Time Zone: UTC+8

International Conference on Mechanical, Aerospace and Electronic Systems

2025 3rd International Conference on Mechanical, Aerospace and Electronic Systems (MAES 2025)

Suzhou, China | November 28-30, 2025

Co-Sponsored by

SUSAA 苏州市航空航天学会 SUZHOU SOCIETY OF AERONAUTICS AND ASTRONAUTICS

Hosted by

SAITFS 大型客机集成技术与模拟飞行全国重点实验室 State Key Laboratory of Airliner Integration Technology and Flight Simulation

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空中交通管理系统全国重点实验室 State Key Laboratory of Air Traffic Management System

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WELCOME MESSAGE

Dear all, we are delighted to welcome you to the 3rd International Conference on Mechanical, Aerospace and Electronic Systems (MAES 2025) to be held in Suzhou, China during November 28-30, 2025, which is co-sponsored by Suzhou Society of Aeronautics and Astronautics, co-hosted by State Key Laboratory of Airliner Integration Technology, Flight Simulation and School of Civil Aviation (Northwestern Polytechnical University), and State Key Laboratory of Air Traffic Management System.

The objective of the conference is to provide a premium platform to bring together researchers, scientists, engineers, academics and graduate students to share up-to-date research results. We are confident that during this time you will get the theoretical grounding, practical knowledge, and personal contacts that will help you build a long term, profitable and sustainable communication among researchers and practitioners in the related scientific areas.

This year's program is composed of the keynote speeches delivered respectively by Prof. Mingwei Zhang (State Key Laboratory of Air Traffic Management System, China), Prof. Zhiyong Chen (The University of Newcastle, Australia), Prof. Liang Yu (Northwestern Polytechnical University, China) with the online technical session. We would like to express our gratitude to all the speakers in the conference. Special thanks to all of our committee members, all the reviewers, the attendees for your active participation. We hope the conferences will be proved to be intellectually stimulating to us all. Finally, we wish you very successful conference!

Conference Organizing Committee

Contact Us

Ms. Teri Zhang

Email: maes2022@163.com

CONFERENCE COMMITTEE

(in no particular order)

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GENERAL INFORMATION

A Materials Provided by the Presenter

Oral Session: Slides (pptx or pdf version). Format 16:9 is preferred.

Presentation Language: English only.

B Duration of Each Presentation

Keynote Speech: 45min, including 5min Q&A.

Oral Session: 15min, including 3 min Q&A.

C Zoom Meeting

zoom	Room	Meeting ID	Link
✓ Zoom Download ✓ Zoom Background ✓ Conference Banner	A	857 4137 0195	https://us02web.zoom.us/j/85741370195

Note:

1. We recommend to install the Zoom platform beforehand. New users can login the Zoom meeting **without registration**.
2. Please set your display name before joining the online meeting. For instance,

   Committee/Speaker: Committee/Speaker_Name < Committee/Speaker_Veronica Reed >

   Author/Presenter: Paper ID_Name < ES001_Veronica Reed >

   Delegate: Delegate_Name < Delegate_Veronica Reed >

AGENDA OVERVIEW

FRIDAY, NOVEMBER 28, 2025 (UTC+8)	
14:00~15:00 Zoom Test Session (Room A: 857 4137 0195, Link: https://us02web.zoom.us/j/85741370195)	
14:00~15:00	ES5002 ES5007 ES5012 ES5003 ES5005 ES5006 ES5009 ES5001 ES5010 ES5011
15:00~15:30	For other online participants, includes but not limited to keynote speaker, session chair, committee member, delegate, etc.

Presenters are required to join the rehearsal in Zoom on Friday, November 28. Duration: 2~3min apiece. Feel free to leave after you finish the test.

AGENDA OVERVIEW

SATURDAY, November 29, 2025 (UTC+8)		
Plenary Session | Room A: 857 4137 0195, Link: https://us02web.zoom.us/j/85741370195		
Chairperson **Hai Xiang**, Northwestern Polytechnical University, China		
09:00~09:10	Opening Remarks **Lingchao Meng**, Northwestern Polytechnical University, China (西北工业大学民航学院教工党支部书记，江苏省科技镇长团昆山市副团长)	
09:10~09:55	Keynote Speech I *"Perspectives on Advancing Low-Altitude Operational Support and Safety Technologies"* **Mingwei Zhang**, State Key Laboratory of Air Traffic Management System, China	
09:55~10:40	Keynote Speech II *"Adaptive Autonomous Synchronization of Multi-vehicle Systems"* **Zhiyong Chen**, The University of Newcastle, Australia	
10:40~11:10	**Virtual Group Photo / Break Time**	
11:10~11:55	Keynote Speech III *"Acoustic and Vibration Testing for Rotating Machinery with Cyclostationary Beamforming and Blade Tip Timing"* **Liang Yu**, Northwestern Polytechnical University, China	
11:55~13:30	**Break Time**	
Technical Session (Online)		
13:30~16:00	**Online Session: Mechanical Control and Electronic Systems in Aerospace Engineering** ES5002 ES5007 ES5012 ES5003 ES5005 ES5006 ES5009 ES5001 ES5010 ES5011	**Room A: 857 4137 0195 https://us02web.zoom.us/j/85741370195**

INTRODUCTION OF KEYNOTE SPEAKER

09:10-9:55 | Nov. 29, 2025
Room A: 857 4137 0195, Link: https://us02web.zoom.us/j/85741370195

Mingwei Zhang

State Key Laboratory of Air Traffic Management System, China

Perspectives on Advancing Low-Altitude Operational Support and Safety Technologies

Abstract: This report addresses the critical needs emerging during the transition of China's low-altitude economy from a scenario-driven to a technology-driven phase — specifically in low-altitude airspace management, flight operations management, and risk mitigation. It presents key insights on the development of low-altitude operational support and safety technologies. Six core operational concepts for the low-altitude domain are proposed. Aligned with the OODA loop, four essential capabilities are defined: real-time comprehensive situational awareness, operational risk identification, intelligent decision making, and decision execution and response. Furthermore, it systematically outlines seven foundational technology pillars — communications, navigation, surveillance, meteorology, operational management, safety and security, and cross-cutting enabling technologies—highlighting the importance of air-ground collaboration, high-precision situational awareness, and AI empowerment. This report provides a practical reference for the safe and sustainable development of our low-altitude operational management.

Biography: Zhang Mingwei, research fellow and deputy chief engineer at Nanjing Research Institute of Electronic Engineering (NIREE), serves as executive deputy director of the State Key Laboratory of Air Traffic Management System, and committee member of the National Technical Committee for Standardization of Air Transportation (TC464). With long-term dedication to overall design, technological innovation, and top-level planning of Air Traffic Control（ATC） automation systems, he has led more than 10 national major research and engineering projects in ATC field. His notable leadership roles include: serving as chief system designer for Shenyang and Urumqi large regional ATC centers' primary ATC automation systems, project director for Beijing Daxing international airport's ATC automation system, and technical director of national air traffic flow management system. He has been awarded 7 provincial/ministerial level scientific and technological progress awards, including 1 first-class scientific and technological progress award in Jiangsu province and 1 special prize for scientific and technological progress award from the China Electronics Technology Group Corporation (CETC). Additionally, he has published 12 high-impact academic papers and been granted over 30 national invention patents.

INTRODUCTION OF KEYNOTE SPEAKER

09:55-10:40 | Nov. 29, 2025
Room A: 857 4137 0195, Link: https://us02web.zoom.us/j/85741370195

Zhiyong Chen

The University of Newcastle, Australia

Adaptive Autonomous Synchronization of Multi-vehicle Systems

Abstract: In this talk, we introduce a new type of synchronization problem for heterogeneous multi-vehicle systems, called autonomous synchronization. Unlike traditional synchronization, neither the synchronized dynamics nor the synchronized states are predefined. Instead, they emerge autonomously based on the vehicle' inherent properties and initial states, providing greater adaptability and improving synchronization efficiency. To achieve this, we propose a novel control law and establish the necessary and sufficient conditions, particularly when the synchronized dynamics are unstable. Additionally, we present an adaptive, fully distributed control scheme that operates without relying on network topology. This approach is well-suited for tasks like deploying a swarm of drones over disaster areas to quickly locate survivors and assess damage. The exponentially diverging trajectories allow the swarm to cover large areas rapidly, while synchronization ensures reliable cooperation among drones.

Biography: Zhiyong Chen received the B.E. degree in automation from the University of Science and Technology of China, Hefei, China, in 2000, and the M.Phil. and Ph.D. degrees in mechanical and automation engineering from the Chinese University of Hong Kong, in 2002 and 2005, respectively. He worked as a Research Associate at the University of Virginia, Charlottesville, VA, USA from 2005 to 2006. In 2006, he joined the University of Newcastle, Callaghan, NSW, Australia, where he is currently a Professor. He was also a Changjiang Chair Professor with Central South University, Changsha, China. His research interests include nonlinear systems and control, networked systems, and reinforcement learning. Dr. Chen is/was an Associate Editor of Automatica, IEEE Transactions on Automatic Control, IEEE Transactions on Neural Networks and Learning Systems, and IEEE Transactions on Cybernetics.

INTRODUCTION OF KEYNOTE SPEAKER

11:10-11:55 | Nov. 29, 2025
Room A: 857 4137 0195, Link: https://us02web.zoom.us/j/85741370195

Liang Yu

Northwestern Polytechnical University, China

Acoustic and Vibration Testing for Rotating Machinery with Cyclostationary Beamforming and Blade Tip Timing

Abstract: This report addresses the challenges in acoustic and vibration testing for rotating machinery, which is critical for fault localization and noise source identification in modern industry. The presentation is divided into two primary technical methodologies: Cyclostationary Acoustic Beamforming (CSCBF) and Blade Tip Timing (BTT). First, the report introduces Cyclostationary Acoustic Beamforming. Since acoustic pressure from rotating machinery is cyclostationary, conventional beamforming often fails to capture the signal characteristics or localize sources effectively. The report details a CSCBF framework that utilizes Cyclic Spectral Density (CSD) to improve interference robustness and source identification. To further enhance performance, the presentation proposes hardware improvements via non-synchronous measurements using synthetic arrays, which significantly improve spatial resolution without requiring complex, fully synchronous setups. Software advancements are also discussed, including the use of deconvolution models (e.g., DAMAS, NNLS), sparse representation, and functional beamforming to improve imaging accuracy. Second, the report discusses Blade Tip Timing (BTT), a technique used to monitor rotating blades for breakage and fatigue. Addressing the issue of sparse sampling in BTT, the author proposes a block sparsity-induced Bayesian learning model. A key insight presented is the mathematical similarity between BTT signal processing and acoustic array processing. Consequently, the report demonstrates how "Spectrum Forming" techniques—analogous to high-performance beamforming methods like CLEAN-SC, NNLS, and Functional Beamforming—can be adapted to BTT to suppress aliasing and improve natural frequency estimation. The report concludes with experimental validations of these methods on industrial applications, such as high-pressure pumps and compressor blades, demonstrating that these advanced processing techniques significantly outperform conventional methods in accuracy and resolution.

Biography: Liang Yu is a Professor and PhD Supervisor at the School of Civil Aviation, Northwestern Polytechnical University (NWPU). He is a permanent member of the National Key Laboratory of Integrated Technology and Flight Simulation for Large Airliners and the National Key Laboratory of Strength and Structural Integrity.

Professor Yu has long been dedicated to research in "Vibration/Acoustic Sensing and Intelligent Information Processing for Mechanical Equipment." His research achievements include the development of synthetic aperture array asynchronous measurement, cyclostationary modeling and inversion for rotating machinery vibration/acoustics, and precision measurement methods using time-variant subspace Bayesian learning under complex interference. He has also developed high-frequency response, large-range fiber grating sensors and demodulation systems. His theoretical methods have been widely applied in source identification, modal identification, impedance extraction, and fault diagnosis.

He serves on the Vibration and Noise Control Professional Committee of the Chinese Society of Vibration Engineering and the Aerodynamic Noise Professional Committee of the Chinese Aerodynamics Research Society. He has served on the organizing committees of four international conferences (ICICSP, MEAE, ICMIE, MAES) for a total of nine sessions. Professor Yu has published over 200 papers, received two provincial and ministerial awards, and won over 10 conference excellent paper awards. He is a reviewer for more than 40 domestic and international journals and serves as a guest editor for several special issues.

ONLINE SESSION

SATURDAY, November 29, 2025 <13:30~16:00>	Room A: 857 4137 0195 https://us02web.zoom.us/j/85741370195

Session Title: Mechanical Control and Electronic Systems in Aerospace Engineering

Chairperson: Asst. Prof. Alexander Hamilton D. Atienza, Mapua Malayan Colleges Laguna, Philippines

13:30~13:45 ES5002	Evaluation of Abrasive Wear in Twin-Screw Shredder Blades for PET Block Recycling through DEM **José Váquez**, Universidad Peruana de Ciencias Aplicadas (UPC)/ Peru Abstract-The recycling of polyethylene terephthalate (PET) in block form poses significant mechanical challenges for industrial shredding systems. Among these， abrasive wear on the blades of twin-screw shredders drastically limits operational life and increases maintenance costs. This paper presents a comparative evaluation of the structural performance and wear resistance of four AISI tool steels—AISI A2， AISI D2， AISI M42， and AISI 440C—used as cutting blade materials under realistic PET crushing conditions. A dual methodology is implemented， combining an analytical model based on beam theory and shear stress， and a transient simulation using the Discrete Element Method (DEM) in ANSYS Rocky. PET was modeled as block shaped particles (hereafter referred to as PET blocks) with an edge length of 0.1 m， with five particles per trial. To enable realistic penetration and fragmentation within the simulation， the Young ’ s modulus of PET was reduced to 350 MPa， a justified calibration for convergence and interaction fidelity. Wear was simulated using Archard ’ s model with calibrated coefficients per material. Results confirm that AISI M42 exhibits the best combined performance， with the highest safety factor， lowest deformation， and minimal volumetric wear. The study validates a replicable methodology for material selection in harsh recycling environments.
13:45~14:00 ES5007	Full Waveform Inversion using a Deep Neural Operator with Haar Wavelet Basis Function **Myung Shin**, Hanyang University, South Korea Abstract-This study presents a new full waveform inversion technique that combines the Haar wavelet basis functions with a deep neural operator to reconstruct material properties， especially in media with discontinuous physical property distributions. Full waveform inversion enables high-resolution imaging of heterogeneous media but remains limited by high computational cost， sensitivity to initial models， and the ill-posedness of the inverse scattering problem. Although full waveform inversion methods combined with machine learning have partially reduced these limitations， their generalization performance in imaging heterogeneous media with high-contrast material properties still faces challenges. The present method focuses on generating a neural operator mapping between finite element method solutions and material properties by combining the Haar wavelet bases. By leveraging the local discontinuity representation of the Haar wavelet basis functions， the proposed DeepONet achieves higher accuracy in predicting material property distributions， particularly in media with discontinuities. This demonstrates that incorporating Haar wavelet bases is effective for full waveform inversion in high-contrast media and improves its generalization performance.

14:00~14:15 ES5012	Design of a swirl chamber for vacuum drying, using CFD, for agro-industrial application **Wilmer Efrain Garcia Argumedo**, Universidad Peruana de Ciencias Aplicadas, Santiago de Surco, Lima, Perú Abstract-The present work develops the design and analysis of a swirl chamber for vacuum drying, oriented to the post-harvest treatment of agro-industrial products, through Computational Fluid Dynamics (CFD) simulations. In various agricultural regions, adverse climatic conditions, such as heavy rainfall, hinder traditional drying methods, negatively affecting the final quality of products. Faced with this problem, a technological alternative based on a vacuum chamber with dry air injection in induced rotational flow is proposed, which allows greater control of the drying process, especially benefiting small and medium-sized agro-industrial producers. The study focuses on the analysis of the aerodynamic behavior of the cyclonic type of air flow and its interaction with the particles inside the drying chamber, evaluating parameters such as pressure distribution, temperature and speed for the preservation of properties in food. The results obtained allow us to understand the performance of the system and propose design recommendations aimed at its application in the agro-industrial sector in general.
14:15~14:30 ES5003	Thickness-Dependent Q-Frequency Optimization for RF Integrated Inductors **Zukang Lu**, South China Universit of Technology, China Abstract-The quality factor (Q-factor) of RF integrated inductors is a critical parameter that directly indicates the performance of radio-frequency integrated circuits (RFICs). Among the factors influencing Q-factor, skin effect and surface scattering are particularly significant， yet commonly omitted in existing models. Metal thickness plays a decisive role in determining the dominant loss mechanism: surface scattering prevails at nanometer scales， whereas skin effect dominates in the micrometer regime. This study develops a physics-based modelling approach to analyze the Q-frequency (Q-f) behaviour under varying metal thicknesses. Both surface scattering and skin effects are incorporated into the resistance model through analytical derivations and integrated into a simulation framework. Comparative analyses between the proposed model and existing experimental data reveal an improvement in Q-factor prediction accuracy. The proposed model optimizes inductor design and highlights the critical role of metal thickness in determining dominant loss mechanisms in RF integrated inductors.
14:30~14:45 ES5005	Automated aspheric optics manufacturing with integrated error compensated metrology **Ravi Pratap Singh**, Xi'an Jiaotong University, China Abstract-The fabrication of high-precision aspheric optical surfaces remains constrained by iterative, time-consuming processes that are susceptible to errors from tool wear, thermal drift, and environmental instabilities. This paper presents a novel, unified software architecture developed in MATLAB to automate the entire fabrication workflow for both spherical and aspheric optics. The core of the system is a deterministic algorithm that converts optical design parameters including the radius of curvature, conic constant and aspheric coefficients into a high-resolution sag table, which is then used to generate optimized numerical control (NC) code for grinding machining systems. To address unpredictable manufacturing errors, the platform implements a closed-loop error compensation strategy. Following each machining iteration, metrology data from an interferometer or profilometer is ingested by the software. A dedicated module performs a differential analysis between the measured surface profile and the theoretical design. The resulting error map is used to compute and apply a spatially varying tool path correction. The integrated approach minimized form deviation, with results showing a final error of just 0.000413 mm. This high accuracy and superior surface quality confirm the system's potential for advancing high-volume precision manufacturing.

14:45~15:00 ES5006	Design of anon-contact rotary actuator driven by acoustic field energy and fluid dynamics **Chaoning Cao**, Shandong University of Science and Technology, China Abstract-A non-contact rotary actuator is proposed to overcome the drawbacks of friction and wear associated with contact-based rotary drives in this work. Ultrasonic energy is generated by the ultrasonic transducer within the actuator, causing the rotor to levitate and be propelled into rotation. The experimental results show that the steady-state value of the levitation height of the rotor can reach 103.63 μm. The rotational speed stabilizes at 3410 rpm, while the maximum torque is recorded at 0.23 mNm. The rotary drive method proposed in this research is anticipated to offer novel ideas for non-contact operation technologies, including non-contact rotary gyroscope design and non-contact semiconductor wafer processing.
15:00~15:15 ES5009	DAP-based Adaptive IMM Air-Ground Data Fusion Target Tracking **Song Li**, State Key Laboratory of Air Traffic Management System, Nanjing, China Abstract-A Downlink Aircraft Parameters (DAP)-based adaptive Interactive Multiple Model (IMM) multi-source data fusion target tracking algorithm is proposed, which effectively fuses the system track with fundamental data from Mode S radar and ADS-B, as well as additional DAPs. Based on the analysis of multi-source historical surveillance data and the extraction of effective data elements, a ground-air multi-source surveillance data fusion architecture is firstly constructed, enabling flexible expansion on existing air traffic control automation system frameworks. Subsequently, an adaptive IMM filter is designed, where multi-source measurements are fused using D-S evidence theory and additional DAPs are used to improve the identification accuracy of aircraft motion models, thereby enhancing the tracking performance. Finally, the effectiveness of the proposed algorithm is validated using historical data.
15:15~15:30 ES5001	Investigating different acoustic wall treatment materials for attenuation of noise and vibration in a supersonic wind tunnel **DA Desai**, Tshwane University of Technology, South Africa Abstract-The demand for high-performance testing environments with reduced noise levels has driven increased focus on the aerodynamics and acoustics of supersonic wind tunnels. Operating at supersonic speeds, these wind tunnels generate significant noise and vibrations that can interfere with measurement accuracy, cause structural degradation, and disrupt operations. Traditional approaches to attenuate these problems often focused on airflow dynamics, somehow neglecting the impact of compressor fan vibrations and dynamics. However, acoustic wall treatments placed where fans are commonly located in the wind tunnel, can minimize these sounds and vibrations but such investigations seem under researched. Hence, this study investigates the vibro-acoustic performance of three materials: ceramic fibre, mineral wool, and melamine foam using finite element analysis (FEA). The simulated results indicate that ceramic fibre achieved the lowest A-weighted SPL of 24.04 dBA, demonstrating its strong sound-absorbing properties compared to melamine foam and mineral wool, with SPLs of 48.687 dBA and 35.357 dBA, respectively. Analytical validation further confirmed the accuracy of the simulated harmonic response analysis results. These results highlight ceramic fibre as a highly effective material for acoustic wall treatments in minimizing compressor fan-induced noise and vibrations in supersonic wind tunnel applications such as those found at the CSIR. By providing a comparative analysis of material responses specific to compressor fan acoustics, this research contributes to the design of quieter, more efficient supersonic testing environments.

15:30~15:45 ES5010	H Type Darrieus Wind Turbine With Chain Sprocket Transmission System for Small Scale Power Applications **Alexander Hamilton Atienza**, Mapua Institute of Technology at Laguna, Mapua Malayan Colleges Laguna, Philippines Abstract-The aim of the study was to improve the design of H-type VAWT that will enhance the efficiency of the wind turbine by utilizing chain sprocket transmission systems. The electricity produced by the prototype will be used to power up small scale appliances. The possible location for the location for the testing of the prototype was carefully assessed using an anemometer to see if it is feasible to install the prototype. The design conceptualization and the materials selection underwent thorough comprehensive planning and strategy. After the fabrication several adjustments were made to enhance its performance and be ready for testing. The prototype was tested in Lian, Batangas and Silang, Cavite. It was found out that the efficiency was 39.88 % in Lian, Batangas while in Silang, Cavite the efficiency is 34.88 %. The power produced by the prototype will be helpful to the place of installation and this power can be used to power up small scale appliances.
15:45~16:00 ES5011	The Weight of the Metal Used in a Solid Multi-diameter Shaft Versus a Hollow One under the Effect of the Twisting Load **Emad Toma Karash**, Northern Technical University, Iraq Abstract-Hollow shafts weigh less than solid columns of the same length and material, potentially lowering transportation and installation expenses. It provide a higher strength-to-weight ratio, making them more efficient in applications where weight is crucial. When subjected to torsional loads, hollow shafts have more rigidity than solid columns, allowing them to resist twisting better. It can save money on materials because they require less material while keeping equivalent performance qualities, additionally can be used to house additional components such as wiring or fluid conveyance, making them design adaptable. This article uses the SOLIDWORK and ANSYS programs to compute the stress, deformation, and strain of the shafts in the shaft group by applying boundary conditions to the shaft and utilizing the finite element model. In order to compare the weight and ability of hollow models of different shapes to support the loads that solid shafts are subjected to, the goal is to construct a solid shaft model for a gearbox. According to the results, hollow shafts were 10.1% lighter than solid shafts and could transmit the same torque as solid shafts of the same diameter when compared in terms of the stresses they can tolerate, including the maximum shear stress theory and the von Mess stress theory. Additionally, hollow shafts need less energy to accelerate and decelerate. Hollow shafts are therefore very promising for power transmission in a variety of industries, including automotive, industrial, military, and technology. According to this research, the third model was the best design since the stress ratios (stress intensity, von Mises stress, and maximum shear stress) decreased significantly in comparison to the first model, which had ratios of 11.49, 9.94, and 11.49 %, respectively.

NOTE