platform can ensure the effective operation of the manufacturing system.

1-2

Title: Trajectory tracking control method of robotic intra-oral treatment
Author: Wenxiang Xu
Affiliation: Beijing University of Technology, China
Abstract: At present, people suffer from a high rate of cross-infection of oral diseases, and it is an urgent clinical need to explore effective methods to promote high-security and high-quality imaging. This paper proposes a collaborative robot control strategy that assists in oral diagnosis and treatment. This method can track the dynamic movement of the patient's upper and lower jaw during treatment. According to the small space of the oral cavity and the change of the tooth position, dynamic trajectory tracking with adaptive control is performed on the robotic arm. This control strategy is of great significance for accurate oral diagnosis and treatment and reducing cross-infection between doctors and patients.

Title:Online porosity defect detection based on convolutional neural network for Al alloy laser welding

Author: Deyuan Ma

Affiliation: Huazhong University of Science and Technology

Abstract: Porosity is one of the most serious defects in Al alloy laser welding. The online detection of the porosity can identify the weak position of weld seam and take remedial measures accordingly. In this paper, a convolutional neural network (CNN) model where the input is the signal spectrum graphs extracted by wavelet packet decomposition (WPD) is constructed to identify the porosity during Al alloy laser welding in real-time. The porosity monitoring platform is set up to obtain the keyhole opening area signal and the keyhole depth signal in the welding process. The sliding window scanning algorithm is used to scan the signals and the weld seam, and the time-frequency spectrum graphs are obtained by WPD processing on the signals in each sliding window. Through analysis, when there is porosity in a small weld seam section of the current sliding window, the signal spectrum graphs are messy at this moment, while when there is no porosity, the signal spectrum graphs are clean and the frequency bands are concentrated in low-frequency part. The CNN model is constructed to classify the signal spectrum graphs under different porosity status, thereby it can identify the porosity in the weld seam.

Title: An improved dynamic window approach for local trajectory planning in the environment with dense objects

Author: Xiquan Mai

Affiliation: South China University of Technology

Abstract: The Dynamic Window Approach (DWA) has been one of the most popular solutions in local trajectory planning due to the advantages of movement fluency. However, the traditional DWA faces the challenge of low-efficiency in the case of local trajectory planning since the robot cannot perceive the density of the obstacle. In this paper, we propose an improved DWA to solve this problem. First, we use multi-sensor technology and new evaluation algorithms to enable the capability of density perception for the disorderly environment. Second, the evaluation factor related to the density change is introduced into the path evaluation function, which will facilitate the robot to perceive the distribution of dense objects in advance. Computer simulation and field experiments show that the efficiency of the improved DWA is increased by 25%. The improved DWA not only considers the original factors such as heading angle, but also introduces a density factor to evaluate the next path, so as to avoid entering dense areas in advance. It can be seen that the improved DWA has relatively stable speed and acceleration, and can avoid dense areas in advance, which can be widely used in robots running in dense environments.

1-5

Title: On-line monitoring of penetration state in laser-arc hybrid welding based on keyhole and arc features

Author: Minghai Zhang

Affiliation: Huazhong University of Science and Technology

Abstract: Incomplete penetration is a typical defect in laser-arc hybrid welding. On-line monitoring of welding process is an important method to assess welding quality. In laser-arc hybrid welding, there is a strong correlation between keyhole, arc and incomplete penetration. Therefore, an on-line monitoring method of penetration state based on keyhole and arc features is proposed in this paper. In the proposed method, the images of keyhole and arc in laser-arc hybrid welding are captured by high-speed camera, and then the keyhole and arc features are extracted by image processing algorithm. Finally, the features are used as input to classify the penetration state using SVM model. The results show that the SVM model based on keyhole and arc features can accurately identify the penetration state.

1-6

Title: Evaluation of Normal Meshing Profile Deviation based on 3D Measurement

Author: Baoya Zhao

Affiliation: Beijing University of Technology

Abstract: The feature lines on involute surface include profile, helix, normal meshing profile and contact line. In helical gear transmission, the deviation of normal meshing tooth shape can reflect the transmission quality of gear better. In this paper, a method is proposed to obtain the tooth flank normal deviation from the 3D measuring point cloud data of gear, and to obtain the normal meshing profile deviation curve from it, and to evaluate it.

1-7

Title: Design of LQR Excitation Controller of Synchronous Condenser in HVDC System

Author: Hao Li

Affiliation: HoHai University

Abstract: As a kind of reactive power compensation equipment,a synchronous condenser is widely used in High Voltage Direct Current(HVDC) transmission system due to its small influence on the regulation ability and high strong excitation ability. In this paper,the practical state space model of the synchronous condenser is established and the parameters of the model are calculated. The linear quadratic regulator (LQR) Controller for

excitation system is designed and the controllability and stability are analyzed. In order to verify the voltage support ability and dynamic response performance of LQR excitation controller,the simulation is carried out in MATLAB/SIMULINK. The simulation results show that the grid voltage fluctuation can be quickly quelled and the strong excitation function of synchronous condenser is quickly exerted.

2-1

Title: Few-shot learning approach for 3D defect detection in lithium battery
Author: Ke Wu
Affiliation: Chinese Academy of Sciences
Abstract: It is difficult to detect the surface defects in a lithium battery with an aluminium/steel shell. The effect of reflectivity, the limitation of acquiring the 3D information, and the shortage of large amounts of labelled training data make the 2D detection method hard to classify surface defects. In this work, a few-shot learning approach for 3D defect detection in lithium batteries is proposed. The multi-exposure-based structured light method is introduced to reconstruct the 3D shape of the lithium battery. Then, the anomaly part of the 3D point cloud is transferred into 2D images by the height-gray transformation. The MiniImageNet datasets are used as the source domain to pretrain the Cross-Domain Few-Shot Learning (CD-FSL) model. The accuracy in the target domain is 97.17%, which means that our method can be used to classify the surface defects of the lithium battery.

2-2

Title: Research on the Stability of an Air-to-Air Missile Compound Control System with a Pulse Modulator
Author: Dongmei Wang
Affiliation: Guilin University of Aerospace Technology
Abstract: Based on pulse modulator, a method of lateral force and aerodynamic compound control system design in air-to-air missile and the stability is studied. First, the lateral force is assumed to be continuous and blended with aerodynamic fins according to a certain proportion, and the compound control is designed based on three-loop control method. Then the switch order of direct force device is obtained based on the pulse modulator. At last, the stability of control system is analysed based on describing function method, and then the parameter of pulse modulator is properly chosen. Simulation results show the validity of the proposed design.

Title: Quality by Design (QbD): Application of Comprehensive Risk Analysis in Blending Process for XLGB Capsule in Medicine Industry

Author: Yamin Zuo

Affiliation: Hubei University of Medicine

Abstract: Intelligent development is an inevitable choice for the green development of manufacturing enterprises, improving the medical quality and guaranteeing the safety play an important role in the intelligent development of medical industry. Since the risk prediction is crucial in many areas of medical work, risk management and communication are meaningful in industry management. The framework of comprehensive industry risk management of Chinese Patent Medicine (CPM) has been presented and constructed at presence. To improve the quality and safety of medical service and management level, this article explored the different meanings of innovation theory and conducted a comprehensive risk management of Chinese medicine industry. This paper provides guidelines for future investigations that how to apply quality-by-design (QbD) approach for the development of medicine industry. This study demonstrates that employing the QbD concept in this way is a novel area in CPM quality.

Instructions for Presentations

Oral Presentation

1. Timing: a maximum of 15 minutes total, including speaking time and discussion. Please make sure your presentation is well timed. Please keep in mind that the program is full and that the speaker after you would like their allocated time available to them.

2. You can use CD or USB flash drive (memory stick), make sure you scanned viruses in your own computer. Each speaker is required to meet her/his session chair in the corresponding session rooms 10 minutes before the session starts and copy the slide file(PPT or PDF) to the computer.

3. It is suggested that you email a copy of your presentation to your personal inbox as a backup. If for some reason the files can't be accessed from your flash drive, you will be able to download them to the computer from your email.

4. Please note that each session room will be equipped with a LCD projector, screen, point device, microphone, and a laptop with general presentation software such as Microsoft PowerPoint and Adobe Reader. Please make sure that your files are compatible and readable with our operation system by using commonly used fronts and symbols. If you plan to use your own computer, please try the connection and make sure it works before your presentation.

5. Movies: If your PowerPoint files contain movie please make sure that they are well formatted and connected to the main files.

Poster Presentation

1. Maximum poster size is 59.4 CM wide by 84.1 CM high（A1）.

2. Posters are required to be condensed and attractive. The characters should be large enough so that they are visible from 1 meter apart.

3. Please note that during your poster session, the author should stay by your poster paper to explain and discuss your paper with visiting delegates.

Notice for Participants

欢迎各位专家学者们参加 2021 年智能制造与工业自动化国际研讨会（CIMIA 2021），为了您在会议期间方便顺利，请注意以下事项：

Welcome all leaders and researchers to the 2021 International Conference on Intelligent Manufacturing and Industrial Automation. For your convenience during the conference, please pay attention to the following concerns:

一、 参会 Conference

1.会场：风采厅，2 楼，桂林桂湖酒店

Conference Room: Fengcai, 2nd Floor

2. 请您佩戴好参会证，按照会议日程上的安排，提前 10 分钟凭证入场；

Please wear the conference pass and enter the venue 10 minutes in advance according to the schedule;

3. 参会期间，请您务必把手机调为静音或关闭手机；会议期间请勿随意走动。

Please set your mobile phone to silent mode or turn off the phone during the conference; Please do not walk around casually during the conference.

4. 请注意保管好自己的随身物品。

Please take care of your belongings.

二、就餐 Meal

1. 用餐地点：星河阁，2 楼，桂林桂湖酒店

 Place: Xinghe Room, 2nd Floor, Guilin Park Hotel

2. 会务组免费提供餐券，包含了 3 月 26 号晚餐、27 号午餐+晚餐

 The conference group provides meals coupons for free, including dinner on 26th March, lunch and dinner on 27th March;

3. 一人一餐券，请保管好，当天有效，过期作废。

 Please keep it well, one coupon for one person, valid on specified day only.

三、酒店信息 Hotel Information

1. 桂林桂湖饭店 中国桂林叠彩区螺蛳山路 1 号

 Guilin Park Hotel, Address: No.1 Luosishan Road, Guilin, 541001, Guangxi, China

2. 房间预订：大床房 290 元/晚（含早），标间 270 元/晚（含早）。如需预订酒店，请编辑短信"AEIC 桂林站 CIMIA+姓名+入住日期+退房日期+房型+入住人数"发送至 13737735558（秦经理），预订结果以收到确认为准。

 Room Reservation: Standard single room: RMB 290/ night, Standard double room: RMB 270/ night (about USD 42/ night). You can make a reservation by calling the front desk +86 13737735558, please tell that you are a guest of "AEIC Guilin academic conference （CIMIA 2021）".

四、联系我们 Contact us

会议期间，如果您需要帮助，可以咨询以下会务组工作人员。

If you need help during the conference, you can ask the following staff.

会务负责人：李老师 电话（同微信）17737319063

Conference Secretary: Leah Li：＋86 17737319063

Email: contactcimia@163.com

Hotel Information

Guilin Park Hotel （桂湖饭店）

Address: No.1 Luosishan Road, Guilin, 541001, Guangxi, China

中国 桂林 叠彩区 螺蛳山路 1 号