VIRTUAL SUMMER SCHOOL

AEROSPACE ENGINEERING | LOGISTICS | TRANSPORT & RAIL

Where does the future take us?

TRACK 1: AEROSPACE ENGINEERING

15 - 19 AUGUST 2022 (MON - FRI)

TRACK 2: LOGISTICS

- **e-Certificate** upon completion
- **50% off processing fee** when applying for one of our Master of Science programmes offered at TUM Asia
- **20% off Summer School fee** for TUM/TUM Asia alumni & students (including the incoming students for our AY22/23 intake)

TRACK 3: TRANSPORT & RAIL

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 17 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 SUMMER SCHOOL 2022

Experience an engaging and unforgettable time in a one-of-a-kind virtual learning experience during your school break this Summer. The TUM Asia Virtual Summer School 2022 is designed to be an enriching programme for international students from all walks of life, embracing a mix of academic topics alongside insights into Singapore culture.

The Virtual Summer School 2022 will have three parallel streams focusing on Aerospace Engineering, Logistics and Transport & Rail.

All streams will give an insight into multiple facets of aerospace engineering, transportation engineering and logistics/supply chain management that can shape our lives in the near future. The lessons will touch upon the latest developments as well as ongoing trends in these focus areas. The way these ongoing developments influence global commerce, manufacturing techniques and supply chains will be discussed.

During the Virtual Summer School, participants will be introduced to our Master programmes offered at TUM Asia. The theme of the Virtual Summer School resonates with the concepts taught in this programme, thereby giving participants a firm idea on what to expect once they join the Masters programme.

Digital Transformation and Healthcare Logistics will be discussed. Examples and stories on major innovations in the field of logistics and supply chain management, discussions on the benefits, new burdens and risks which come with those innovations, and what that means for career opportunities to students will be made during the Virtual Summer School.

New trends in automated mobility solutions and technologies used to implement autonomous driving will be shown. The focus of the Virtual Summer School will touch upon 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 during the Virtual Summer school.

ABOUT

AEROSPACE ENGINEERING PROGRAMME SCHEDULE (Subject to change)

Monday 15 August - 4.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia Industry 4.0 Introduction
	Afternoon	Industry 4.0 Introduction
Tuesday 16 August - 4 hours	Morning	Lightweight Structural Design
	Afternoon	Introduction to Aerospace: Helicopters and VTOL
Wednesday 17 August -4 hours	Afternoon	Introduction to Structural Health Monitoring (SHM) - Analysis on the Benefit & Opportunities
	Afternoon	Wildfire Detection and Monitoring from Space
Thursday 18 August - 3.5 hours	Afternoon	Research Prospects for CubeSats at TUM
	Afternoon	Dynamic Challenges of eVTOL Aircraft
Friday 19 August - 2 hours	Morning	Student Presentation

LOGISTICS PROGRAMME SCHEDULE (Subject to change)

Monday **15 August** - 4.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia Industry 4.0 Introduction
	Afternoon	Industry 4.0 Introduction
Tuesday **16 August** - 4 hours	Morning	Digital Transformation of Logistics Industry
	Afternoon	How E-Commerce Works
Wednesday **17 August** - 3.5 hours	Morning	Digital Transformation of Logistics Industry
	Afternoon	The Future of Healthcare Logistics is Digital
Thursday **18 August** - 2 hours	Afternoon	How Logistics is Changing the World
Friday **19 August** - 2 hours	Morning	Student Presentation

TRANSPORT & RAIL PROGRAMME SCHEDULE (Subject to change)

Monday **15 August** - 4.5 hours	Morning	Welcome to Technical University of Munich (TUM) Asia Industry 4.0 Introduction
	Afternoon	Industry 4.0 Introduction
Tuesday **16 August** - 2 hours	Afternoon	Traffic Engineering, Control and Simulation for Future Connected and Automated Traffic
Wednesday **17 August** - 6 hours	Morning	Redesigning Pick-Up-Drop-Off Points (PUDOs) to accommodate Autonomous Vehicles
	Afternoon	Dynamic Autonomous Road Transit (DART) System: A New Innovative Public Transport Systems
	Evening	Electric Bus Planning with a Detailed Energy Consumption Model
Thursday **18 August** - 4 hours	Morning	Building Information Modelling in Roadway and Railway
	Afternoon	Engineered Cementitious Composites for Electrified Roadway Application in Singapore
Friday **19 August** - 2 hours	Morning	Student Presentation

INDUSTRY 4.0

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.

LOGISTICS

How Logistics is Changing the World?

2

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

In this lecture, Prof. Klaus offers a series of examples and stories on major innovations from the field of logistics and supply chain management, which change the way of how global commerce works, how things are manufactured, distributed, and also recycled today.

Next, Prof. Klaus adds some discussion on the benefits, new burdens and risks which come with those innovations, and what that means for career opportunities to students.

3

How E-Commerce Works

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.

4

The Future of Healthcare Logistics is Digital

Prof. Dr. Jörg Schlüchtermann
University of Bayreuth

The pandemic has once more emphasised the importance and relevance of healthcare for almost everyone. Currently healthcare systems all over the world are facing massive new opportunities through digitisation. Tons of new digital applications are being developed in order to make the patient journey safer, faster and less costly.

Healthcare logistics is an integral and very important part of service delivery. Professional material flows enable better quality and lower cost. And again, we are at the beginning of a digital transformation that will offer new opportunities but challenges as well for healthcare logistics. This lecture will give an overview of most relevant decision problems in healthcare logistics and discuss perspectives of digitisation.

Digital Transformation of Logistics Industry

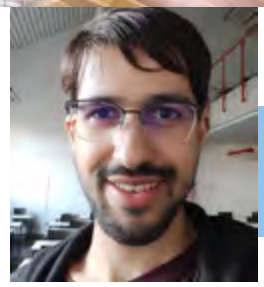
Mr Eldhose Abraham
Technical University of Munich Asia– FESTO Competence Centre for Digitalisation, Technology and Innovation (CDTI)

5

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.

TRANSPORT & RAIL

6 Electric 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.

7 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.

8 Redesigning Pick-Up-Drop-Off Points (PUDOs) to Accommodate Autonomous Vehicles (AVs)

Dr. Graham Leedham
Technical University of Munich Asia

In this session we will look at:
1. The challenges Autonomous Vehicles (AVs) face in mixed traffic and particularly at Pick-Up-Drop-Off Points (PUDOs),

2. The simulation of present and future mixed traffic and pedestrians at PUDOs to better understand the possible scenarios AVs will encounter at PUDOs, and

3. The current design variability of PUDOs and our research into the future design and retrofitting of PUDOs to facilitate the introduction of AVs.

9

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.

Engineered Cementitious Composites for Electrified Roadway Application in Singapore

10

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

The electromobility concept has now started to become a trend to achieve the ultimate public transport system in megacities. Road infrastructure needs to be adapted and reinvented to support these positive trends. The concept of an electrified roadway with Dynamic Wireless Power Transfer technology can be a promising solution to charge electric vehicles (EVs) in megacities. Brought in as a new concept and innovative solution, an electrified roadway using a material called Engineered Cementitious Composites (ECC) was proposed for Singapore. The high-performance fibre-reinforced cementitious composite exhibits an extreme tensile strain capacity much higher than normal concrete. This enable a slab pavement design without the usage of the steel reinforcement hinged. Thus, the interference of the electromagnetic field actuated by the inductive charging can be avoided as this may lead to a major reduction of the charging rate efficiency.

Building Information Modelling in Roadway and Railway

Recently, Building Information Modelling (BIM) technology is implemented in many aspects of the construction, including buildings, bridges, dams, tunnels, and railways. McGraw Hill reported that 12% of the contractors in France, Germany and the UK have been using BIM for at least six years or more. Similarly, in the US and Canada, more than a third of the BIM-using contractors have experience of six or more years. In Singapore, the Building and Construction Authority has implemented the BIM roadmap since 2010, aiming that 80% of the industry will implement BIM by 2015. Singapore is now one of the leading authorities with its guidelines and implementation. BIM offers benefits to its users, yet not without any challenges.

AEROSPACE ENGINEERING

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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?

12 *Introduction to Aerospace: Helicopters and VTOL*

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

What are Rotorcraft and VTOL aircraft?
This lecture will start with an overview of characteristic missions and applications of VTOL (vertical take-off and landing) aircraft, including their advantages and drawbacks. The principal difference to fix wing aircraft will be highlighted as well.

What is “Sizing”?
The development of an aircraft is based on requirements like payload, range, speed, and more. Sizing means to find the aircraft compliant with these requirements at a minimum take-off mass.

Hundreds of projects world-wide are aiming at solutions for new formulas for aerial transport in urban environments: air taxis and personal air vehicles are a real hype topic! The lecture provides a broad overview and tries to answer the question, whether Urban Air Mobility is the future of aviation.

13 *Lightweight Structural Design*

Mr. Andreas Hermanutz
Technical University of Munich Asia

Increasing environmental awareness and expected growth in air traffic are driving the need for improved and innovative aircraft designs and technologies. Nowadays, modern composite designs show significant potential in wing development by tailoring the wing to a specific intended behaviour like passive load alleviation or aeroelastic stabilization by using anisotropic stiffness properties of the structural layout. This lecture presents influences on the design of lightweight structures and discusses the use of typical aerospace materials and their application.

14

Introduction to Structural Health Monitoring (SHM) - Analysis on the Benefit & Opportunities

Dr. Aswin Haridas
TESTIA (an Airbus Company)

With the rapid growth in the aviation sector, there has been an increased interest in exploring new tools and methodologies to both significantly improve safety and reduce maintenance and repair expenses. The captivated interests among various stakeholders to employ advanced technologies to meet the requirements of the aviation sector have necessitated the use of newly developed asset monitoring systems to ensure the robustness and reliability of critical structures. Although Non-Destructive Testing (NDT) methods provide sufficient information about the state of the structure at the time of inspection, the need for continuously monitoring the health of the structure has asserted the use of Structure Health Monitoring (SHM) technologies to increase the levels of safety and thereby, reducing the overall costs for operation and maintenance.

In this context, the lecture will focus on providing an industrial perspective on Structural Health Monitoring (SHM), a strategy towards data-driven, predictive maintenance and scheduled inspection. The listeners would be introduced to the principle of SHM along with a technical description of the current state of the art. Working principles, details and implementation strategies of technologies including, fiber optics and acousto-ultrasonic would be elaborated. Furthermore, recent advances, opportunities and benefits in the field of SHM would be elaborated based on industrial pain-points, with a key focus on the aerospace sector.

15

Wildfire Detection and Monitoring from Space

Dr.-Ing. Martin Langer
Technical University of Munich

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.

Research Prospects for CubeSats at TUM

Dr.-Ing. Martin Rott
Technical University of Munich

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When it comes to space-based astronomy or fundamental physical research, the general public usually assumes the need for large, complex and expensive satellites or space probes (e.g. James Webb Telescope, LOFT, Pamela etc.). However, due to huge technological progress in miniaturisation, small satellites have become a very versatile and widely used platform in the space sector. In particular, the number of CubeSats (a class of miniaturised satellites often used for educational purposes) launched into low-Earth-orbits have risen significantly in recent years. Satellites have increasingly become the focus for small science instruments and technology demonstrators.

To enable the development of miniature scientific instruments on small satellites, a Laboratory for Rapid Space Missions (LRSM) is currently being set up at the Technical University of Munich (TUM) under the supervision of the chair of astronautics and the physics department. LRSM will enhance and foster the link between the science community (scientific problems => instrument R&D) and the Tech community (mission operations => spacecraft R&D). Based on the experience of three successfully launched CubeSats with orbital verification experiments and the experience in antiproton detector and x-ray detector design, the LRSM will develop a CubeSat bus suitable for future science missions (e.g. X-ray astronomy).

The talk will give an overview on the past involvement of the chair of astronautics in the CubeSat programme with special focus and the latest information on MOVE II (Munich Orbital Verification Experiment). The current state of the LRSM development and the associated envisaged science missions will be presented.

TESTIMONIALS

"The topics of the lectures were very interesting. In addition, the professors presented it very well. I specifically enjoyed the interactive sessions in the transportation lecture."

Georg-Friedrich Schneider,
Virtual Summer School 2021

"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/summer-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 Summer School 2022 – we are excited to have you join us!

Your registration will be completed and your place in the Virtual Summer School will be **reserved when you have made the full payment of the Virtual Summer 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 Summer School.

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15 - 19 AUGUST 2022

TUM Asia | 20 IGNITING LEADERS OF TUMORROW

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