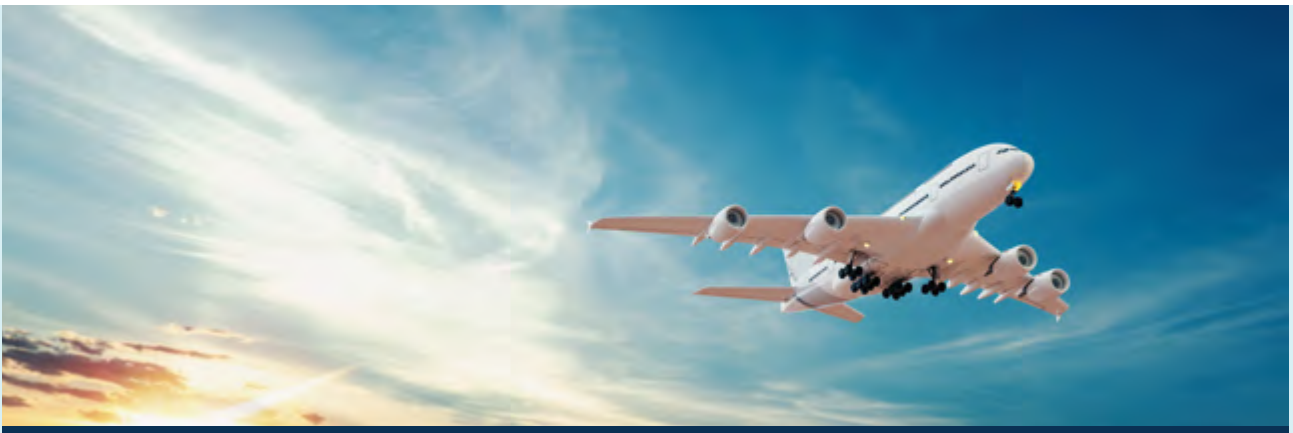
VIRTUAL WINTER SCHOOL

AEROSPACE ENGINEERING | LOGISTICS | TRANSPORT & RAIL

Where does the future take us?



TRACK 1: AEROSPACE ENGINEERING

06 - 10 FEB 2023

(MON - FRI)

TRACK 2: LOGISTICS

TRACK 3: TRANSPORT & RAIL

- **e-Certificate** upon completion
- **50% off processing fee** when applying for one of our Master of Science programmes offered at TUM Asia
- **20% off Winter School fee** for TUM/TUM Asia alumni & students (including the incoming students for our AY23/24 intake)

WHO WE ARE

The Technical University of Munich (TUM) was founded in 1868 and is regularly placed among the best universities in Germany and worldwide. It is the only university to have won recognition as a German ‘Excellence University’ in every round since 2006. TUM has produced 18 Nobel Prize winners since 1927.

Technical University of Munich (TUM) Asia was set up in 2002 as the first academic venture abroad by a German university, blending German academic excellence with industry relevance in Asia. Its partnerships with top Asian universities and industry leaders combine German engineering with Asian relevance to equip talents for industry and research sectors in the world.

VIRTUAL WINTER SCHOOL 2023

Experience an engaging and memorable time in a unique virtual learning experience during your school break this Winter. The TUM Asia Virtual Winter School 2023 is designed to be an enriching programme for international students from all walks of life, embracing a mixture of academic topics alongside insights into Singapore culture.

The Virtual Winter School 2023 will have three parallel streams focusing on Aerospace Engineering, Logistics, and Transport & Rail.

All three streams will give a deep insight into the many facets of Aerospace Engineering, Transportation Engineering, and Logistics / Supply Chain Management that holds the potential to revolutionise the way we live. The lessons will dive deep into the respective streams and provide opportunities to discuss how these developments influence global commerce, manufacturing techniques and supply chains.

In this Virtual Winter School, participants will also be introduced to the master's programmes offered at TUM Asia, enabling them to gain a firm grasp of the range of topics taught in our master's programmes.

Apart from this, we will also discuss the benefits, challenges and risks of the recent innovations in Digital Transformation and Logistics Systems using examples and real-life examples as points of discussion. Students will also be given to explore the career opportunities through these discussions.

New trends in automated mobility solutions and technologies that are used to implement autonomous driving will be shared. Students will learn more about the development of new automated transport concepts and the challenges that arise while operating a mixed fleet of automated and driver-steered vehicles sharing the same road space. An example of infrastructure supporting development of transportation technologies like new innovative pavement concepts that enable inductive charging of electric vehicles during driving will be shown in this Virtual Winter School.

ABOUT

AEROSPACE ENGINEERING PROGRAMME SCHEDULE (Subject to change)

Monday 6 February - 2.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia
	Afternoon	Flying Electric in the Urban Environment – When Will It Happen?"
Tuesday 7 February - 4 hours	Morning	Industrial Addictive Manufacturing
	Afternoon	The Space Environment and Its Simulation on Earth
Wednesday 8 February - 3 hours	Morning	Industrial Addictive Manufacturing
	Afternoon	Wildfire Detection and Monitoring from Space
Thursday 9 February - 4 hours	Afternoon	Dynamic Challenges of Electric Vertical Take-Off and Landing (eVTOL) Aircraft
	Afternoon	When Aeroplanes Come to Life
Friday 10 February - 2 hours	Afternoon	Student Presentation

LOGISTICS PROGRAMME SCHEDULE (Subject to change)

Monday 6 February - 2.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia
	Morning	Industry 4.0 Introduction
	Morning	Industrial Addictive Manufacturing
Tuesday 7 February - 5 hours	Afternoon	The Future of Urban Logistics
	Afternoon	How Logistics Is Changing the World
Wednesday 8 February - 3 hours	Morning	Industrial Addictive Manufacturing
	Afternoon	Human-Machine Interaction in Modern Transportation and Logistics Systems
Thursday 9 February - 4 hours	Afternoon	Digital Transformation of the Logistics Industry
	Afternoon	The Logistics behind the Click - How E-Commerce Changes Retail
Friday 10 February - 4 hours	Morning	Digital transformation of Logistics Industry
	Afternoon	Student Presentation

TRANSPORT & RAIL PROGRAMME SCHEDULE (Subject to change)

Monday 6 February - 2.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia
	Morning	Industry 4.0 Introduction
Tuesday 7 February - 4 hours	Morning	Industrial Addictive Manufacturing
	Afternoon	Traffic Engineering, Control and Simulation for Future Connected and Automated Traffic
Wednesday 8 February - 4 hours	Morning	Industrial Addictive Manufacturing
	Afternoon	Re-Thinking Our Approach in Disaster Resilient Infrastructure
Thursday 9 February - 4 hours	Morning	Dynamic Autonomous Road Transit (DART) System: A New Innovative Public Transport System
	Afternoon	Electric and Autonomous Bus Planning with a Detailed Energy Consumption Model
Friday 10 February - 4 hours	Morning	Dynamic Autonomous Road Transit (DART) System: A New Innovative Public Transport System
	Afternoon	Student Presentation

HIGHLIGHTS

1 *Introduction to Industry 4.0*

Dr. Jesmond Hong
Technical University of Munich Asia

This workshop provides an overview of the four Industrial Revolutions. Students will also understand the evolution of the manufacturing paradigms and the changing roles of customers. The nine pillars of Industry 4.0 will be briefly discussed. Students will also learn about the synergies and contradictions between Lean Management and Industry 4.0.

2 *Industrial Additive Manufacturing*

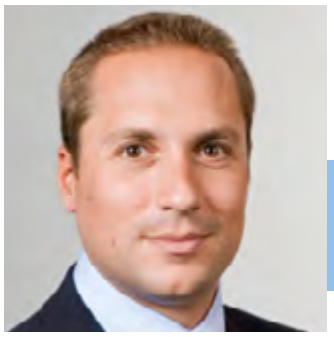
Mr. Benjamin Moey
Founder of I²Mavericks Holdings

The module is broken into two sessions Part 1 – Overview of Additive Manufacturing Technology and Part 2 – Industrial Applications.

In Part 1, the participant will learn the technology of additive manufacturing compared to current traditional manufacturing methods. This session will cover the various key types of additive manufacturing technologies (3D printing) used in an industrial setting, such as Powder Bed Fusion (PBF), Fused Deposition Modelling (FDM), Fused Filament Fabrication (FFF), binder-jetting, Direct Energy Deposition (DED), SLA (stereolithography etc.). Participants will understand the generic end-to-end processes of these manufacturing technologies and their limitations and design strengths.

In Part 2, participants will explore current industrial applications in key industries such as aerospace, marine, medical and general manufacturing. Participants will appreciate the use of advanced software design tools such as the digital twin and FEA/CFD simulations to help optimise the design for Additive Manufacturing (DfAM). Participants will be exposed to the key benefits of additive manufacturing to product design.

AEROSPACE ENGINEERING



3

Dynamic Challenges of eVTOL Aircraft

Prof. Dr.-Ing. Florian Holzapfel
Technical University of Munich

In spite of the current health crisis, aerospace research and development have currently embarked on a thrilling journey.

Step changes in many technologies like electric propulsion, power electronics and energy storage just, miniaturised high performance sensors, rigged computing resources with unprecedented computational power for safety-critical real time computations and finally tremendous advances in modeling, simulation and system analysis enable what many call the **“Third Revolution of Aerospace”.**

Delivery drones, urban air mobility – utilising the sky above us in a sustainable and automated manner for the good of all has just come in our reach.

But to make this happen, serious hurdles need to be overcome and challenges need to be met. Over the first century of aviation almost all aircraft looked alike – fuselage, wing, empennage, engines. Now a wealth of new configurations enter the stage. What are their dynamic challenges? What are their potentials and shortcomings? Where is the limit?

Flying Electric in the Urban Environment – When Will It Happen?

Prof. Dr.-Ing. Manfred Hajek
Technical University of Munich

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With several hundreds of Electric Vertical Take-Off and Landing (eVTOL) projects worldwide, start-up companies and big players in the aviation industry are trying to make a revolution happen. They all share the same dream that in only a few years from now, using an air taxi shall be as expected and easy as a ride with Uber®. But other than the car, the eVTOL will not get stuck in a traffic jam, it will fly on a direct line towards your destination - with zero emission, and it will cost marginally more than a cab.

If we want to find out when all this will be a reality, we need to have a closer look at the biggest challenges lying ahead:

- Will all necessary technologies for this scenario be available and mature on time?
- Will eVTOL traffic over densely populated urban areas be safe enough?
- Can I land anywhere in a city – or will there be regulations and constraints?
- How affordable will air taxi flights be?

The essence of this talk will be: It requires engineers to find answers to these questions! Even though financial, commercial, or legal aspects might be at the centre of public discussions, it requires engineering solutions as an essential basis first. Engineers will have to provide new technologies for performance and efficiency and the safety or commercial viability of future UAM.

5

When aeroplanes come to life

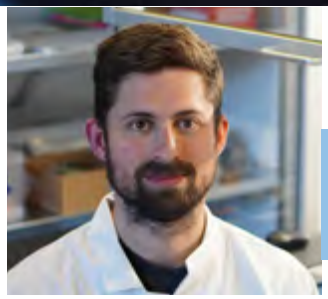
Dr. Aswin Haridas
TESTIA (an Airbus Company)

From very early times, humans have always been captivated by understanding how our bodies work, which resulted in a high amount of literature detailing microscopic details of the most complex machine in the world, our body. How would you react if I said we have grown outside our bodies?

From living in a cave to building 2000 ft skyscrapers, from inventing the wheel to breaking the sound barrier, humans have found a way to use the resources available to extend our inherent capabilities to achieve wonders. This raises the following question: When do we start seeing these structures as an integral part of our daily life? Ask yourself how you feel when you enter your home after a long work day. Should we then not treat these structures as we treat our bodies? This is the question I intend to ask during this session.

To help us focus on the idea, we will try to imagine a scenario where aeroplanes come to life. To do this, we will investigate what these structures go through and how one can quantify structural integrity, a quantity that defines the health of a structure at any given time. Using this, just like how a doctor determines our health status, we identify parameters related to the remaining life of these structures, which can thereafter help in prescribing “checks” and hopefully extend the overall lifespan.

Wildfire Detection and Monitoring from Space



Dr.-Ing. Martin Langer
Technical University of Munich

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Wildfires heavily contribute to global warming as they emit tonnes of CO2 into the atmosphere, up to 20% of global greenhouse gas emissions yearly. Estimates by the UN project a global increase of extreme fires of up to 14 per cent by 2030, and 30 per cent by the end of 2050. Climate change and land-use change accelerates this development, making wildfires more frequent and intense in the future.

OroraTech strongly addresses this problem on a global scale with a wildfire service that aggregates more than 20 satellite data sources in thermal-infrared on a global scale. In the future, this data will be complemented by a constellation of nanosatellites, enhancing the quality of detection, the revisit rate, and the monitoring capabilities. The first nanosatellite called “FOREST-1” was launched in early 2022 and has successfully achieved its mission goals.

The Space Environment and its Simulation on Earth

Dr.-Ing. Martin Rott
Technical University of Munich

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The space environment in our solar system is so much different from what we use on Earth. Our space activities are significantly affected by these extreme environmental conditions, such as reverberation, vibrations and shock load during launch, the residual atmosphere and vacuum during rocket ascent, and neutral particles, plasma, radiation, fields, mass-particles and Qg conditions in orbit during operation.

This talk provides an overview of the individual conditions of the space environment and their effects on the design, technology, and operation of spacecraft and satellites. The simulation of these extreme conditions in dedicated labs and facilities on Earth will be shared.

LOGISTICS

How Logistics is Changing the World?

8

Univ.-Prof. (I.R.) Peter Klaus
Universität Erlangen-Nürnberg

In this lecture, Prof. Klaus will introduce you to the exciting world of Business Logistics. He will provide examples and stories from logistics and supply chain management, which change how global commerce works and how things are manufactured, distributed, and recycled today.

Prof. Klaus will also discuss the benefits, new burdens, and risks that come with those innovations and what that means for career opportunities for students.

9

The Logistics behind the Click - How E-Commerce Changes Retail

Prof. Dr. Christian Kille
University of Applied Sciences Würzburg-Schweinfurt

Ever wonder what happens after the ‘click‘ in E-Commerce? The answer is logistics. This lecture will explain the processes and the logic of logistics in E-Commerce plus and provide some outlook in future trends.

The Future of Urban Logistics

Prof. Oliver Kunze
Technical University of Munich Asia

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How will logistics in cities be carried out in the midterm future? To answer this question, an overview of different existing and emerging transport logistics operations is provided, and the pros and cons of these different operations are set out. Based on these findings, a partial qualitative systemic model is presented showing how these operations are influenced by global and logistics trends on the one hand and by delivery service requirements on the other hand. From this model, a vision of urban logistics in the year 2030 is presented and discussed.

11

Human-Machine Interaction in Modern Transportation and Logistics Systems

Prof. Dr. Alexander Hübner
Technical University of Munich

Activities in operations management contexts are prone to automation in digital transformation. Humans still play an essential role in many settings, and human-machine interactions need to be managed efficiently to ensure smooth operations. In many of those interactions, machines determine the assignment and sequencing of tasks, while human workers mainly execute repetitive and monotonous activities.

One downside of such division of work is the mental impoverishment of workers, which relates to stagnating productivity coupled with undesired effects on human factors such as low satisfaction, self-determination, and perceived fairness. We will be introducing a study with a semi-automated grocery warehouse to address these shortcomings. Humans, their actions and behaviour will continue to play a significant role in the operational efficiency of firms. Our insights contribute to the growing field of addressing behavioural issues in human-machine interactions.

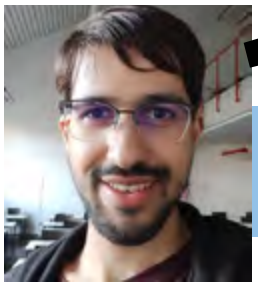
12

Digital Transformation of Logistics Industry

Mr Eldhose Abraham
Technical University of Munich Asia– FESTO Competence Centre for Digitalisation, Technology and Innovation (CDTI)

Logistics Industry have been undergoing a process of digital transformation in the last few years. This has enabled the industry to drive efficiency and lower costs, as well as pursue new business opportunities. In this lecture we will explore the different technologies and market trends in the logistics industry and how businesses worldwide are adapting to the industry 4.0.

13 *Electric and Autonomous Bus Planning with a Detailed Energy Consumption Model*



Mr. Mohammad Sadrani
Technical University of Munich

In recent years, public transport agencies have shown a great interest in the deployment of electric buses (EBs) to decarbonise the transport sector. In this talk, we will provide a basic understanding of the main factors affecting the energy consumption of EBs. An optimisation model will be presented for the planning of EBs with a detailed energy consumption model. Analysis of the economic aspects of EBs, considering the benefits of passengers and operators will also be shared at this session.

14 *Traffic Engineering, Control and Simulation for Future Connected and Automated Traffic*

Mr. Martin Margreiter
Technical University of Munich

This talk will focus on the current state-of-the-art and state of research in the field of traffic engineering, traffic operation and control and traffic modelling and simulation for future mobility. The topic focuses on current and ongoing research in this field at the Technical University of Munich, Chair of Traffic Engineering and Control, Research Group for Automated Traffic as well as real-word and virtual test beds for connected and automated traffic.

15

Dynamic Autonomous Road Transit (DART) System: A New Innovative Public Transport System

Dr.-Ing. Andreas Rau
Technical University of Munich Asia

Dynamic Autonomous Road Transit (DART) system developed by TUMCREATE in Singapore will be introduced. The vehicle concept is a new shared-mobility system encompassing flexible-and fixed-route services. It consists of a fleet of mixed-size modular electric, autonomous road-based vehicles, with high level secure communication between vehicle-to-vehicle and vehicle-to-intelligent infrastructure, to realise an efficient, attractive and comfortable mobility service.

16

Re-thinking Our Approach in Disaster Resilient Infrastructure

Dr.-Ing. Ali Bawono
Technical University of Munich Asia

Asia-Pacific nations experience more natural disasters than any other region. In urban areas, exposure to climate and geophysical hazards, such as earthquakes and volcanic eruptions, is already widespread across Asia and the Pacific.

Between 2004 and 2020, developing countries in Asia incurred losses of over $500 billion from disasters, affecting 2.1 billion people. The World Meteorological Organisation reported in 2021 that the number of weather-related disasters has increased by a factor of five over 50 years (1970-2019), driven by climate change, more extreme weather, and improved reporting.

How the infrastructures are planned, designed, operated, and financed will fundamentally shape resilience in the region. It's time to re-think the current approach to infrastructure.

TESTIMONIALS

"All the professors are experienced and passionate in their respective areas, and they are well-prepared for each class, which is informative and well-structured. In addition, assistant teachers are friendly and effectively solve all the problems we encounter."

Yu Heyue,
Virtual Summer School 2022

"This project has shown me the great human spirit of the Technical University of Munich in its use of technological innovation. This is the unique charm of a world-leading university."

Hanyu Zhou,
Virtual Winter School 2022

REGISTRATION DETAILS

1. Register via the sign-up form: https://tum-asia.edu.sg/winter-school/
or scan QR code:

2. Complete your payment by following the instructions in the email that will be sent to you once you have completed your registration form.

3. Successfully enroll in the Virtual Winter School 2023 – we are excited to have you join us.

Your registration will be completed and your place in the Virtual Winter School will be **reserved when you have made the full payment of the Virtual Winter School Participant Fee of $600* Singapore Dollars.**

*This Fee is applicable to one participant per Fee, and the Fee is only inclusive of the virtual activity costs during the stipulated dates of the Virtual Winter School.

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06 - 10 FEBRUARY 2023

Technical University of Munich (TUM) Asia

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