International Conference on Aeronautical Materials and Aerospace Engineering (AMAE 2019)

In Conjunction with SAASE 2019

Conference Programme

http://www.amae2019.org/

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Conference organized by

Hong Kong Society of Mechanical Engineers

2019.05.24-05.26 ● Shanghai ● China

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WELCOME MESSAGE

Dear Participants,

Welcome to Shanghai! Welcome to participate in International Conference on Aeronautical Materials and Aerospace Engineering (AMAE 2019) and International Symposium on Aviation and Aerospace System Engineering (SAASE 2019). AMAE 2019 and SAASE 2019 are organized by Hong Kong Society of Mechanical Engineers (HKSME). The proceeding will be published by IOP Conference Series: Materials Science and Engineering (ISSN: 1757-899X) (Online Publish), which will be indexed by EI Compendex, Scopus, Thomson Reuters (WoS), Inspec, and other indexing organizations.

AMAE 2019 and SAASE 2019 aim to present the latest research and results of scientists related to aeronautical materials and aerospace engineering, aviation and aerospace system engineering and other topics. This conference provides opportunities for the delegates to exchange new ideas face-to-face, to establish business or research relations as well as to find global partners for future collaborations. We hope that the conference results will lead to significant contributions to the knowledge in these up-to-date scientific fields.

We would like to thank our outstanding speakers: Prof. Ramesh Agarwal, Washington University in St. Louis, USA; Prof. Youmin Zhang, Concordia University, Canada; Prof. Nickolay Zosimovych, Shantou University, China; for sharing their deep insights on future challenges and trends.

We would like to thank all committees for their great support on organizing the conference. We also would like to thank all the reviewers for their great effort on reviewing the papers submitted to AMAE 2019 and SAASE 2019. Special thanks to all the researchers and students who with their work and participate in the conference.

We hope you enjoy the conference, the food, the hospitality, and the beautiful and charming city of Shanghai.

AMAE 2019 & SAASE 2019 Organizing Committee

CONFERENCE SPEAKERS

Keynote Speakers

Prof. Ramesh Agarwal
Washington University in St. Louis, USA

Biography: Prior to joining the faculty at Washington University in 2001, Professor Agarwal was the Chair of the Aerospace Engineering Department at Wichita State University from 1994 to 1996 and the Executive Director of National Institute for Aviation Research from 1996 to 2001. From 1994 to 2001, he was also the Bloomfield Distinguished Professor at Wichita State University. Over a period of 35 years, Professor Agarwal has worked in Computational Fluid Dynamics (CFD), Computational Magnetohydrodynamics (MHD) and Electromagnetics, Computational Aeroacoustics, Multidisciplinary Design and Optimization, Rarefied Gas Dynamics and Hypersonic Flows, Bio-Fluid Dynamics, and Flow and Flight Control. More recently, he has devoted some of his efforts in nanotechnology and renewable energy systems - in particular wind, solar and biomass. He is the author and coauthor of over 500 publications and serves on the editorial board of more than 20 journals. He has given many plenary, keynote and invited lectures at various national and international conferences worldwide. Professor Agarwal continues to serve on many professional, government, and industrial advisory committees. Professor Agarwal is a Fellow of eighteen societies: AIAA, APS, ASME, IEEE, SAE, SME, AAM, ASCE, ect.

Keynote Lecture: Ground Effect Aerodynamics of an Airplane and a Race Car
High lift multi-element airfoils/wings are used in airplanes during take-off and landing in the close proximity of the ground. Inverted multi-element airfoils/wings are used in race cars to provide negative lift or downforce to increase the amount of traction between the tires and the ground that ultimately allows the drivers to turn at faster speeds. This paper studies the ground effect aerodynamics of airplanes and race cars by numerical simulations. The influence of ground effect on lift and drag is studied for various angles of attack and heights above the ground by solving the Reynolds-Averaged Navier-Stokes (RANS) equations in conjunction with a turbulence model. Details of the flow physics are provided and some conclusions are drawn to assist in the design of multi-element airfoils/wings.

Prof.Youmin Zhang
Concordia University, Canada

Biography: Youmin Zhang is a Professor with the Department of Mechanical, Industrial & Aerospace Engineering and the Concordia Institute of Aerospace Design and Innovation (CIADI) at Concordia University, Canada. His main research interests include fault detection and diagnosis (FDD), fault-tolerant control (FTC), fault-tolerant cooperative control (FTCC) of single and multiple unmanned aerial/space/ground/surface vehicles, smart grids, and applications of unmanned systems to forest fires, power lines, environment, natural resources and disasters monitoring, detection, and protection by combining with remote sensing techniques. He has authored four books, over 500 journal and conference papers, and book chapters. Dr. Zhang is a Fellow of CSME, a Senior Member of AIAA and IEEE, A Member of ASME, Vice-President of International Society of

Intelligent Unmanned Systems, and a Member of the Technical Committee for several scientific societies. He has been an Editorial Board Member, Editor-in-Chief, Editor-at-Large, Editor or Associate Editor of several international journals. He has regularly served as the General Chair, Program Chair, and IPC Member of several international conferences, particularly in the field of unmanned systems. More detailed information can be found at http://users.encs.concordia.ca/~ymzhang/.

Keynote Lecture: Challenges and New Developments on Practical and Reliable Applications of Unmanned Aerial Vehicles

Benefited from technical advances in materials, mechatronics, communication, computation, control, sensors, actuators and new/smart designs, Unmanned Aerial Vehicles (UAVs) are gaining more and more attention and rapid development during the last a few years due to their relatively easy and cost-effective uses in various application tasks such as surveillance, sensing, search and rescue, agriculture, forest, environment, pipelines, powerlines, military and security applications. In this talk, brief overall view on the challenges and latest developments on Guidance, Navigation, and Control (GNC) of UAVs integrating with Remote Sensing (RS) techniques for autonomous, efficient and reliable applications to forest and environment monitoring and fires/damages/risks detection will be presented first, then some of new developments and current research works being carried out at presenter's group will be introduced as the second part of the presentation. In particular, new developments on Fault Detection and Diagnosis (FDD), Fault-Tolerant Control (FTC), and Fault-Tolerant Cooperative Control (FTCC) techniques towards autonomous and reliable applications to the above-mentioned tasks, and the new technical developments for efficient and reliable detection of fires/damages/risks based on remotely sensed signals/images from onboard UAVs will be presented.

Invited Speaker

Prof. Nickolay Zosimovych
Shantou University, China

Biography: Mykola Nickolay Zosimovych has completed his Bachelor's, MS and PhD at the Moscow Aviation Institute (National Research University), Moscow, Russian Federation. He is working as the Professor at the Mechatronic Engineering Department of Shantou University (China). He has published more than 5 books, 120 scientific publications, 14 scientific and technical reports and 3 methodical manuals. His research Fields including designs and manufacture equipment, specialized systems and components that are supplying to the aerospace and mechatronic fields and parametrical optimization, computation and structural designing of drones and aerospace flying vehicles new generation.

Invited Lecture: Stability Area of a Spacecraft's Partially Invariant Centre of Mass Motion Stabilization System

In practice, a spacecraft's stabilization system, which is partially invariant to the disturbing moment, is the easiest to implement. In order to comply with the invariance conditions, there must be a positive control actuator feedback with a gain equal to the object's angular deflection gain of in the angular stabilization channel. Stability of the system shall be ensuring by introduction of an additional second derivative action from the object's deflection angle into the action as well as by introduction of an equivalent delay loop in the feedback of control actuator in order to compensate

for the dynamic delay of the stabilization controller. It is also possible to synthesize a stabilization system, which shall be partially invariant fewer than two disturbances simultaneously. Open feedback control actuator and exclusion of control according to object's deflection angle and of the spacecraft centre of mass drift coordinate from the angular stabilization channel are the invariance conditions in this case. Such a stabilization system has obvious advantages over a system, which is invariant under disturbing moment, and therefore it is more suitable for practical implementation. The study of the stability of the proposed partially invariant stabilization system revealed that it is possible to ensure sufficient stability margins in the system under consideration by choosing parameters for the stabilization controller. At the same time, it allows to provide high quality of the transition process.

PRESENTATION GUIDE

Oral Presentation

1. File format: MS-PowerPoint (*.ppt) or Adobe PDF (*.pdf)

2. Time: About 15mins, including Q/A time.

3. Language: English

4. Fonts: Arial or Times New Roman

5. Dress code: Formal clothes

6. Facility: A laptop will be available in the conference room, presenters are suggested not use their own laptop. If presenters plan to use own laptop, please notify conference secretary via e-mail in advance and test the connection (It's better to bring any necessary adaptors) before session start.

7. Procedure: Copy the presentation file to conference laptop on the registration day. Contact the session chair(s) and introduce yourself to the session chair(s) before session starts. (Your paper ID, Name, Organization and Paper's title)

Poster Presentation

1. Poster Size: 1m*0.8m (height*width).

2. Language: English.

3. Color printing.

4. The poster should include: Paper ID, Conference Name’s Acronym, Significance of the research, the methods used, the main results obtained, and conclusions drawn.

5. Posters are required to be condensed and attractive.

6. The conference organizer won't send/keep any posters after the conference.

PROGRAMME OVERVIEW

Date	Time	Programme	Location
May 24, 2019	14:00-17:00	Registration	Lobby
May 25, 2019	09:00-09:45	Keynote Lecture Ramesh Agarwal	Lilac Conference Room, 3F
	09:45-10:30	Keynote Lecture Youmin Zhang	
	10:30-10:50	Group Photo + Coffee Break	
	10:50-11:20	Invited Lecture Nickolay Zosimovych	
	11:20-12:20	Technical Session1 Aeronautical Technology Session	
	12:20-14:00	Lunch	Leisure all day dining Restaurant, 1F
	14:00-15:30	Technical Session 2 Aerospace Technology Session A	Lilac Conference Room, 3F
	15:30-15:50	Poster Presentation	
	15:50-16:00	Coffee Break	
	16:00-18:00	Technical Session 3 Aerospace Technology Session B	
	18:00-19:30	Banquet	Ming palace Chinese Restaurant, 2F
May 26, 2019	10:00-11:00	Technical Tour	Pending

TECHNICAL SEESION

Keynote Lecture May 25, Saturday, Lilac Conference Room			
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Technical Session 1: Aeronautical Technology Session Session Chair: Prof. Ramesh Agarwal May 25, Saturday, Lilac Conference Room			
10:50-11:20	I1	Stability Area of a Spacecraft's Partially Invariant Centre of Mass Motion Stabilization System ***Nickolay Zosimovych,*** Shantou University, China	5
11:20-11:35	A016	Environmental Worthiness Model of the Civil Aircraft Based on the Grey Theory ***Zhanghui,*** Aircraft strength research institute, China	14
11:35-11:50	A1016	A CAS Message Simulation Module Used in Civil Aircraft for Air Management System Failure Diagnosis ***Xi Haiyan,*** Shanghai Aircraft Design and Research Institute, China	14
11:50-12:05	A307	Mechanism and Characteristics of High-Frequency Pulsed Jet Circulation Control ***Ren Zhan,*** Airforce Engineering University, China	14
12:05-12:20	A1304	Uncertainty Analysis of Squeeze-type Regulation Method for Equal Expulsion of Parallel Tanks ***Wenjuan Yin,*** Beijing institute of Control Engineering, China	15
12:20-14:00	**Lunch**		
Technical Session 2: Aerospace Technology Session A Session Chair: Prof. Youmin Zhang			

May 25, Saturday, Lilac Conference Room			
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14:15-14:30	A1307	Electromagnetic Thermal Coupling Simulation Analysis of Silicon Carbide Shock Absorber ***Yin Xiaofang,*** Beijing Institute of Spacecraft Environment Engineering, China	15
14:30-14:45	A1308	Study on Sequent Test Effects of Atomic Oxygen/thermal Cycling ***Ruiqiong Zhai,*** Beijing Institute of Space Environment Engineering, China	16
14:45-15:00	A006	Mission Capability Assessment of 3D Printing CubeSats ***Zhiyong Chen,*** Shantou University, China	16
15:00-15:15	A1014	Assembly Method for Satellite Propulsion system based on HoloLens ***Wei Zhang,*** Beijing Institute of Spacecraft Environment Engineering, China	16
15:15-15:30	A1018	In-orbit Failure Analysis and Verification for Thermistors outside Satellites ***Bin Zhang,*** Beijing Institute of Spacecraft Environment Engineering, China	17

Poster Presentation 15:30-15:50, May 25, Saturday, Lilac Conference Room	
A004	An Improved Regression Analysing Method for Multi-position Calibration Test of Gyrowheel System ***Kai Cui,*** Harbin Institute of Technology Control and Simulation Center, China
A015	Initialization method of nozzle flow field based on one- dimensional isentropic theory and the study of its application ***Dawei Zhang,*** National University of Defense Technology, China
A017	Cotton-bamboo composite material and structure applications ***Hongyu Zhang,*** National University of Defense Technology, China
A019	Research on Safety Risk Evolution of Military Aviation System Based on ANP-SD ***Qiuhan Liu,*** Air Force Engineering University, China
A020	Application of Fault Diagnosis Expert System for Unmanned Vehicle Safety ***Jie Zhang,*** Air Force Engineering University, China

A021	Structural Design and Difficulties of Solar UAV ***Wangwang Zhang,*** Shenyang Aerospace University, China
A022	Study on Effects of Atmospheric Parameters on Space Vehicle Design ***Guo Peng-fei,*** China Academy of Launch Vehicle Technology, China
A023	Research on Sinking Movement of Liquid Propellant in Space Vehicle ***Guo Peng-fei,*** China Academy of Launch Vehicle Technology, China
A1001	Research on the cabin's local orientation cues of space station oriented to navigation enhancement ***Zhang Yanfei,*** Harbin Institute of Technology Robot Group Co.Ltd, China
A1002	Research on the Variation Analysis Model for CFRP Assembly ***Jianfeng Yu,*** Northwestern Polytechnical University, China
A1003	A method of remote support jamming based on the chaff clouds scattering ***Shidai Qiu,*** Air Force Engineering University, China
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A1008	Identification of Key Conflict Nodes Based on Complex Network Theory ***Li Jiawei,*** Air Force Engineering University, China
A1009	One Real-time Micro-thrust Measurement System Based on Barkhausen Effect ***Xinru Du,*** National University of Defense Technology, China
A1010	Review on the Development of Satellite Formation and Collision Avoidance Technology ***Sun Hongqiang,*** Space Engineering University, China
A1011	Research on Optimization of Working Mode of Long-range Early Warning Radar Guided by Space-based Information ***Zhou Tong,*** Space Engineering University, China
A1012	A Method of Communication Constellation Resilience Evaluation ***Han Jingbin,*** Space Engineering University, China
A1015	Human Interface Research of Civil Aircraft Cockpit Based on Touch Control Technology ***Yang Wen,*** Shanghai Aircraft Design and Research Institute, China
A301	Research on height and diameter of Doppler VHF omnidirectional beacon in complex environment ***Liang Fei,*** The Second Institute of CAAC, China
A303	Solving Velocity Ambiguity for Pulse Doppler Radar Space Target Measurement ***Zhihua Yuan,*** Beijing institute of technology, China

A308	Long Time Integration for High Speed Target Detection Based on RadonKT-LVT ***Jie Chen,*** National University of Defence Technology, China
A309	A Fast and Collision Avoidance Distributed TDMA Schedule Based on the Multi-Arms Bandit ***ChaoYi Zheng,*** National University of Defense Technology, China
A310	Preliminary Discussion on the Spacecraft Electrostatic Discharge and standards ***Ruijin Jia,*** Beijing Institute of Spacecraft Environment Engineering, China
A317	A Modified KNN Indoor WiFi Localization Method With K-median Cluster ***Wei Lan,*** lanzhou university, China
A318	Research of High Resolution ISAR Algorithm Based on Coherent Registration and Fusion for Distributed Radar ***Xi Luo,*** Xidian University, China
A321	Generation Method of Air Defense Missile Weapon Interception Scheme ***Song Jiaming,*** Naval aviation university, China
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Technical Session 3: Aerospace Technology Session B

Session Chair: Prof. Nickolay Zosimovych

May 25, Saturday, Lilac Conference Room

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16:15-16:30	A311	Adaptive Backstepping Sliding Mode Fault Tolerant Control for Satellite Attitude Under Actuator Faults ***Junhai Huo,*** Zhejiang University, China	17
16:30-16:45	A313	Nano-Pico Satellite Actuator Fault Diagnosis Based on adaptive Observer ***Y un Fei,*** Zhejiang University, China	18
16:45-17:00	A315	Local Information based Organization of Distributed Spacecraft Swarm Using Artificial Potential Field ***Wen Feng,*** Technology and Engineering Center for Space Utilization, CAS, China	18
17:00-17:15	A316	Use of Tetrahedral Finite Element Method for Computing the Gravitation of Irregular-shaped Asteroid	18

		Weidong Yin, Technology and Engineering Center for Space Utilization, CAS, China	
17:15-17:30	A319	Deep Neural Networks based Real-time Optimal Control for Lunar Landing ***Lingchao Zhu,*** Technology and Engineering Center for Space Utilization, CAS, China	19
17:30-17:45	A1302	Numerical Simulation of Cooling system for Solar Simulator ***Chao He,*** Beijing Institute of Spacecraft Environment Engineering, China	19
17:45-18:00	A1303	Study on the Determination of Attitudes and Orbits of Micro-satellites Only by 3-axis Magnetometer ***MyongChol Jang,*** Automation Institute, the State Academy of Sciences, the Democratic People's Republic of Korea	20
18:00-19:30	**Banquet**		

ABSTRACT

Technical Session 1: Aeronautical Technology Session

Time	Content
11:20-11:35 May 25	**A016:** Climatic Environmental Worthiness Model of the civil Aircraft Based on the Grey Theory **Presenter:** Zhang Hui, Aircraft strength research institute, China **Abstract:** The civil aircraft must have the ability to the global operation. The aircraft may experience the high temperature, the low temperature, the high humidity, ice and other extreme climatic environment. Environmental worthiness plays an important role in the integrated capability of the civil aircraft. Environmental worthiness evaluation is a major part of the civil aircraft engineering. According to the environmental worthiness to diversified environmental factors, we can establish the criteria for environment classification. The environmental worthiness model of the civil aircraft was set up using the grey theory. The rationality and feasibility of the model was validated by the example. The results indicate that the environmental adaptability of the aircraft was ranked “poor” to “better”. The result can supply the reference data for the environment adaptability requirement for the design of the civil aircraft.
11:35-11:50 May 25	**A1016:** A CAS message simulation module used in civil aircraft for air management system failure diagnosis **Presenter:** Xi Haiyan, Shanghai Aircraft Design and Research Institute, China **Abstract:** Air management system is one of the most important airborne systems on civil aircraft, which is responsible for controlling aircraft bleed air, cabin pressure control, wing anti-icing, cabin ventilation and temperature control. And the air management control system is the brain and neural network of the entire air management system. The air management control system control the various subsystems of the air management system and control the air management system to work together with other interfaced systems. Air management system control logic and interface signals are the key points and most difficulty parts in air management system control. For this highly complex system, failure diagnosis is most important and difficult part in ground test and flight test. Usually faults are reflected on the CAS message and synoptic pages as the alarms. However, the causes of such alarms may be varied. The traditional trouble shooting approach is to check the control specification documents which are complicated and hard to find the root cause. If there is a CAS message simulation module database that can be quickly traced back to the trigger logic of any one of the alarms, and the signal relationship between the alarms is displayed, the control logic of the system is clearly displayed, the failure diagnosis would became simple and intuitive. Based on the above design intention with referring to control specification, this paper created a set of air management system alarm models by using Matlab/Simulink. These alarm models are used for system troubleshooting and design’s optimization. Finally, an application of cabin pressure control alarm with both trouble shooting and optimization is introduced.
11:50-12:05 May 25	**A307:** Mechanism and Characteristics of High-Frequency Pulsed Jet Circulation Control **Presenter:** Ren Zhan, Airforce Engineering University, China **Abstract:** Conventional circulation control technology presents problems in certain

	situations. Pulsed jet circulation control appears to be a feasible alternative to solve such problems, especially for the high-frequency pulsed jet (HFPJ). To acquire the aerodynamic characteristics of the HFPJ and reveal the mechanism behind it, numerical simulation is conducted using a verified computational fluid dynamics （CFD）method. The action mode of the pulsed jet characterized by equilibrium and oscillation is proposed according to the analysis of a dynamic procedure. Lift and drag characteristics are obtained, defining the critical frequency to demarcate high and low frequencies. An oscillation function is also established to illustrate the difference between the characteristics of the HFPJ and a low-frequency pulsed jet (LFPJ) by analyzing the simulation results. The pressure distribution and flow field in the simulation results explain the stall characteristic of the HFPJ. Series results indicate the HFPJ demonstrates superior lift augmentation and drag reduction compared to the LFPJ and steady jets..
12:05-12:20 May 25	**A1304:** Uncertainty analysis of squeeze-type regulation method for equal expulsion of parallel tanks **Presenter:** Wenjuan Yin, Beijing institute of Control Engineering, China **Abstract:** Focused on the problem of unbalanced propellant consumption in parallel tanks of propulsion system, a squeeze-type regulation method based on the gas law method was discussed in the paper. Taking the tank system as the research object, the thermodynamic models under isothermal, adiabatic and other conditions were given and the factors affecting the uncertainty of the model were analysed. The results show that the measurement uncertainty of the model mainly comes from the pressure measurement accuracy and the volume measurement accuracy. The model was applied to different cases and the influence law of different tank parameters on the model uncertainty was studied. It is found that under the premise of the fixed pressure difference of the parallel tanks, the uncertainty of the regulation model is almost linear with the regulation amount. In addition, the relative uncertainty of the model can be reduced effectively by improving the pressure difference of the parallel tanks. The accuracy of the regulation model can reach to 7.7%, which can meet the requirements for on-orbit use.
Technical Session 2: Aerospace Technology Session A	
14:00-14:15 May 25	**A013:** Numerical simulation of the reliability of in-situ eddy current testing considering the influence of penetration depth **Presenter:** Peiqiang Tian, Northwestern Polytechnical University, China **Abstract:** In order to study the reliability of in-situ eddy current testing, the factors affecting the in-situ eddy current detection and the signal response values are firstly determined. Then the numerical simulation model of eddy current detection is established by COMSOL, and the different values of the device and the tested structural are substituted into the simulation model to obtain the signal response value. Finally, the probability of detection (POD) curve is obtained by numerical simulation method based on function model. In this paper, based on the numerical simulation method of probability density function, the numerical simulation of eddy current testing reliability is formed. Through the in-situ eddy current testing reliability numerical simulation case, the detection probability of cracks in the structure is quantitatively affected by the penetration depth.
14:15-14:30 May 25	**A1307:** Electromagnetic Thermal Coupling Simulation Analysis of Silicon Carbide Shock Absorber

	Presenter: Yin Xiaofang, Beijing Institute of Spacecraft Environment Engineering, China **Abstract:** This paper introduces a set of absorbing equipment used in 3.2GHz band vacuum high and low temperature environment. Through the finite element method modeling, COMSOL Multiphysics multi-physics simulation software analyzes the electromagnetic thermal coupling capability. The simulation results show that the absorbing properties of the silicon carbide pyramidal absorbing material are good. If the loss caused by the electrical conductivity of silicon carbide is considered, the absorbing performance of the silicon carbide pyramid will be greatly improved to -40dB. The simulation calculation model combines the electromagnetic field with the thermal, and gives the temperature curve and the isothermal contour dynamic diagram of the pyramid. It provides theoretical guidance for practical engineering applications.
14:30-14:45 May 25	**A1308:** Study on sequent test effects of atomic oxygen/thermal cycling **Presenter:** Ruiqiong Zhai, Beijing Institute of Space Environment Engineering, China **Abstract:** Two kinds of unidirectional laminates made from carbon/epoxy composite named M40/DFA-1 & M40/DFA-N3(nano TiO2 contained) are selected to study the different effects between different test sequences of atomic oxygen/thermal cycling. Based on the ground simulating test of atomic oxygen and thermal cycling, several kinds of tests and analysis are conducted, such as surface morphology observation, mass loss test, inter-laminar shear strength test, and X-ray photoelectron analysis of surface components. After the exposure of atomic oxygen and thermal cycling, surface erosions is observed on both of the materials, in addition, mechanical properties are both changed. It must be highlight that, under the condition of 1.5×1020 atoms/cm2 AO and 200 thermal cycles within the range of -150℃~+150℃, different sequences lead to different results, either the extend or the tendency. In which, samples under AO+TC sequence exhibited relatively higher mass loss and erosion rate as well as more severe mechanical performance degradation.
14:45-15:00 May 25	**A006:** Mission capability assessment of 3D printing CubeSats **Presenter:** Zhiyong Chen, Shantou University, China **Abstract:** With the successful development of integrated technologies, many spacecraft subsystems have been continuously miniaturized, and CubeSats have gradually become the main executors of space science exploration missions. It is a new challenge to combine the CubeSat design with 3D printing. Compared with traditional manufacturing through machining, 3D printing technology has several advantages including short period of manufacturing, high accuracy in manufacturing small parts and low cost. The research task of this paper is a LEO (Low Earth Orbit) CubeSat mission, with a maximum acceleration of 5 g during the launch process, the internal operating temperature range of the CubeSat is from 0 to 40 ℃, external temperature from -80 to 100 ℃. The environmental factors were fully considered in the CubeSat design process, the impact load received during the CubeSat launch process and the working environment after reaching orbit were simulated and analyzed by ANSYS after the design parameters were obtained to verify the feasibility of the design.
15:00-15:15 May 25	**A1014:** Assembly Method for Satellite Propulsion system based on HoloLens **Presenter:** Wei Zhang, Beijing Institute of Spacecraft Environment Engineering, China

	Abstract: As the satellite design changes from the traditional 2D mode to the 3D digital mode, the satellite assembly also enters the 3D assembly mode. An effective and accurate propulsion system assembly information transmission method from designers to operators is not formed, in the process of complex propulsion assembly, operators need to frequently confirm status back and forth between satellite and computer stations, and accidents with incorrect polarity in component installation often occur. In order to improve efficiency and quality of satellite propulsion system installation, a system based on HoloLens is designed. The successful application of this system provides a new solution for satellite propulsion system installation and marks a new step in the digital assembly capacity.
15:15-15:30 May 25	**A1018:** In-orbit Failure Analysis and Verification for Thermistors outside Satellites **Presenter:** Zhang Bin, Beijing Institute of Spacecraft Environment Engineering, China **Abstract:** Satellite thermistor is used to measure the in-orbit temperature to support thermal control so that the on-board equipment can work in the appropriate temperature to get higer reliability and more life-time. In recent years, there have been several in-orbit failure events of thermistors outside the satellite, which have brought troubles to the thermal control of the whole satellite. In this paper, failure modes of in-orbit thermal resistors outside cabin are analyzed by fault tree, and ground simulation experiment is carried out by high-low temperature impact test. Fault cause is given according to test result and analysis.
Technical Session 3: Aerospace Technology Session B	
16:00-16:15 May 25	**A1019:** Research on Three-Dimensional Digital Assembly Technology of Communication Satellite Cable **Presenter:** Zhibin Liu, Beijing Institute of Spacecraft Environment Engineering, China **Abstract:** With the development of information technology and the increasing task of communication satellite products, higher requirements are put forward for the design and manufacture of cables. The traditional cable design is based on the two-dimensional deployment layout. The design efficiency is low and the error of cable length is large. It is difficult to check the interference in the cable channel. In view of the new technology status of a telecommunication satellite, a comprehensive study has been carried out from cable design, production and manufacture to field laying of assembly. The design and production modes have been analysed and expounded, and the field laying of assembly has been summarized, which not only improves the efficiency, but also strengthens the quality and reliability. The three-dimensional digitization of subsequent satellites has been carried out in an all-round way. Design, manufacture and assembly technology provide technical basis and experience for reference.
16:15-16:30 May 25	**A311:** Adaptive backstepping sliding mode fault tolerant control for satellite attitude under actuator faults **Presenter:** Junhai Huo, Zhejiang University, China **Abstract:** Modern spacecraft missions place stringent performance requirements on the reliability and stability of spacecraft attitude control system. However, during long-term in-orbit mission, actuators may suffer faults. In this paper, we proposed an adaptive fault tolerant control law for attitude control under actuator failures and external disturbances. Firstly, the attitude dynamic model under

	actuator faults and attitude kinematics are described. Then, in order to solve the attitude control problem under actuator faults and external disturbances, an adaptive backstepping sliding mode fault tolerant control scheme is designed. According to Lyapunov theory, the closed-loop system is proved to be globally asymptotically stable. Finally, the numerical simulation results demonstrate that the proposed adaptive controller can achieve anticipative attitude control performance, fault information estimation and well fault-tolerant capability.
16:30-16:45 May 25	**A313:** Nano-Pico Satellite Actuator Fault Diagnosis Based on adaptive Observer **Presenter:** Yun Fei, Zhejiang University, China **Abstract:** This paper concerns with actuators fault diagnosis of nano-pico satellite, and a double adaptive estimation algorithm is proposed. Based on the non-linear mathematical model of reaction flywheel, a parameterized description method of flywheel fault type is established. Using the input and output information of the flywheel, a local adaptive observer is constructed and can identify the fault type of the flywheel. A global adaptive observer based on the satellite dynamics model uses the gyroscope sampling signal and the estimation of local observer as inputs, so failure moment of the other actuator can be identified. Combining two observers' identification results, the fault diagnosis of flywheel and the other actuator can be completed. In this paper, a control system composed of reaction flywheel and magnetorquer is simulated. Results show the effectiveness of proposed method for nano-pico satellite actuator fault diagnosis.
16:45-17:00 May 25	**A315:** Local Information based Organization of Distributed Spacecraft Swarm Using Artificial Potential Field **Presenter:** Wen Feng, Technology and Engineering Center for Space Utilization, CAS, China **Abstract:** This paper investigates the problem of distributed organization of spacecraft swarm where each spacecraft is an independent agent that can interact with neighbouring members within a certain distance. According to the global objective of the organization, each agent makes decisions on its behaviour based on its own status and adjacent members within a certain distance. By a carefully designed strategy and under certain conditions, the swarm can accomplish the global objective. In the configuration reconstruction mission, only the expected global configuration is specified. The target position of each spacecraft is uncertain and not fixed. At the beginning of the reconstruction, every spacecraft can only determine the initial target point according to certain rules. It is possible to have conflicts of destination point selections since all spacecraft can only get local information. Each spacecraft constantly adjust their target point according to the local information in the process of accomplishing this task, until the group converges into the specified global configurations. In this paper, three different target allocation strategies are designed, so that each spacecraft can do continuous selection and optimization, and finally determine a non-conflict target matching to complete the formation reconstruction task. The artificial potential field method is utilized to control each spacecraft and complete the path planning, while ensuring that the spacecraft swarm to achieve collision avoidance and other requirements. In addition, the time and fuel consumption are compared. The numerical simulations show that these three strategies make obvious optimization effects.
17:00-17:15 May 25	**A316:** Use of tetrahedral finite element method for computing the gravitation of irregular-shaped asteroid **Presenter:** Weidong Yin, Technology and Engineering Center for Space

	Utilization, CAS, China **Abstract:** Asteroids are one of the most important targets for deep space exploration. In previous asteroid missions, the accurate estimate of gravity has proved to have a strong influence on the design of the approach orbit and navigation strategy. The wield gravitational field of an asteroid is mainly caused by the irregular overall shape and possible heterogenous mass distribution the interior. We propose to use the finite element method to compute the gravity of irregularly shaped asteroids; this method combines the advantages of the conventional mascon method and the polyhedral method. The tetrahedral meshes can be generated following the conventional division technique. Taking asteroid 216 Kleopatra as an example, we calculate the exterior gravitational field using the above mentioned methodology. We then compare the results from the finite element method and the polyhedral method under a degenerated case, i.e., with constant density. Then, four different density distribution assumptions are given, and the gravitational fields are calculated respectively. The comparative study and the density distribution assumptions indicate that the proposed method is suitable for modeling an arbitrary asteroid with nonuniform mass distribution. This method is expected to provide reliable gravity data for the design of guidance, navigation, and control systems in future asteroid missions.
17:15-17:30 May 25	**A319:** Deep Neural Networks based Real-time Optimal Control for Lunar Landing **Presenter:** Lingchao Zhu, Technology and Engineering Center for Space Utilization, CAS, China **Abstract:** Recent research on deep learning control, a new control algorithm based on machine learning able to learn deep architectures, has shown excellent performance on robots and drones. With the development of intelligent control like deep learning and reinforcement learning, accuracy, real-time, adaptability, robustness and autonomy of control algorithm have been achieved by the intelligent controls. Traditional control methods have difficulties to achieve nice performance in complex situations. Deep learning offers powerful algorithms to real-time search near-optimal controllers of lunar landing spacecraft with nonlinear dynamics. In terms of lunar landing control system, deep architectures offer the possibility to get an approximate solution of co-state equation without time-consuming iterative process. Furthermore, real-time optimal thrust during lunar landing may be derived directly through deep neural networks. As a single infrastructure for machine learning in both production and research, TensorFlow is chosen for training the deep artificial neural networks in this paper. Numerical simulations demonstrate the effectiveness of deep neural networks. The results of deep neural networks based optimal control are contrasted with traditional optimal algorithm, whose main idea is to track the pre-designed optimal trajectory by ground station. This research provides an effective approach to cope with the lunar landing problem.
17:30-17:45 May 25	**A1302:** Numerical Simulation of Cooling system for Solar Simulator **Presenter:** Chao He, Beijing Institute of Spacecraft Environment Engineering, China **Abstract:** The cooling system for the solar simulator was introduced, which contained wind-cooling system, water-cooling system, and refrigeration system. Then the numerical simulation of the wind-cooling system was numerical simulated. The solar simulator with 13 xenon lamp was modeled, and the flow and the heat transfer in the solar hood was simulated by the FLUENT. The flow field in

	the solar hood was studied, especially the flow near the xenon lamp and the collector. The result showed that the velocity of the most area in the solar hood was slow, but the area near the xenon lamp, because the flow area suddenly decreases, the velocity of the gas increased significantly, which is conducive to the heat exchange between the xenon lamp and the gas. The temperature of the xenon lamp was lower than 328K, and the velocity on the surface of the xenon lamp was higher than 17m/s, which met the operating requirement of the xenon lamp, and the temperature of the collector was lower than 308K, and meet the operating requirement of the collector.
17:45-18:00 May 25	**A1303:** Study on the determination of attitudes and orbits of micro-satellites only by 3-axis magnetometer **Presenter:** MyongChol Jang, Automation Institute, the State Academy of Sciences, the Democratic People's Republic of Korea **Abstract:** This paper explains a method to determine the attitude and orbit only using onboard magnetometer. This method, only using 3-axis magnetometer, makes it efficient and possible to get the attitude and orbit information, without high-priced and complicated sensors. This method comprises 2 parts- one is the attitude determination and the other is the orbit determination by the magnetometer. In the attitude determination, 2-stage filter (Linear Kalman filter and Unscented Kalman filter) is applied and in the orbit determination, the Extended Kalman filter. The attitude determination accuracy is below 1°, the attitude angular rate determination accuracy below 0.005°/s and the orbital position determination accuracy below 10 kms when the measurement error of magnetometer is about 200nT. Thus, this study contributes to the mission of the micro satellites.

CONFERENCE VENUE

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Transportation Information

1. Pudong International Airport → Parkview Hotel
浦东国际机场 → 上海东怡大酒店

A. Taxi (出租车)
About 40mins, 37 kilometres
约 40 分钟，37 公里

B. Metro (地铁)
【Line 2】 Pudong International Airport Station → Shanghai Science & Technology Museum Station→Walk 760 meters to Parkview Hotel
【2 号线】浦东国际机场站 →上海科技馆站 →步行 760 米到达上海东怡大酒店

2. Shanghai Hongqiao International Airport → Parkview Hotel
上海虹桥国际机场→ 上海东怡大酒店

A. Taxi (出租车)
About 60 mins, 30 kiometres
约 60 分钟，30 公里

B. Metro (地铁)
【Line 2】 Hongqiao Airport Terminal 2 Station → Shanghai Science & Technology Museum Station → Walk 760 meters to Parkview Hotel
【2 号线】上海虹桥国际机场→上海科技馆站→步行 760 米到达上海东怡大酒店

3. Shanghai Hongqiao Railway Station→ Parkview Hotel
上海虹桥火车站 → 上海东怡大酒店

A. Taxi (出租车)
About 60mins, 30 kilometres
约 60 分钟，30 公里

B. Metro (地铁)
【Line 2】 Hongqiao Railway Station → Shanghai Science & Technology Museum Station→ Walk 760 meters to Parkview Hotel
【2 号线】虹桥火车站 →上海科技馆站 →步行 760 米到达上海东怡大酒店

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