ACMAE 2020

2020 THE 11TH ASIA CONFERENCE ON MECHANICAL AND AEROSPACE ENGINEERING

December 25-27 | Virtual Conference

CONTENTS

Welcome Address

We are pleased to welcome you to 2020 The 11th Asia Conference on Mechanical and Aerospace Engineering (ACMAE 2020), which will be held during December 25-27, 2020. Since COVID-19 broke out, considering the safety and health of all participants, the conference committees decided to hold this event online via ZOOM Apps.

After several rounds of review procedure, the program committee accepted those papers to be published in conference proceedings. We wish to express our sincere appreciation to all the individuals who have contributed to ACMAE 2020 in various ways. Special thanks are extended to our colleagues in the program committee for their thorough review of all the submissions, which is vital to the success of the conference, and also to the members in the organizing committee and the volunteers who had dedicated their time and efforts in planning, promoting, organizing and helping the conference.

Let me, on behalf of the conference committees; cordially invite you to this outstanding conference. We look forward to receiving your paper in either research or development of acquired knowledge in order to disseminate to the wider audience. Join us at this event to see other excellent researchers share their work.

Wish you have a good experience in ACMAE 2020 and hope to see you soon!

Conference Committees

Beijing Time (UTC+8)

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Online Conference Guideline

Beijing Time (UTC+8)

Network

- Stable WIFI or Wired network.
- Equipment be with enough battery or connected with chargers.
- If your network is not good, please send us presentation videos within 10 Minutes as a back-up.

Presentation

- Stay online during Keynote & Invited speeches and your own sessions.
- English only during the conference.
- Certificates & receipts will be emailed to you after the conference

Time Zone

- The conference is arranged based on Beijing Time (UTC+8).
- Please carefully check your presentation time, and join the conference 15 minutes in advance.

ZOOM Usage

- Download the APP ZOOM on zoom.us or www.zoom.com.cn (China only). Turn on your Audio and start your Video. Use headsets/Earphones to enhance the audio effect and avoid the speaker echo or howling. Stay in a quite place without noise.
- Authors, please rename like Session Number+Paper ID+Name as you join the room. E.g.: S1+ME1001+Ashily.
- For KN or SC, please rename like KN/SC+ Name
- Join TEST DAY on December 25th

Keynote Speakers

Beijing Time (UTC+8) **Room A: 622 6683 1542**

Topic: Shape Optimization of Axisymmetric Bodies in Hypersonic Reactive Flow Using a Genetic Algorithm for Minimizing Drag and Heat Transfer

A large design concern for high-speed vehicles such as next generation launch vehicles or reusable space vehicles is the drag and heat transfer experienced at hypersonic velocities. In this talk, the optimized shapes for minimum drag and heat transfer for axisymmetric bodies are developed using computational fluid dynamics (CFD) software in conjunction with a multi-objective genetic algorithm. For flow field calculations, the commercial flow solver ANSYS Fluent is employed to solve the unsteady compressible Reynolds Averaged Navier-Stokes (RANS) equations using several turbulence models, namely the Spalart-Allmaras (SA) model, the SST k-ω model and the transitional flow model k-kl-ϵ. The results from these models are compared to determine their accuracy for drag and heat transfer predictions. The hypersonic body shapes are optimized for minimum drag and heat transfer using a multi-objective genetic algorithm. Both cases with air in equilibrium and thermochemical non-equilibrium are considered. For air in thermochemical non-equilibrium, a seven species (N, O, N2, O2, NO, NO+ and e-) chemical reaction model is considered. The shape optimization results for a blunt body with a spherical nose are presented. Nearly 25~30% reduction in drag and 18~20% reduction in heat transfer is obtained for the optimized shape compared to the original shape; slight variations in reduction in drag and heat transfer are due to the fact whether the air is in equilibrium or in non-equilibrium.

Ramesh K. Agarwal
Professor of Washington University in St. Louis, USA
(IEEE, AIAA, AAAS Fellow)

Time: 09:35-10:20 (December 26th)

Keynote Speakers

Beijing Time (UTC+8) **Room A: 622 6683 1542**

Bio-Sketch

Prof. Ramesh K. Agarwal is the William Palm Professor of Engineering in the department of Mechanical Engineering and Materials Science at Washington University in St. Louis. From 1994 to 2001, he was the Sam Bloomfield Distinguished Professor and Executive Director of the National Institute for Aviation Research at Wichita State University in Kansas. From 1978 to 1994, he was the Program Director and McDonnell Douglas Fellow at McDonnell Douglas Research Laboratories in St. Louis. Dr. Agarwal received Ph.D in Aeronautical Sciences from Stanford University in 1975, M.S. in Aeronautical Engineering from the University of Minnesota in 1969 and B.S. in Mechanical Engineering from Indian Institute of Technology, Kharagpur, India in 1968. Over a period of forty years, Professor Agarwal has worked in various areas of Computational Science and Engineering - Computational Fluid Dynamics (CFD), Computational Materials Science and Manufacturing, Computational Electromagnetics (CEM), Neuro-Computing, Control Theory and Systems, and Multidisciplinary Design and Optimization. He is the author and coauthor of over 500 journal and refereed conference publications. He has given many plenary, keynote and invited lectures at various national and international conferences worldwide in over fifty countries. Professor Agarwal continues to serve on many academic, government, and industrial advisory committees. Dr. Agarwal is a Fellow eighteen societies including the Institute of Electrical and Electronics Engineers (IEEE), American Association for Advancement of Science (AAAS), American Institute of Aeronautics and Astronautics (AIAA), American Physical Society (APS), American Society of Mechanical Engineers (ASME), Royal Aeronautical Society, Chinese Society of Aeronautics and Astronautics (CSAA), Society of Manufacturing Engineers (SME) and American Society for Engineering Education (ASEE). He has received many prestigious honors and national/international awards from various professional societies and organizations for his research contributions.

Ramesh K. Agarwal
Professor of Washington University in St. Louis, USA
(IEEE, AIAA, AAAS Fellow)

Time: 09:35-10:20 (December 26th)

Keynote Speakers

Beijing Time (UTC+8) **Room A: 622 6683 1542**

Konstantin Lukin
Professor of National Academy of Sciences of Ukraine, Ukraine
(IEEE Fellow, Head of LNDES at IRE NAS of Ukraine)

Time: 14:00-14:50 (December 26th)

Topic: Conceptual Design of Ukrainian Reusable Single-Stage Rocket with Vertical Takeoff & Landing Capability

Successful launches by the private company Space-X (USA) in 2020 of spacecrafts with the return of the reusable first stage of the Falcon-9 Launch Vehicle (LV) has confirmed the stable trend of private space companies to the reuse of the LV stages saved due to soft landing after its mission is completed. This topic has been studied for quite a long period of time aiming its practical implementation. For example: apart from SpaceX and other US space companies, two private Chinese companies are testing their rockets with a reusable first LV stage that returns to Earth by soft and vertically oriented landing: 'Space Transportation' (NKSPACE) and 'LinkSpace' (based on 'NewLine-1' LV).

In addition to being reusable, the vertical landing method reduces the size of the exclusion ground areas, does not leave carrier rockets in outer space, and the spacecraft launched into orbit can be returned by the carrier after its mission is completed. This is especially important for providing cost-effective spacecraft launches accounting the following:

-reduction of the LV cost due to its reuse;

-prevention of fines for non-working units left in their orbits (this tendency is currently being worked out with the aim of reducing the debris in outer space);

- abandoning of the old XXth century spaceports, since for the launch and landing of such a rocket vehicle only a small size concrete pad is needed, which makes the rocket launch possible even in a relatively populated country, such as Ukraine.

In the paper we briefly describe conceptual design of Ukrainian reusable single-stage rocket demonstrator. The main objective consists in design, development and trials of a series of 'Grasshopper' demonstrators equipped with both the jet propulsion engine set and microwave/optical vision and measurement systems for the performing and control of its soft landing at the starting point. The greatest advantages of our design consist in availability of the results of previous developments of rocket engines [1, 2], and guiding systems for space ships, as well as advanced technique for microwave real-time 3D imaging using random/noise signals and MIMO radar operation mode with FPGA-based signal processing. The maximal height of the flights/jumps will depend on the jet propulsion available and will growth with advancing of the demonstrator.

Keynote Speakers

Beijing Time (UTC+8) **Room A: 622 6683 1542**

Konstantin Lukin
Professor of National Academy of Sciences of Ukraine, Ukraine
(IEEE Fellow, Head of LNDES at IRE NAS of Ukraine)

Time: 14:00-14:50 (December 26th)

Bio-Sketch

Prof. Konstantin Lukin received his diploma in Radiophysics & Electronics from Kharkov State University, Ukraine, in 1973. He is Head of the Laboratory for Nonlinear Dynamics of Electronic Systems, LNDES, at IRE NASU. He completed his Candidate of Sciences thesis in IRE NASU and defended it at Moscow State University (MSU) in 1980. He completed his Doctor of Sciences dissertation in Physical Electronics in IRE NASU and defended it at Kharkov State University in 1989. Since 2009 he is IEEE Fellow, Aerospace and Electronic System society. He has been a visiting scientist at the International Center for Theoretical Physics (ICTP, Trieste, Italy) in 1995-1997 and a visiting professor at the Joint Research Center of EC (JRC, Ispra, Italy) in 1997-1998. His current research interests are as follows: generation and processing of random/chaotic/noise signals and their applications in Noise Radar for 2D&3D SAR imaging, differential interferometry; microwave monitoring of urban areas and detection of pre-catastrophic states of large natural and manmade objects, such as landslides, bridges, TV towers, dams, large building, hangars, etc. He is Co-Chairman of RTO/NATO Task Group on 'Space and Frequency Diverse Noise Radar'. Dr. Lukin is author or coauthor of more than 260 journal publications and 2 monograph on Interstellar propagation of EM signals and signal processing. He is working on similarity of Noise Radar and Quantum Radar concepts and performance. He was/is a TPC member of the EUSAR, IRS, SPSympo, IRMMW-THz, MSMW, IEEE IVEC and Chairman of NRT-2002, 2003, 2012 International Conferences. He was leader of many international R&D projects on Noise Radar Systems and Sensors; on 2D&3D SAR imaging and microwave monitoring of environment. Currently he is leader of two Projects under SPS/NATO Program and Co-Chairman of SET-287 Task Group on Noise Radar Technology.

Keynote Speakers

Beijing Time (UTC+8) **Room A: 622 6683 1542**

Topic: The Role of Cognition in Radar Sensing

The role of cognition in modern radar sensing is explored covering fundamental issues and challenges about the transmitter, receiver and signal processing units. Firstly, the definition of a cognitive radar is introduced and key basic aspects are pinpointed with special emphasis on the differences with respect to a classic radar. Secondly, the role played by the perception-action cycle and the awareness gleaned by dynamic databases and/or sensing networks is emphasized. Hence, applications of the cognitive paradigm to some important situations, such as radar operation in spectrally crowded environments, are discussed. In this last context, examples involving the use of real hardware are shown. Finally, a glimpse on enabling technologies and future research avenues is given.

Bio-Sketch

Antonio De Maio received the Dr.Eng. (Hons.) and Ph.D. degrees in information engineering from the University of Naples Federico II, Naples, Italy, in 1998 and 2002, respectively. From October to December 2004, he was a Visiting Researcher with the U.S. Air Force Research Laboratory, Rome, NY, USA. From November to December 2007, he was a Visiting Researcher with the Chinese University of Hong Kong, Hong Kong. He is currently a Professor with the University of Naples Federico II. His research interest lies in the field of statistical signal processing, with emphasis on radar signal processing, waveform diversity, cognitive radar, optimization theory applied to radar signal processing, and electronic defense. He is the recipient of the 2010 IEEE Fred Nathanson Memorial Award as the young (less than 40 years of age) AESS Radar Engineer 2010 whose performance is particularly noteworthy as evidenced by contributions to the radar art over a period of several years, with the following citation for “robust CFAR detection, knowledge-based radar signal processing, and waveform design and diversity”. He is the corecipient of the 2013 best paper award (entitled to B. Carlton) of the IEEE TRANSACTIONS ON AEROSPACE AND ELECTRONIC SYSTEMS with the contribution “Knowledge-Aided (Potentially Cognitive) Transmit Signal and Receive Filter Design in Signal-Dependent Clutter”. Dr. De Maio is a Fellow of IEEE, a Distinguished Lecturer for the IEEE AES (biennium 2020-2021), and a co-author (with A. Farina and S. Haykin) of the book “The Impact of Cognition on Radar Technology”, Scitech Publishing, Radar, Sonar & Navigation, 2017.

Antonio De Maio
Professor of University "Federico II" of Napoli, Italy(IEEE Fellow)

Time: 14:50-15:35 (December 26th)

Test Day Schedule (Dec. 25th)

Beijing Time (UTC+8)

Friday, December 25th, 2020 (Test day)		
Test Time	ROOM A ID: 622 6683 1542	ROOM B ID: 652 3359 9694
10:30-11:30	Session 1&2 ME32, ME25, ME3004, ME3007, ME56, ME49, ME4003, ME1001, ME04, ME05, ME1003, ME3006. ME1002. ME44	Session 3&4 ME15, ME34, ME60, ME58, ME43, ME03, ME49, ME14, ME28, ME31, ME06, ME07, ME12
11:30-14:00	Break	
	ROOM A ID: 622 6683 1542	ROOM B ID: 652 3359 9694
14:00-15:00	Speakers and chairs Test Prof. Konstantin Lukin, National Academy of Sciences of Ukraine, Ukraine Prof. Antonio De Maio, University "Federico II" of Napoli, Italy Prof. Ian McAndrew, Capitol Technology University, USA Prof. Qing Guo, UESTC, China	Session 5&6 ME61, ME02, ME18. ME41, ME55, ME57, ME4002-A, ME33, ME23, ME3003, ME35, ME36, ME37, ME3001
15:00-15:30	Break	
	ROOM B ID: 652 3359 9694	
15:30-16:30	Session 7&8 ME24, ME27-A, ME46, ME3005, ME42, ME2001, ME54 ME09, ME13, ME38, ME2002, ME3002, ME53, ME4001-A. ME20	

Conference Agenda(Dec. 26th)

Beijing Time (UTC+8)

Saturday, December 26th, 2020		
Beijing Time	ROOM A ID: 622 6683 1542 Chair: Prof. Ian McAndrew, Capitol Technology University, USA	
09:30-09:35	Opening Remarks	Prof. Ian McAndrew, Capitol Technology University, USA
09:35-10:20	Keynote Speaker I	Prof. Ramesh K. Agarwal, Washington University in St. Louis, USA
10:20-10:35	Break	
	ROOM A ID: 622 6683 1542	ROOM B ID: 652 3359 9694
10:35-12:20	Session 1 Material Design and Performance Analysis	Session 2 Control Theory and Control Engineering
12:15-14:00	Break	
	ROOM A ID: 622 6683 1542 Chair: Prof. Qing Guo, University of Electronic Science and Technology of China, China	
14:00-14:50	Keynote Speaker II	Prof. Konstantin Lukin, National Academy of Sciences of Ukraine, Ukraine
14:50-15:35	Keynote Speaker III	Prof. Antonio De Maio, University "Federico II" of Napoli, Italy
15:35-16:00	Break	
	ROOM A ID: 622 6683 1542	ROOM B ID: 652 3359 9694
16:00-17:45	Session 3 Mechanical Design Manufacturing and Automation	Session 4 Power Machinery Engineering

Conference Agenda(Dec. 27th)

Beijing Time (UTC+8)

Sunday, December 27th, 2020		
	ROOM A ID: 622 6683 1542	ROOM B ID: 652 3359 9694
10:00-11:45	Session 5 Unmanned Driving System and Key Technology	Session 6 Fluid Mechanics and CalculationAircraft
11:45-14:00	Lunch & Break	
14:00-15:45	Session 7 Satellite System and Aerospace Engineering	Session 8 Aircraft Design and Modeling

Session 1 (Dec. 26th 10:35-12:20)

Beijing Time (UTC+8)
Room A: 622 6683 1542

Time	Topic: Material Design and Performance Analysis Session Chair: Assoc. Prof. Liu Lei	
10:35-10:50	ME32	**Thermal performance affected by the mesoscopic characteristics of the ceramic matrix composite for hypersonic vehicle** **Assoc. Prof. Liu Lei,** Yang Xiaofeng, Xiao Guangming, Wei Dong, Du Yanxia China Aerodynamics Research and Development Center, China
10:50-11:05	ME25	**Technology and test of fiber Bragg grating in composite materials** **Ms. Meiling Shi,** Chen Yang, yunlong Hu,hong YAO, Chaojun XIN Space Engineering University, China
11:05-11:20	ME3004	**Research on longitudinal dynamic character of flexible waverider based on CFD/CSD/RBD coupling method** **Mr.Y M Shang,** R H Hua, X X Yuan, Z G Tang, Z W Wang China Aerodynamics Research and Development Center, China
11:20-11:35	ME3007	**Research on Creep Constitutive and Numerical Simulation of Composite Solid Propellant** **Mr. S.X. Feng,** H.F. Qiang, Y.X. Liu, X.R. Wang, T.J. Geng, Z.W. Yang Rocket Force University of Engineering, China
11:35-11:50	ME56	**Bending analysis of simply-supported sandwich beam using Chebyshev quadrature element method** **Mr. Meng Ge,** Yang Zhao, Yixin Huang, Wenlai Ma Harbin Institute of Technology, China
11:50-12:05	ME29	**Study on the optical emission spectrum diagnosing of the low-temperature plasma using a collision** **Mr. Kuan Qiao,** Qing-Lin Sun, Xiong Yang, Mou-Sen Cheng, Da-Wei Guo, Chu Yang National University of Defense Technology, China
12:05-12:20	ME4003	**Analysis on the dislocation of GaN on different substrate** **Yilun Chen** Northwestern Polytechnical University, China

Session 2 (Dec. 26th 10:35-12:20)

Beijing Time (UTC+8)
Room B: 652 3359 9694

Time	Topic: Control Theory and Control Engineering Session Chair: Dr. Shengzhou Bai	
10:35-10:50	ME1001	**Linearization Method for Constant Thrust Control** **Dr. Shengzhou Bai,** Chao Han, Xiucong Sun Beihang University, China
10:50-11:05	ME04	**Design of general aviation airspace planning and management system based on Google Earth** **Mr. Jing Mou** Chengdu Industry and Trade College, China
11:05-11:20	ME05	**Design of automatic system of lead sheet roll for fishing gear industry** **Mr. Yangji Zeng,** Yong Cai, Zihong Liu, Sen Mao, Jun Xiao Southwest University of Science and Technology, China
11:20-11:35	ME1003	**A Newly Constant-Thrust Control Method Based on Parameter Estimation** **Mr.Yujin Zhang,** Chao Han Beihang University, China
11:35-11:50	ME3006	**Research on parameter adjustment method of servo controller based on genetic algorithm** **Mr. Huan Tian,** Wenyong Dong, Yafen Xu, Yuan Gao , Cheng Fang Shanghai Aerospace Control Technology Institute, China
11:50-12:05	ME1002	**Linear Transfer Guidance based on Lyapunov Method** **Dr. Shengzhou Bai,** Chao Han and Xiucong Sun Beihang University, China
12:05-12:20	ME44	**Research and establish ment of steam dryness detection method** Yusheng Wu, **Mr. Chunyuan Zhang**, Jichun Qian, Junhui Wu Tongji University, China

Session 3 (Dec. 26th 16:00-17:45)

Beijing Time (UTC+8)
Room A: 622 6683 1542

Time	Topic: Mechanical Design Manufacturing and Automation Session Chair: Prof. Ian McAndrew	
16:00-16:15	ME15	**Design and simulation of a micro thrust solenoid valve nozzle based on CFD&DOE optimization analysis** **Mr. Zhiqin Zhuo,** Zongfeng Li Chinese Academy of Sciences , China
16:15-16:30	ME34	**The effect of wall temperature on three-dimensional rotating detonation wave** **Asst.Prof. Pengxin Liu,** Chen Li, Dong Sun, Qilong Guo, Wei Zhao State Key Laboratory of Aerodynamics, China
16:30-16:45	ME60	**An Estimation Method for Parachute Parameters** **Mr.Zhibin Li,** Wenquan Cai, Yunchen Wu Harbin Institute of Technology, China
16:45-17:00	ME58	**Study on a Quality Assessment Method for Rocket Body Structure Based on Product Quality DNA** **Mr. Yao Jiayu,** Liu Haijiang Tongji University, China
17:00-17:15	ME43	**Pilot's Mental Workload nonlinear correlation among objective and subjective measurements** **Mr.Antonio Esposito,** Andrea Alaimo, Calogero Orlando Università degli Studi di Enna Kore, Italy
17:15-17:30	ME03	**Summary of the Test Methods for Icing Strength of Freshwater and Seawater** Yongjie Zhang, **Mr. Yunhui Zhang**, Renzhong Guo Northwestern Polytechnical University, China
17:30-17:45	ME49	**Improved weighted NND scheme for shock-capturing** **Dr. Chen Li,** Jianqiang Chen ,Xianxu Yuan, Pengxin Liu ,Dong Sun, Qilong Guo State Key Laboratory of Aerodynamics, China

Session 4 (Dec. 26th 16:00-17:45)

Beijing Time (UTC+8)
Room B: 652 3359 9694

Time	Topic: Power Machinery Engineering Session Chair: Assoc. Prof. Vsevolod Koryanov	
16:00-16:15	ME14	**Dynamic Models of Satellite Relative Motion and their effects on the Kalman Filter** **Mr. Ali Imran,** Xue Chuan Wang, Kui Xiao Yue Northwestern Polytechnical University , China
16:15-16:30	ME28	**Heat transfer enhancement mechanism of jet impingement on aeroengine curved surface using large eddy simulation** **Ms. Qin Li,** Wei Dong, Xuecheng Cai, Xiaofeng Yang, Haoran Zheng Shanghai Jiao Tong University, China
16:30-16:45	ME06	**Study on a Quality Assessment Method for Rocket Body Structure Based on Product Quality DNA** **Ms. Rui Cao,** Huacong Li Northwestern Polytechnical University, China
16:45-17:00	ME31	**Design of Torque Motor Characteristic Test System** **Ms. Huajin Zhang,** Fan Lin ,Xin Zhang, Xianghua Wen Beijing Institute of Technology, China
17:00-17:15	ME07	**Analysis of Pressure Pulsation in Aviation Gear Pump** **Mr. Ning Gao,** Huacong Li Northwestern Polytechnical University, China
17:15-17:30	ME12	**Prediction of engine total pressure distortion in improved cascaded forward network** **Mr. Shi Fenglei**, Wang Kuan Aircraft Flight Test Technology Institute of China, China
17:30-17:45	ME20	**Dynamics of the movement of the descent vehicle in the atmosphere of Mars with the use of inflatable brakes in the lower atmosphere** Danhe Chen, **Mr. Léo Richier**, Vsevolod V. Koryanov ISAE-ENSMA

Session 5 (Dec. 27th 10:00-11:45)

Beijing Time (UTC+8)
Room A: 622 6683 1542

Time	Topic: Unmanned Driving System and Key Technology Session Chair: Assoc. Prof. Rongyu Ge	
10:00-10:15	ME61	**Design of picking seedling device for plug seedling transplanter** **Assoc. Prof. Rongyu Ge,** Beibei Kong, Jialiang Wu University of Jinan, China
10:15-10:30	ME02	**A Review of High Precision Finite Element Modelling Methods for Light and Small UAS** Zhang Yongjie, **Mr. Huang Yingjie**, Cao Kang, Wang Yafeng, Guo Yazhou, Wang Jizhen, Liu Xiaochuan Northwestern Polytechnical University, China
10:30-10:45	ME18	**Multi-target UAV path planning based on improved RRT algorithm** **Ms. Xueping Ren,** Li Tan,Jiaqi Shi, Xiaofeng Lian Beijing Technology and Business University, China
10:45-11:00	ME41	**A Review of Impact Tests of Light and Small UAV** Zhang Yongjie, **Mr. Li Zhiwen**, Huang Yingjie, Cao Kang, Wang Yafeng, Guo Yazhou, Wang Jizhen, Liu Xiaochuan Northwestern Polytechnical University, China
11:00-11:15	ME55	**Research on parameter adjustment method of servo controller based on genetic algorithm** **Mr. Tianqi Zhang**, Weimin Lv, Gen Li, Chenxuan Li, Zhenyu Liu, Yongqiang Li Naval Aviation University, China
11:15-11:30	ME57	**Compound Control method for Anti-Unmanned Aerial Vehicle (UAV) Vertical Launch Missile** **Mr. Chang Jiapan,** Liu Yongshan Beijing Institute of Technology, China
11:30-11:45	ME4002-A	**Investigation of the flow characteristics of tube jet** Xinyu Xiong, Zixin Xu Hubei University of Technology, China

Session 6 (Dec. 27th 10:00-11:45)

Beijing Time (UTC+8)
Room B: 652 3359 9694

Time	Topic: Fluid Mechanics and Calculation Session Chair: Prof. Xing-hao Xiang	
10:00-10:15	ME33	**Wall temperature correlation for convective heating prediction of aircraft heat shield in high-enthalpy and chemically reacting flow** **Prof. Xiaofeng Yang**, Guangming Xiao, Lei Liu, Yanxia Du, Yewei Gui China Aerodynamics Research and Development Center, China
10:15-10:30	ME23	**Multi-dimensional dissipation strategy within advection upstream splitting methods in hypersonic flows** **Assoc. Prof. Shu-sheng Chen,** Hua Yang, Fang-jie Cai, Zheng-hong Gao Northwestern Polytechnical University, China
10:30-10:45	ME3003	**Investigation on noise generation of open cavity flow using Lagrangian coherent structures** **Mr. Shuaibin Han,** Yong Luo, Hu Li, Conghai Wu, Shuhai Zhang State Key Laboratory of Aerodynamics, China
10:45-11:00	ME35	**Transition prediction with hypersonic cross-flow model on HIFiRE-5** **Prof. Xing-hao Xiang**, Hai-jie Ren, Yi-feng Zhang, Xian-xu Yuan, Jian-qiang Chen, Shu-sheng Chen China Aerodynamics Research and Development Center, China
11:00-11:15	ME36	**Bayesian uncertainty analysis of SA turbulence model for backward-facing step simulations** **Ms.Jinping Li,** Ming Ma, Chao Yan Beihang University, China
11:15-11:30	ME37	**Application of Colour Fluorescent Oil Flow Visualization for a High Speed Cavity** Binhua He, **Dr. Guoshuai Li**, Fangqi Zhou, dawei Liu, xiang Xie China Aerodynamics Research and Development Center, China
11:30-11:45	ME3001	**An intelligent polynomial chaos expansion method based upon features selection** **Dr. Wei Zhang**, Qiang Wang, Chao Yan Beihang University, China

Session 7 (Dec. 27th 14:00-15:45)

Beijing Time (UTC+8)
Room A: 622 6683 1542

Time	Topic: Satellite System and Aerospace Engineering Session Chair: Prof. Ian McAndrew	
14:00-14:15	ME24	**Vibration responses of a satellite subjected to acoustic excitation at launch stage** **Dr. Jie Zhang,** Weihua Xie, Jiacong Yin, Huiliang liu, Jiang Zhou China Academy of Spacecraft Technology, China
14:15-14:30	ME27-A	**Method and application of GNSS receiver in high orbit satellite** **Mr. Xiaojing Yang** Space star technology co., LTD, China
14:30-14:45	ME46	**Investigation on the depth effects of the micro-grooves on the suppression of the second modes in the hypersonic boundary layer** **Dr. Qilong Guo,** Chen Li, Guohua Tu, Jianqiang Chen, Bingbing Wan, Yong Liu State Key Laboratory of Aerodynamics, China
14:45-15:00	ME3005	**Research on moon surface positioning and navigation method based on stellar vector measurement** **Mr. Gao Yuan,** Zheng Xunjiang, Mao Xiaonan, Tian Huan, Sun Shuodong Shanghai Aerospace Control Institute of Technology, China
15:00-15:15	ME42	**Hypersonic Boundary Layer Receptivity on Flat Plate with Blunt Leading Edge Due to Acoustic Disturbance** **Mr.Yifeng Zhang,** Jianqiang Chen, Xianxu Yuan, Xi Chen, Xinghao Xiang China Aerodynamics Research and Development Center, China
15:15-15:30	ME2001	**Study on the Reliability Evaluation Method for Sun-synchronous orbit Satellite Power Subsystem** **Dr. Zhang Haiwei**, Li Yong, Ren Denggao, Du Dongmei, Liu Chenhu Xi'an Satellite Control Center, China
15:30-15:45	ME54	**Development of unsteady background-oriented schlieren system in an indraft supersonic wind tunnel** **Dr. Guoshuai Li**, Jifei Wu, Konstantinos Kontis, Stryczniewicz Wit, Zhaolin Fan China Aerodynamics Research and Development Center, China

Session 8 (Dec. 27th 14:00-15:45)

Beijing Time (UTC+8)
Room B: 652 3359 9694

Time	Topic: Aircraft Design and Modeling Session Chair: Assoc. Prof. Guangjun Yang	
14:00-14:15	ME09	**Fluid-Structure Interaction Framework based on structured U-RANS solver** **Dr. Davide Cinquegrana,** Pier Luigi Vitagliano Italian Aerospace Research Center , Italy
14:15-14:30	ME13	**Design and Test Verification of Hybrid Airfoil Based on Multi-objective Genetic Algorithm** Zhao Li, **Assoc. Prof. Guangjun Yang**, Xiaoyan Tong, Feng Jiang Northwestern Polytechnical University, China
14:30-14:45	ME38	**Fracture failure analysis on swivel nut of 30CrMnSiA steel in aircraft** **Mr.Cheng Chen,** Zhen Chen, Shangqiang Li, Jinpeng Zhu, Tianxiang Li, Haiqing Bian AVIC Chengdu Aircraft Industrial (Group) Co., Ltd, China
14:45-15:00	ME2002	**An Optimization Design Method for Aerodynamic Configuration of High Aspect Ratio Wing** Ning Zong, **Dr. Jing Sun**, Meijuan Dong Northwestern Polytechnical University, China
15:00-15:15	ME3002	**Modeling and Analysis of Customer Preference in Civil Aircraft Manufacturing Supervision** **Mr.Yu Feng**, Hua Lei Shanghai Aircraft Design & Research Institute , China
15:15-15:30	ME53	**Overview of Surfing Aircraft Vortices for Energy** **Ms. Yixin Zhao,** Hanyu Wu, Qiang Zhang, Qing Cheng Civil Aviation Flight University of China, China
15:30-15:45	ME4001-A	**The influence of thicknesses on lift coefficient and pressure distribution of the airfoil** Ruiyang Zhang, Yijun Zhao, Yuhao Chang, Pantao Hu Shangdong University, China

Session Details

Session 1

ME32	The rigorous thermal environment brought by long-time high-speed flight is imposed severe requirements on the structural bearing capacity and structural thermal safety of the aircraft. The integrated non-ablative thermal protection system based on continuous fiber-reinforced ceramic matrix composites is becoming a hot spot on the design of aircraft structures. However, the multi-scale, non-linear, non-uniform features of such materials, as well as complex thermal and mechanical characteristics, pose serious challenges to structural design and evaluation. Under the aero heating environment, the non-uniform temperature rising and thermal matching between different components in the continuous fiber-reinforced ceramic matrix composites are extremely complicated, which has a significant influence on the thermal safety performance of the structure. In this paper, based on the commonly used 3D orthogonal weaving process and the thermal characteristics prediction method of fiber bundles considering the effect of PyC interface layer, the fluid-structural strong thermal coupling characteristics of different woven parameters in typical aircraft structure is carried out. Quantitatively characterizing the heat transfer characteristics of this new material under the actual flight condition of the aircraft can further to improve the accuracy of the thermal property parameters obtained based on the ground test. The analysis results show that increasing the proportion of fiber bundles in a certain direction is the most effective method to increase the thermal conductivity in this direction. At the same time, the arrangement of the coupling yarns will also have a greatly influence on the thermal conductivity of the material. These results is of great significance for the design of the materials.
ME25	In this process, the processing flow of fiber Bragg grating (FBG) embedded carbon fiber reinforced composites are prepared by means of pressurized film forming and end-surface elicitation. Firstly, the development of composites in aerospace field is introduced. Then, according to the principle of FBG sensor, a scheme for embedding fiber grating into carbon fiber composites is designed. There are three key steps involved in this process, namely, laying the bare fiber parallel to the carbon fiber cleavage direction, applying the end-surface elicitation method with the use of stainless steel thin tubes and Teflon fine tubes for protection,

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	and pasting the rubber strip tile on the end to prevent the curing of the fiber break. After processing, a 260x60x3mm surface intact product is made according to the design scheme. There is no deformation in Carbon fiber surface and the end-surface is intact. Experimental tests show that this product has good temperature and strain response.
ME3004	The shape of hypersonic aircrafts represented by the waveriders is becoming more slender and flatter, thereby greatly reducing the structural rigidity of the aircrafts. This innovation is applied to satisfy the demand of long-range flight. In this paper, the effect of elastic deformation on the trimming and dynamic stability of the waverider was analysed through Computational Fluid Dynamics(CFD)/Computational Structural Dynamics(CSD) /Rigid Body Dynamics(RBD) coupling. The results show that as the decline of structural stiffness, the angle of attack increases and the lift-drag ratio deteriorates when the waverider is trimmed. The elastic deformation makes the dynamic center get forward, and the static stability of waverider becomes poorer. What's more, the dynamic stability of pitching motion is reduced due to the coupling of rigid-body motion and elastic vibration.
ME3007	Through the composite creep solid propellant creep experiment, the composite solid propellant curve is obtained. The power rate constitutive model, linear viscoelastic model and Schapery nonlinear constitutive model are used to describe the creep process. The study shows that Schapery modified nonlinear constitutive model can better describe the creep properties of composite solid propellants. Through the ABAQUS user subroutine, the finite element application of Schapery's creep-type nonlinear constitutive model is studied. The research results in this paper can provide a reference for the analysis of the creep effect of the grain during the vertical storage of the solid rocket motor.1.
ME56	Based on the higher-order sandwich beam theory, the Chebyshev quadrature sandwich beam element is established for the bending analysis of the simply-supported sandwich beam. Gauss Lobatto sampling is adopted as element nodes. The discrete governing equation of the sandwich beam is obtained by the principle of minimum potential energy. A series of numerical examples are carried out on simply-supported sandwich beams under sinusoidal loading. The results are compared with the finite

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	element method, showing that the proposed method can yield very accurate displacements and stresses. This method is suitable for the static analysis of simply-supported sandwich beams with different materials and different geometric parameters.
ME29	Considering the difficulty of large computation and the characteristic of helicon plasma, a modified collisional-radiative model was proposed for the diagnosis of low-temperature helicon argon plasma. A simplified 47-level is proposed due to the lack of experimental support of transition data at high levels as well as heavy computation to obtain macroscopic parameters of helicon argon plasma, e.g., electron number density ne and electron temperature Te. A creative twice-matching method is proposed in the model because the current double-line intensity ratio method shows significant sensitivity in diagnosing low-temperature electrons. Calculations based on this model shows the spectrum intensity depends on the electron temperature as well as density for low-temperature plasma, especially when it's below 6eV. The twice matching process based on the priori knowledge chooses 15 spectrums cognizable within the wavelength from 680nm to 860nm, adopting the absolute values of the lines to match with the results calculated by the collisional-radiative model. This method greatly reduces the average error to 13.7%. The result indicates that the precision of the electron temperature and density has been improved a lot and the relative errors are 25% and 40%, respectively. Within the accuracy range above, the research shows when RF power is 500-800W and the pressure is 0.5-1.3Pa, the electron number density rises with the increasing RF power and decreases with the increasing magnetic field strength (450-900G) and gas pressure. Moreover, comparing to the number density of electrons, the electron temperature changes less and rises with the decreasing pressure.
ME4003	Though there are still disputes on whether the threading dislocation density (TDD), to produce high quality Gallium Nitride （GaN） with low TDD is needed. In this passage, we would first show the impact of dislocation and review the latest methods to reduce dislocation on Si, GaN, and sapphire. The Si substrating with serpentine channels could produce GaN by using Si substrate with low density dislocations. The method that use the markless-3D provides a new way to reduce the dislocation from big off-angle. The

	multiple-step growth technique controls the conditions of crystallization and use two steps of crystallizing to grow with both low dislocation density and 2D growth shape. The last method is to use the Na-flux method to exclude cracks with sapphire in crystal. Keywords: GaN, dislocation, substrate mask, markless-3D, Na-flux

Session 2

ME1001	Low-thrust control technologies display advantages in space missions. In this study, a linearization method for constant-thrust control is proposed. Based on elliptic integrals, the constant-thrust linear equations are introduced. Furthermore, an analytical two-section linear equations are derived. In addition, for considering J2 perturbation, semi-analytical linear equations are also presented. Numerical simulations are conducted to demonstrate the validation of the proposed method, which proves to be a practical choice for engineering.1.
ME04	By studying the classification and use characteristics of navigable airspace, studying the methods and standards of all kinds of navigable airspace planning, determining all kinds of key parameters of navigable airspace, constructing the navigable airspace planning and management system based on Ge, providing corresponding technical reference and effective management means for the planning of navigable airspace, and solving the problems of airspace planning, efficient use of airspace and low altitude supervision Question.
ME05	In this paper, we report an automatic system which combines machine design and machine vision to promote the automatic lead sheet roll production. In terms of the key problem identifying and locating millimetre-level slit in motion, the rotating module and the slit recognition module are designed based on the geometric characteristics of the lead sheet roll hub, and machine vision technology is used to extract the features of slit images. The automatic system enhances the production efficiency of lead sheet roll by nearly 8 times and lowers the production cost.
ME1003	Finite-thrust control technology is widely applied to space missions such as orbital transfer and rendezvous. However, traditional low-thrust method requires time-varying acceleration for achieving transfer and rendezvous. In this study, a newly piecewise constant thrust method is proposed for orbital transfer problems considering J2 perturbation. To rapidly obtain the solution, UKF parameter estimation method is adopted, which transform the original problem into a parameter estimation problem. Numerical simulations are conducted to demonstrate the validation of the proposed method. It proves to be a practical choice for

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	engineering applications.1.
ME3006	In view of the problem that the controller parameters of the servo system of launch vehicle cannot be adjusted after installation, the parameter adjustment method of the servo system controller parameters is designed by the optimization method based on the genetic algorithm. Set the scale, the notch frequency and the damping coefficient as the variable to be adjusted. The adjusted ITAE guideline module is the error criterion, and the notch filter parameters are adjusted. The experimental verification results of servo system simulation test bench show that the method of this paper can effectively optimize the parameters of servo system controller and improve the quality of servo system. 1.
ME1002	Low-thrust propulsion technology is widely used in space missions. However, traditional methods are not appropriate for the general case. In this study, a linearization Lyapunov method for constant thrust control is proposed. Based on relative orbit elements (ROEs), analytical constant-thrust linear equations are introduced. Moreover, via Lyapunov method, the linear constant-thrust control strategy is obtained. Numerical simulations are conducted to demonstrate the validation of the proposed method. Given different thrust magnitudes, the accuracy meets the requirement in these cases. Thus, it proves to be a practical choice for engineering applications.1.
ME44	In this paper, by designing the overall idea of the pipeline steam dryness control measurement system, designing and implementing the pipeline steam dryness control measurement system, constructing the pipeline steam dryness control measurement test platform, integrating the pipe steam dryness control measurement system and the effect verification, studying and establishing the steam dryness detection method to improve the application effect of steam in the tobacco processing process. 1.

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ME15	Supersonic micro nozzles are widely used in aerospace propulsion, supersonic gas assisted processing and other fields. In this paper, combining numerical analysis and computational fluid dynamics (CFD) simulation methods, using a fast parameter optimization method, the design of experiment response surface method (DOE_RSM) to optimize the design of a micro solenoid valve Laval nozzle about single element cold air propulsion. Simulate the flow characteristics of the nozzle under different configurations and working conditions. Using the three-dimensional model to draw the structure grid and analyse the influence of the micro solenoid valve nozzle configuration on the thrust, effective specific impulse, outlet flow rate, mass flow rate, and outlet cross-sectional pressure difference under different environmental conditions. Determine the significant influencing factors and carry out parameter optimization. Different from the traditional rocket or air assisted processing nozzles, the satellite micro-thrust nozzles need to consider frequent switching actions. In this paper, we finally obtained the optimized configuration and size of the solenoid valve nozzle. Based on the calculation results, a cold-air propeller which include replaceable nozzles and can be used under normal pressure was designed, to provide a reference for cold air propulsion in the space station cabin and ground supersonic gas assisted processing.
ME34	The effect of wall temperature on the three-dimensional rotating detonation wave in an annular chamber is investigated by utilizing premixed hydrogen/air as the reactant and the improved delayed detached-eddy simulation method to evaluate the turbulent transportation. Four cases are set with different wall temperature, i.e. adiabatic wall, isothermal wall with 400K, 800K and 1200K. When using isothermal wall, there is no reactant deficit zone which appearing in the case with adiabatic wall. As the wall temperature increasing, the leading oblique shock will form at both side of the detonation front. When comparing the specific impulse with the adiabatic case, all the three isothermal cases have a better performance. And the lowest wall temperature case shows the highest specific impulse.
ME60	As a significant tool of transportation widely used in the logistics field, a well-performed parachute is highly required for this

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	demand, especially for the sake of higher cost performance. The current study aims to investigate the internal relationship amidst various parameters of the parachute, conducting error analysis and accordingly providing an optimal experimental scheme. The objective of this experiment is to determine reference area and the resistance coincident, which are primarily parameters to estimate the weight of the designed parachute. Because the reference area is hard to determine using regular geometry method, a new parameter area ratio is redefined as the ratio of the original area of parachute surface to the reference area so that the reference area can be calculated by solving geometry problem. A simplified assumption that the parachute can be seen as a quasi-rigid body was previously made in order to approach the ideal parachute. Despite several limitations of the experiment, the final results perfectly aligned with the pre-experiment expectation. By following the similar procedures and after several trials, the ratio of the original area of parachute surface to the reference area was determined to be 3.90 and the resistance coincident to fall in the range of 2.00-3.00.
ME58	As a significant tool of transportation widely used in the logistics field, a well-performed parachute is highly required for this demand, especially for the sake of higher cost performance. The current study aims to investigate the internal relationship amidst various parameters of the parachute, conducting error analysis and accordingly providing an optimal experimental scheme. The objective of this experiment is to determine reference area and the resistance coincident, which are primarily parameters to estimate the weight of the designed parachute. Because the reference area is hard to determine using regular geometry method, a new parameter area ratio is redefined as the ratio of the original area of parachute surface to the reference area so that the reference area can be calculated by solving geometry problem. A simplified assumption that the parachute can be seen as a quasi-rigid body was previously made in order to approach the ideal parachute. Despite several limitations of the experiment, the final results perfectly aligned with the pre-experiment expectation. By following the similar procedures and after several trials, the ratio of the original area of parachute surface to the reference area was determined to be 3.90 and the resistance coincident to fall

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ME43	In the aviation framework, the workload evaluation is influenced by human factors effects both for pilots and ground operators. Nevertheless, the measurement of workload is of great importance to prevent human errors due to fatigue. In the present work, correlation analysis has been carried out to investigates the relationship between subjective and objective workload measurements. An experimental campaign was conducted using a full flight business aircraft simulator. Particular attention has been paid to the NASA-TLX subscales contribute. In terms of objective measurements, three different indexes gathered from heart rate variability have been considered. As the main result, the frequency-domain index reveals a large correlation effect with the workload subscale for the maneuvers taken into account.
ME03	Polar navigation ships, offshore platforms, and amphibious aircraft sometimes need to work in low temperature environments, which will inevitably form varying degrees of icing on the surface of structures such as cabin doors. In order to ensure their normal working conditions, it is advisable to choose reasonable anti-icing and deicing methods to prevent icing or effectively remove icing. Therefore, it is necessary to study the mechanical properties of ice to provide a reference for the selection of anti-deicing methods. This article summarizes the common methods for measuring the shear strength and tensile strength of ice, which can provide some guidance for the freezing strength test of fresh water and sea water.
ME49	Aimed at decreasing the numerical dissipation of weighted non-oscillatory and non-free-parameter dissipation (WNND) scheme, we present an improved counterpart for shock-capturing. The new algorithm is based on the framework of Z-type weighting procedure with new local and global smoothness indicators. The performances of the proposed scheme are evaluated on several numerical tests governed by one-dimensional Euler equations. Numerical results indicate that the improved WNND scheme has advantages over the original WNND and third-order WENO-JS and WENO-Z schemes.

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ME14	In this paper we will study the effects of an increasingly complex Kalman filter state transition matrix on the accuracy of the estimation of a non-linear relative navigation system. The propagation model will be constant in all the cases. The measurements are generated using Xu-Wang model and then noise is added. Whereas the process non-linear vector function/propagation matrix of the Kalman filter will be modified. In the first scenario the Clohessy-Wiltshire equations are considered as the basic propagation model of the Kalman Filter. In the second scenario the eccentricity of the chief satellite's orbit is included in the model of the Kalman Filter. In the 3rd case we are using the model presented by Xu-Wang which incorporates the oblateness of Earth into the Tschauner-Hempel model. The divergence of the Kalman Filter is studied and provides a guideline to design engineers.
ME28	Jet impingement is widely used in anti-icing and de-icing of aeroengines. To improve the efficiency of anti-icing and de-icing, heat transfer in jet impingement flow should be further enhanced. By using large eddy simulation (LES) method, jet impingement flow was analysed in time-domain and spatial-domain. It was revealed that the jet flow has quasi-periodic characteristics in time, and heat transfer is dominated by vortex structure. In addition, the impinged surface curvature has a certain influence on the spatial distribution of Nusselt number. Better heat transfer effect can be achieved by inducing more vortices and applying proper surface curvature.
ME31	The steering gear is an important part of the guided missile control system and the actuator of the flight control system. The torque motor is one of the key components of the steering gear. Its performance directly affects the performance of the steering gear and directly determines the dynamic quality of the guided missile during flight. According to the composition and working principle of the torque motor, to judge its performance, the no-load angular displacement characteristics and pressure characteristics of the torque motor should be tested. In order to accurately and quickly measure the performance of the torque motor under working conditions, the design of the torque motor test system is realized based on the virtual instrument development software. The test system mainly includes two parts: a hardware platform and a human-computer interaction

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	interface. The hardware platform mainly includes an industrial computer, a torque motor test bench, a control box and a data acquisition card.The human-computer interaction interface has the functions of test parameter setting, data acquisition, data processing, data storage and form printing. The torque motor test system has the advantages of small prototype size, convenient operation and accurate test results. The test results show that the test method of the test system is reasonable, the test system runs reliably, the test efficiency is high, it can carry out stable and real-time data collection and processing, is easy to operate and maintain, and meets the key requirements of torque motor testing.
ME06	In order to analyse the influence of gear parameters on the internal pressure pulsation of the aviation gear pump, the flow field analysis software PumpLinx is used to calculate the internal flow field of the aviation gear pump. By setting monitoring points inside the gear pump under different gear parameters, the pressure pulsation results at different positions under different gear parameters are obtained and analysed. The results show that the larger the modulus, the greater the pressure pulsation in the oil inlet area, oil trapped area and the oil outlet area; the greater the number of teeth, the greater the pressure pulsation in the oil trapped area, and the smaller the impact on the oil inlet area and oil outlet area; the larger the index circle pressure angle, the smaller the pressure pulsation in the trapped oil area, and the smaller the impact on the oil inlet area and the oil outlet area. The analysis results provide a reference for further optimizing the internal pulsation and oil trapping problems of aviation gear pumps.
ME07	In order to study the thermal lubrication characteristics of aero-gear pump journal bearing (APJB) under certain load and low medium viscosity, a APJB numerical model was established based on the combination of Reynolds and adiabatic flow energy equations. The hydrodynamic lubrication and temperature effects on the viscosity are considered and the finite difference method is adopted. The results show that with the increase of APJB width parameters, the eccentricity decreases monotonically, the minimum oil film thickness increases, the friction resistance increases and the end discharge decreases. In addition, the eccentricity

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	of bearing, maximum oil film pressure, end discharge flow and oil film thickness increase with the APJB radial clearance, while the friction and temperature inside the APJB decrease. When the APJB width changes from 21 to 27mm, the maximum oil film temperature and pressure increases by 2.16% and −35.23%, respectively; when the radial clearance changes from 0.0315 to 0.0413mm, the maximum oil film temperature and thickness decrease by 3.03% and 8.99%, respectively.
ME12	In order to solve the problem of the result delay in the real-time calculation of engine inlet total pressure distortion index in flight test, the multi-step prediction of engine inlet total pressure distortion index in flight test is carried out. The average prediction error of traditional cascade forward neural network prediction model is higher than traditional autoregressive integrated moving average model. An improved algorithm is proposed. By establishing a time series dynamic level model, the time series of engine inlet total pressure distortion index is divided into low dynamic series and high dynamic series by using particle swarm optimization algorithm. The cascade forward neural network prediction model is used for training and prediction respectively. The results show that the average prediction error and maximum prediction error of the improved algorithm are reduced by 3.90%, 10.66% and 3.29% and 1.38% respectively compared with autoregressive integrated moving average model and traditional cascaded feedforward neural network.
ME20	Currently, more and more spacecrafts are being designed, to explore the planets of the solar system. One of the very important stages in the execution of such missions is the movement from the moment of deorbiting until the moment of approaching the surface. The entire descent trajectory from the moment of separation to contact with the surface is a very important stage and a very important object of research particularly in the field of Computational Fluid Dynamics (CFD). It is to this process that a series of articles by the authors is devoted. This article is devoted to the movement of the descent vehicle in the lower atmosphere. Some parameters of the descent vehicle movement at this stage of movement are analyzed. The importance of such research and the possibility of using inflatable braking devices are shown.

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ME61	Plug seedlings are the main way of modern seedling cultivation in China. Aiming at the problems of low efficiency, high labor intensity and poor work quality for manual transplanting or semi-automatic transplanting of plug seedlings, a stable and efficient seedling picking device is designed for the automatic transplanting machine. It is based on the gear-cam-link composite mechanism to realize the seedling trajectory in accordance with the agronomic requirements. The mathematical model of the seedling picking device is established, and the theoretical profile equation of the cam groove and the actual picking trajectory equation are deduced. The 3D model and the virtual prototype model of the picking seedling device are constructed, and the simulation trajectory is obtained, using SolidWorks and ADAMS software. The simulation results show that the simulation working trajectory has good consistency with the theoretical trajectory.
ME02	In the dynamic mechanics analysis of light and small unmanned aerial systems (UAS), The importance of the high-precision modelling of UAS is unquestionable. Modelling can be classified into 3D geometric model modelling and finite element model modelling, of which the finite element model modelling is mainly divided into four parts: discretization, connection modelling, contact modelling and material attribute definition. This review summarizes the existing modelling methods of light and small UAS, and provides the basic methods and modelling methods for the simulation calculation of light and small UAS. Implications for practice and future research are provided.
ME18	When the Rapidly-exploring Random Tree (RRT) algorithm in the global path planning algorithm is used for autonomous online path planning of UAVs, there is a problem that the optimal path cannot be obtained. An improved RRT algorithm is proposed ,including The dynamic constraints, heuristic search strategy, dynamic step fusion strategy, and the improvement of the selection method of changing new nodes under specific conditions. The simulation results show that the improved RRT algorithm can meet the premise of UAV dynamic constraints. Next, the optimal path planning for multiple goals is realized, especially in reducing the nodes in the random tree.1.

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ME41	Unmanned Aerial Vehicles are widely used in aerial photography, exploration, logistics and other fields for their low cost, low take-off and landing requirements and many other advantages. With the deep application of UAVs, their safety problems have become increasingly prominent. The frequent occurrences of collision events have attracted the public attention. This paper reviews the UAVs weight threshold estimation test, UAVs impact aircraft windshield test and aircraft horizontal stabilizer test, and compares the results with bird collision results, discusses the impact safety challenges of light and small UAVs. This paper puts forward what should focus on about UAVs designing.
ME55	Plasma stealth is a new concept and principle of stealth technology. Firstly, WKB analysis method is used to analyse the attenuation of electromagnetic wave under the action of plasma. Then, a certain UAV inlet was selected to establish a model, and the inner wall was covered with a ring of closed cavity. Plasma was generated by discharge, and the stealth performance of the inlet was numerically simulated for the L-band electromagnetic wave and its stealth effect was analyzed. This method verifies the feasibility of applying plasma stealth technology to the l-band radar wave for inlet stealth.
ME57	A compound control method with aerodynamic canard and reaction jet is proposed for anti-Unmanned Aerial Vehicle (UAV) vertical launch missile. The purpose of this method is to solve the problem of vertical launch with high angle of attack and low dynamic pressure. This paper first introduces the actuator layout and ignition strategy of reaction jet. Then the model of compound control system is established and compared with aerodynamic control in detail. Simulation studies demonstrate the effectiveness of the proposed method.
ME4002-A	Aiming at optimizing the selection of valve specifications according to different conditions, this study mainly introduces and investigates flow characteristics of tube jet. In this study, the motion of the fluid after reaching the highest point is regarded as the free falling motion. Therefore, selecting the coordinates of the highest point as the observation object can indirectly obtain the maximum jet height and distance of the fluid . The research methods of this study include experimental measurements, theoretical

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	analysis and numerical simulations . In the process of theoretical analysis , continuity equation , Bernoulli's equation , momentum equation and Navier-Stokes equation are mainly used for quantitative calculations. In the process of numerical simulations ,this study are based on ANSYS numerical simulation, establish the energy equation, continuity equation and momentum equation with Euler equation as the system. And in FLUENT, the VOF two phases flow model and the k-epsilon standard turbulence model are used. The experimental results show that the higher the blockage rate or the higher the fluid velocity at the inlet, the greater the maximum distance and height the fluid can reach .And their relationship is fitted into an equation by least square method . The errors analysis among the experimental , theoretical analysis and simulation results are also included in this study. According to the data obtained, it is found that their laws are in good agreement but there is a big gap in the numerical value . In addition, during the CFD simulation, the offset angle and dispersion of fluid are observed and recorded . It is found that the relationship between offset angle and blockage rate is linear and the offset angle is irrelevant with inlet fluid velocity. And, with the increase of the inlet fluid velocity, ejected fluid changes from continuous flow to dispersed droplets. The simulation results show that when the blockage rate is 50%, the critical point for the change from continuous flow to dispersed droplets is when the velocity is about 0.9 m/s

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ME33	Hypersonic aircrafts and aero-engine combustion chambers both generate non-equilibrium and high-enthalpy flows and bring complex material-relied heat convection performance. The convective heating prediction is difficult due to unknown surface thermal state, leading to poor usability of wall temperature correlation method (WTCM). This paper aims at improving WTCM for convective heating prediction in chemically reacting flows through coupling computation of catalysis on thermal protection materials. Modified WTCM for chemically reacting flows accounts for two distinct physical events driven by temperature gradient and species reaction, which follow the Fourier's and Fick's laws, respectively. Preliminary validation testing demonstrates the feasibility of the modified WTCM to rapidly evaluate aerodynamic heating with limited deviation. The current research provides essential technical support for the evaluation and design of hypersonic aircrafts and aero-engine combustion chambers.
ME23	The work develops the multi-dimensional dissipation strategy within advection upstream splitting methods (AUSM) in hypersonic flows based on the affordable shock-stable item by Chen et al. (J. Comput. Phys. 373 (2018) 662-672). This strategy is related to the sear velocity difference and the pressure-based sensing function. It strengthens the robustness of AUSM-family schemes against shock anomalies and meantime preserves shear layer. A series of numerical cases illuminate its potential capability for hypersonic flows, particularly in the extreme situations such as the large aspect ratio of cells, skewed non-orthogonal grid, and unstructured grid.
ME3003	The noise generation mechanism of an open cavity flow is investigated using Lagrangian coherent structures (LCS) together with dynamic mode decomposition and Helmholtz decomposition methods. The flow field of an open cavity with the length-depth ratio L/D = 2, Mach number Ma = 0.8 and Reynolds number Re = 2500 is first obtained through direct numerical simulation with 5-th order weighted essentially non-oscillatory (WENO) scheme. LCSs are then obtained from flow field reconstructed by the mean velocity field and the decomposed modes. The interactions between LCSs inside the shear layer and the squeezing zone are found to be important sound sources. The method efficiently isolates the structures responsible for the noise generation.

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ME35	The work develops a localized hypersonic cross-flow transition criterion considering the influence of cross-flow intensity and surface roughness. A cross-flow extension of hypersonic modified γ-Reθ transition model based on Chant2.0 computing platform is implemented. The extended transition model is used to predict the cross-flow transition on the elliptic cone (HIFiRE-5) in multiple states, and the predicted results are in good accordance with the experimental results.
ME36	The Reynolds averaged Navier-Stokes models are still the workhorse in current engineering applications due to its high efficiency and robustness. However, the closure coefficients (also known as model parameters) of turbulence models are calibrated by model builders according to some fundamental flows, and the values suggested by the model builders may not be applicable to all flow types. In this work, the Bayesian method is applied to recalibrate the closure coefficients of SA turbulence model to improve its performance in backward-facing step problem. The results show that the four parameters Cb1, Cw3, Cv1 and κ are well informed by the experimental data of skin friction coefficient. The recalibrated model parameters show better performance than the nominal values in the prediction of skin fiction coefficient.
ME37	For studying the complex flow structure of a high speed cavity, including shear layer, separation, reattachment and vortex, the single-color fluorescent oil flow visualization system in the 0.6m×0.6m trisonic wind tunnel of China Aerodynamic Research Development Centre was enhanced. Different portions of the cavity such as its bottom wall, left and right side walls, front and rear walls and area outside the cavity utilized different oil films with different fluorescent particles to visualize the flow mixing more effectively in the cavity. Specialized ultraviolet light sources are used to enhance the oil flow image contrast. Additionally, to ensure the oil film follows the surface streamlines and indicates the skin friction lines more accurately, the thickness and viscosity of the oil film are well controlled. A high-speed cavity wind tunnel test was conducted to validate the improved oil flow
ME3001	Polynomial chaos expansion (PCE) method is a common tool for uncertainty quanti-fication (UQ) in fluid mechanics. However, there exists ‘Dimensional Curse’ when the para-meters dimension is very high, and large samples are required to solve the PCE

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	function. This would hinder the application of PCE in high dimensions. An intelligent PCE method based on the idea of features selection in machine learning is proposed in this paper. Therefore, only several important features will be selected to construct the PCE function, then fewer samples will be needed to solve the model, and it will be more efficient. Several benchmark functions and an RAE2822 airfoil flow case are utilized to verify the UQ capability of the intelligent PCE. It is proved to be more efficient than the original PCE, with nearly same accuracy.

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ME24	Acoustic-vibration prediction at early stage of satellite development can contribute to their structural and layout design. In this paper, numerical models of a practical satellite subjected to acoustic excitation at launch stage were established. Then, the effect of acoustic condition was further analyzed. The results demonstrate that it is difficult to predict all-frequency-band acoustic response of complex satellites by an individual method, so a combined method was proposed in this paper. The damping loss factor model of panels with equipment was introduced to resolve the issue of on-board equipment modelling in the statistical energy analysis model. The service modules are extremely sensitive to acoustic excitation of about 354~2828Hz, which should be highlighted when carrying a rocket with a high sound pressure level at this frequency band.
ME27-A	The utilization of GNSS is becoming an attractive approach for orbit determination of high orbit satellite. As a flight test for the feasibility of GNSS-based orbit determination at high orbit altitude, a GEO satellite named TJS-2 has been launched, which is equipped with a high sensitivity receiver. We investigate the methods of high sensitivity processing for GNSS side lobes signals and onboard orbit determination filter to improve navigation performance. According to flight data, the GNSS signal characteristics and flight performance have been analyzed. In the future, GNSS receiver may become an effective navigation equipment for high orbit satellite.
ME46	The transition of the hypersonic boundary layer and the corresponding control have been extensively interested since the strong engineer background. In the present work, a hypersonic boundary layer over a flat plate of Mach 6 is computed using the high-order finite-difference scheme. The influences of the two-dimensional micro-grooves on the evolution of the second-mode instability wave are investigated. The comparison is carried out between different depths of the micro-groove. The results indicate that the actual control effect does not significantly vary with the depths under the condition with large grooves. The DNS prediction show different results with the theoretical model for the acoustic reflection coefficient. It is suggested that new model should be derived to guide the design and optimize of the parameters of the micro-groove.

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ME3005	In response to the needs of positioning and navigation in lunar exploration projects such as manned landing on the moon, and the initial positioning of the lunar lander, this paper proposes a lunar positioning and navigation method based on stellar vector measurement and inclination information fusion, and demonstrates the correctness of the algorithm. A semi-physical simulation platform was built and the experimental method verified that the accuracy reached the positioning accuracy index of 30 arc seconds. Lunar surface positioning is different from ground positioning and cannot be positioned by satellites. This method solves the problems of low timeliness and low accuracy of ground measurement and control methods, greatly improving the timeliness and accuracy of lunar surface positioning, and has positive significance for lunar exploration projects.
ME42	In the process of hypersonic boundary layer transition, the leading edge receptivity due to free-stream acoustic disturbance provides unstable perturbations in boundary layer with initial amplitudes, which is one of hot issues in the study about transition mechanism. The receptivity of leading edge is influenced by many factors, involving geometry parameters, disturbance types, etc., among which the bluntness plays a key role for generating disturbances. In order to reveal the mechanism of bluntness influence on the boundary layer transition, investigations into the acoustic receptivity on flat plates with sharp and blunt leading edge are carried out. The flow conditions are as follows: Mach number 6, Reynolds number 1e7/m, adiabatic wall. By introducing two-dimensional plane fast and slow acoustic waves into the free-stream, the whole receptivity process of free-stream disturbances passing through shock wave into boundary layer is simulated with high-order accuracy DNS method. With sharp leading edge as a reference, the generation mechanism of the perturbations near blunt leading edge and its influence on the boundary layer downstream are analyzed. Some conclusions are obtained: for acoustic disturbances in hypersonic free-streams, the receptivity mechanism of blunt leading edge is different from that of sharp leading edge; both the fast and the slow mode can be produced respectively near the sharp leading edge by the fast and the slow acoustic wave, while only fast mode appears near the blunt leading edge; the receptivity of blunt leading edge due to the fast acoustic is stronger than that due to slow acoustic, and is also stronger than that of the sharp leading edge in a certain region of boundary layer downstream.

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ME2001	As an important component to provide satellite energy, the power subsystem in-service operation state is of great significance to satellite safety. In this paper, the power subsystem reliability evaluation is carried out on the basis of the actual telemetry data from satellites. Firstly, the influence factors of the power subsystem telemetry data are analyzed, and the modified method to calculate the output parameters is established; Furthermore, the degradation trajectory of the power subsystem output power is analyzed under different in-service time, and then the difference between the global and the local degradation is discussed. Finally, using the performance degradation model, the reliability evaluation method for the power subsystem is set up. The result shows that the local degradation trajectory in the end of lifetime is critical for the remaining useful life prediction, and the method can provide references for the in-service reliability analysis of the on-orbit satellites.
ME54	To visualize the flow in the test section of an indraft supersonic wind tunnel in the University of Glasgow as long as possible, a background-oriented schlieren system was built up preliminarily. A MATLAB program based on a random dot algorithm developed in this study provides a fully customizable tool to generate background patterns with different sizes and dot densities. Background patterns produced by the in-house developed program then can be printed by a common ink-jet printer. To enhance the signal-noise ratio of the measurement system, white reflective film sheets, or semi-transparent paper can be employed. The correlation algorithm base on fast Fourier transform that is also applicable for PIV was chosen to process background oriented schlieren images. A validation test was performed to visualize the flow structure around a Pitot tube at M = 2.0. The experimental result proves that the BOS system established in this study is capable of visualizing the supersonic flow structure around the Pitot tube and sensitive enough to reveal weak density changes produced by the boundary layer, expansion waves, and weak oblique shock waves. Next, the current BOS system will be improved further by increasing the intensity of light sources to shorten the exposure time, using new cameras with better spatial resolution, and optimizing the background pattern.

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ME09	A Fluid Structure Interaction framework developed at CIRA to deal with multi-physics problems in a partitioned approach is presented. The CIRA multi-block structured flow solver for unsteady Navier-Stokes equations UZEN was updated and tightly coupled with an open-source solver for non-linear structural dynamics in a modular approach. The solvers are glued in space and time through an open source library, able to control the executing processes and to deliver exchanging data by specific adapters. The validity of the framework is tested on vortex-induced vibration effects of a cantilevered beam in low Reynolds flow and on as three-dimensional wing flutter in transonic turbulent flow.
ME13	Certification of modern aircraft requires the manufacturers to demonstrate flight safety within the flight envelope, including icing conditions. Icing wind tunnel test is an important way for flight safety and certification. However, the size of aircraft models that can be tested in icing wind tunnels is limited by the dimensions of the facilities. It is an effective method to replace the large model with a hybrid airfoil to carry out the experiment. If properly designed, these hybrid airfoil models can generate the full-scale ice accretion on the leading edge and reduce blockage. Based on the similarity of flow field in the leading edge, a multi-objective genetic optimization algorithm is proposed to design the hybrid airfoil under different conditions. The pressure tests are carried out and compared with the leading edge pressure coefficient of the corresponding full-scale airfoils. The design and experimental results show that the pressure coefficient deviation between the hybrid airfoils designed and the corresponding full-scale airfoil in the 15% chord length range of the leading edge is within 3%. Finally, icing wind tunnel test is used to inspect the ice shape of full-scale and hybrid airfoils, and the results shows that ice accretion process have good agreement of hybrid and full-scale airfoils.
ME38	In this work, the cracks of HB4-49-14CdD swivel nut in aircraft were found and analyzed by macroscopic observation, morphology testing and metallographic examination. In order to figure out the cause of cracks, manufacturing and assembling process were investigated， and finite element method was used to simulate the tightening process. The results showed that overload tightening

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	torque lead to the fracture and failure of swivel nut.
ME2002	The aerodynamic shape optimization design of the aircraft is to combine the aerodynamic performance analysis of the aircraft with the optimization method, by constantly changing the design shape of the aircraft, its aerodynamic performance is improved to achieve optimal aerodynamic performance under certain constraints. Aircraft aerodynamic shape optimization is a comprehensive design platform that integrates geometric parameterization, moving grid, CFD calculation and optimization algorithms. With the development of computational fluid dynamics (CFD) and the maturity of calculation methods, the role of aerodynamic shape optimization in modern aircraft design becomes more and more important. To this end, an aerodynamic shape optimization design platform based on non-uniform rational B-spline (NURBS) was established. In the optimization process, a mesh deformation method based on radial basis functions is used, and an arbitrary Lagrangian Eulerian method (ALE) is used to describe the unsteady process of the wing. The optimization analysis of the large aspect ratio wing under subsonic conditions has certain reference value for the deformation problem in the aerodynamic shape optimization design. 1.
ME3002	Customer manufacturing supervision of civil aircraft refers to the operator of the aircraft or its authorized entity's supervision and inspection process during aircraft's manufacturing and final assembly, through which the operator (airline company) ensures that the delivered aircrafts meet the requirements of approved technical standards, process specifications, and engineering documents, as well as confirming that optional components and aircraft's layout comply with technical standards required by the purchase contract. Manufacturing supervision brings forward aircraft delivery inspection, qualitative improvement of which enables the improvement of efficiency in single aircraft airworthiness inspection, ensuring aircraft's continued airworthiness. From the manufacture's perspective, analyzing customer's needs and preference on manufacture supervision in advance, taking advantage of the relatively long production cycle, disposing proper engineering solutions for manufacture deviations, reducing the business negotiation items due to deviations not only helps reach the goal of customer supervision, but also helps optimize engineering

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	dispositions.
ME53	Surfing Aircraft Vortices for Energy（SAVE）refers to the behavior that an aircraft "rides" on the vortex of the front aircraft just like the formation flying of migratory birds and it can also provide guidance for the aircraft that is difficult to avoid entering the front vortex, reduce the incidence of flight accidents caused by the vortex, and improve the safe operation ability of civil aviation. The technology has the advantages of saving energy and increasing range, which is a hot issue in the field of aviation research. Firstly, this paper analyzes the main research contents, technological developments and applications in the field of SAVE at home and abroad. Then discusses the key technologies of SAVE such as aerodynamic principles, control of SAVE, safety guarantee, path planning, and related experimental verification technologies. Finally, the development and application trend of SAVE technology in military and civil aviation fields and its corresponding benefits brought by it will be pointed out. 1.
ME4001-A	The wing is the main component that produces lift for aircraft, and the thickness of airfoil is the factor that significantly affects the performance of wings. In this work, several types of airfoil were created by decreasing and increasing the standard Boeing 737 airfoil thickness (10 mm) by 30%, then CFD method the was utilized to do airflow simulation to find out the lift coefficient and pressure distribution of these airfoils under the cruising speed of Boeing 737 (237m/s) and attack of angles between 5 to 15 degrees. Moreover, FEA method was utilized to obtain the maximum deflection visualize the pressure influence of the wing, the maximum deflection of each airfoil was compared with the design standard to ensure that the allowable defection is not exceeded. By analyzing the simulation results, at a 10-degree angle of attack, the 100% thickness airfoil has a relatively smooth pressure while the other two can be observed turbulence on the upper part of the wing. The turbulence causes the lift coefficient of the wing to decrease and the deformation to increase which will significantly affect the dynamic performance of airfoil. Therefore, the 100% thickness airfoil is determined as the best performance airfoil.

THANKS FOR ATTENDING

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