

# M o m e n T U M

TUM ASIA EVENTS, HIGHLIGHTS  
& ALUMNI STORIES

2021 | Edition 01

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## PRESIDENT EMERITUS AND DIRECTOR'S MESSAGE



In 2020, the TUM Virtual Dialogue was organised to bring many international participants to connect, exchange knowledge, access expert insights, and share solutions to address challenges of food safety and technology in the age of disruption – an issue close to our hearts as we rethink global models and supply dependencies amid the long-drawn pandemic. In the midst of the COVID-19 hiatus, we have never forgotten our belief of igniting the curiosity and interest of precocious young minds. In this issue, you would appreciate the beauty of technology in the form of a quaint little robot which successfully found its way to the centre of Munich with the help of passers-by – an interesting class taught by TUM professor, Prof. Dr. -Ing./Univ. Tokio Martin Buss, to students from German European School Singapore.

What a whirlwind 2020 has been! While the world continues its battle against the COVID-19 pandemic, we have experienced change across every aspect of our lives – be it professional, academic or personal. Whether it is learning remotely, connecting or re-acquainting virtually, the world that we live in has evolved radically in the span of a year. The silver lining of it all is that digital transformation is no longer a buzzword as we see a rapid adoption of technology and innovation that enables us to overcome challenges of tomorrow. In our first issue of MomenTUM 2021, we feature some of the valiant efforts of our research team at TUM whose relentless pursuit to better the world has fuelled discoveries related to the unknown SARS-CoV-2 virus, enabling us to learn more of what we do not yet know.

### Learning: a journey of surprise

Indeed, learning is a wonderful journey. It is not so much about learning a particular subject, but more of an adventure that empowers us to explore our strengths and interests and find our calling from within. Mr Andreas Hermanutz, Assistant Faculty Head of Aerospace Engineering at TUM Asia, is a sterling example of that. In this issue, we interview him as he opens his heart about how he found his love for Aerospace Engineering. While learning at TUM Asia has taken on a distinctly different format, our professors have embraced the change and switched their teaching methodologies by creating a number of avenues for students to acquire the required skill sets and knowledge for continued success while inspiring a love for lifelong learning. We hear from TUM professor, Prof. Dr. Andreas Herkersdorf, of how he brings learning to life, even from afar.

### Weaving community with technology

As much as the pandemic has disrupted all facets of life, it has also enabled our TUM community from different parts of the world to come together.

While technology has made communication easier, perhaps, it still could not yet replace the physical and emotional connections that we all love. This was keenly felt in the recent Virtual Graduation Ceremony for the Class of 2020. Without the celebratory mood of commencement and gales of laughter from graduates, it felt different. Although it lacked some of the distinctive features of a graduation ceremony, we continued to uphold the true meaning of graduating, and honour the achievements that every student has made. Like the decades of students who had entered TUM with aspirations waiting to be fulfilled, each of them left with deeper knowledge, newer skills, and broader perspectives, as they readied themselves to tackle the world regardless of what challenges that might come their way. That is also the tenacious spirit that every TUM student embodies. And that itself is a mark of a milestone that COVID-19 will never be able to take away.

### Aligning to new challenges

Lastly, we have curated a selection of students' success stories who, despite the pandemic, have beaten their own paths of successes through trials and tribulations. This is testament to the entrepreneurial mindset of all TUM students who align themselves with new challenges and continuously improve their ways of working. I strongly believe that we will emerge from this pandemic stronger and wiser.

We cordially wish you a continuing good health – let us exercise any possible precaution to master the present pandemic situation in hopes of meeting soon again face-by-face.

**Prof. Dr. Wolfgang A. Herrmann**  
President Emeritus, TUM  
Academic Director, TUM Asia

**Dr. Markus Wächter**  
Managing Director,  
TUM Asia



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## STUDENTS' REFLECTIONS ON THE YEAR 2020

What a year 2020 has been! It might not have been a walk in the park but it definitely was a year worth remembering. We would like to share the heartfelt reflections of our TUM Asia's students, Chen Qi and Liu Haoyu, of how the year 2020 had been for them.

May the year 2021 be a better year for all of us.

### CHEN QI, MSc IN RAIL, TRANSPORT & LOGISTICS

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In a blink of an eye, we have come to the last day of 2020. In retrospect, it seems much of life has come to a standstill in 2020. For me, I'm glad that 2020 was the year I began my learning journey with TUM Asia.

Looking back at this time last year, I was savouring the euphoric moment when I had just completed my postgraduate entrance examinations, preparing to enjoy my hard-earned holiday. It was during the early stages of the onset of the COVID-19 virus in Wuhan city. No one in their wildest dreams would have imagined it to evolve into an outbreak. In the ensuing months, the outbreak slowly crept into

our lives and various media were reporting worrying numbers of infections. At that point in time, I was still oblivious to the severity of the situation and continued my commute with neither any mask nor protection back to my hometown, which was 100km away from Wuhan. When I arrived, I unwittingly became the centre of attention. Every day, there would be a nurse to check on my temperature and condition - part of the national effort in curbing the outbreak. Not long after, the city was under lockdown, and my hometown was sealed off. It was not how I expected my holiday to pan out. Thankfully, things have since come to a turn with the city and province slowly opening back up. Finally, it feels almost normal.

***“Clouds of doubt that I had before were swept away when I received my admission letter from TUM Asia! Studying abroad was perhaps a move I made to tell myself that life still had to go on.”***



It was also at this time that I applied for the Master of Science in Rail, Transport and Logistics at TUM Asia. The application process was difficult. With most restrictions still in place, obtaining the relevant documents was a challenge. In addition, everyone was worried about my move to study abroad, especially in the thick of the pandemic. Many advised to shelve my plans till the situation stabilised. Just as I was about to falter, I received my admission letter from TUM Asia. Naturally, clouds of doubt that I had before were swept away. Studying abroad was perhaps a move I made to tell myself that life still had to go on.

It was definitely strange when I first arrived in Singapore as classes were conducted online and everyone on the streets wore a mask. The everyday things that were so common before seem to be a luxury today. Although it was a pity that I did not have the opportunity to sit in a classroom and interact face-to-face with my classmates and professors, I did not regret my decision of coming to Singapore.

Indeed, what a rollercoaster ride 2020 has been! We went through lockdowns, witnessed chaos but found glimmers of hope. In the new year, I wish the pandemic stayed in 2020 and we could finally resume more forms of normalcy in our lives. 2021, we look forward to welcoming you!

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**CHEN QI**

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***“Although it was a pity that I did not have the opportunity to sit in the classroom and interact face-to-face with my classmates and professors, I did not regret my decision of coming to Singapore.”***

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### LIU HAOYU, MSc IN GREEN ELECTRONICS

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Halfway into 2020, while the world was undergoing unprecedented change, I received my letter of acceptance, in which I was offered a place in the Master of Science in Green Electronics, jointly conferred by Technical University of Munich (TUM) and Nanyang Technological University (NTU) Singapore. Not long after, I began to attend the lessons virtually. Just as I thought I would be spending the rest of the year or perhaps most of my learning journey bounded to my desk and confined within four walls, I was informed to head to Singapore where I could attend the lessons in person. It was news that I least expected given the current COVID-19 situation.

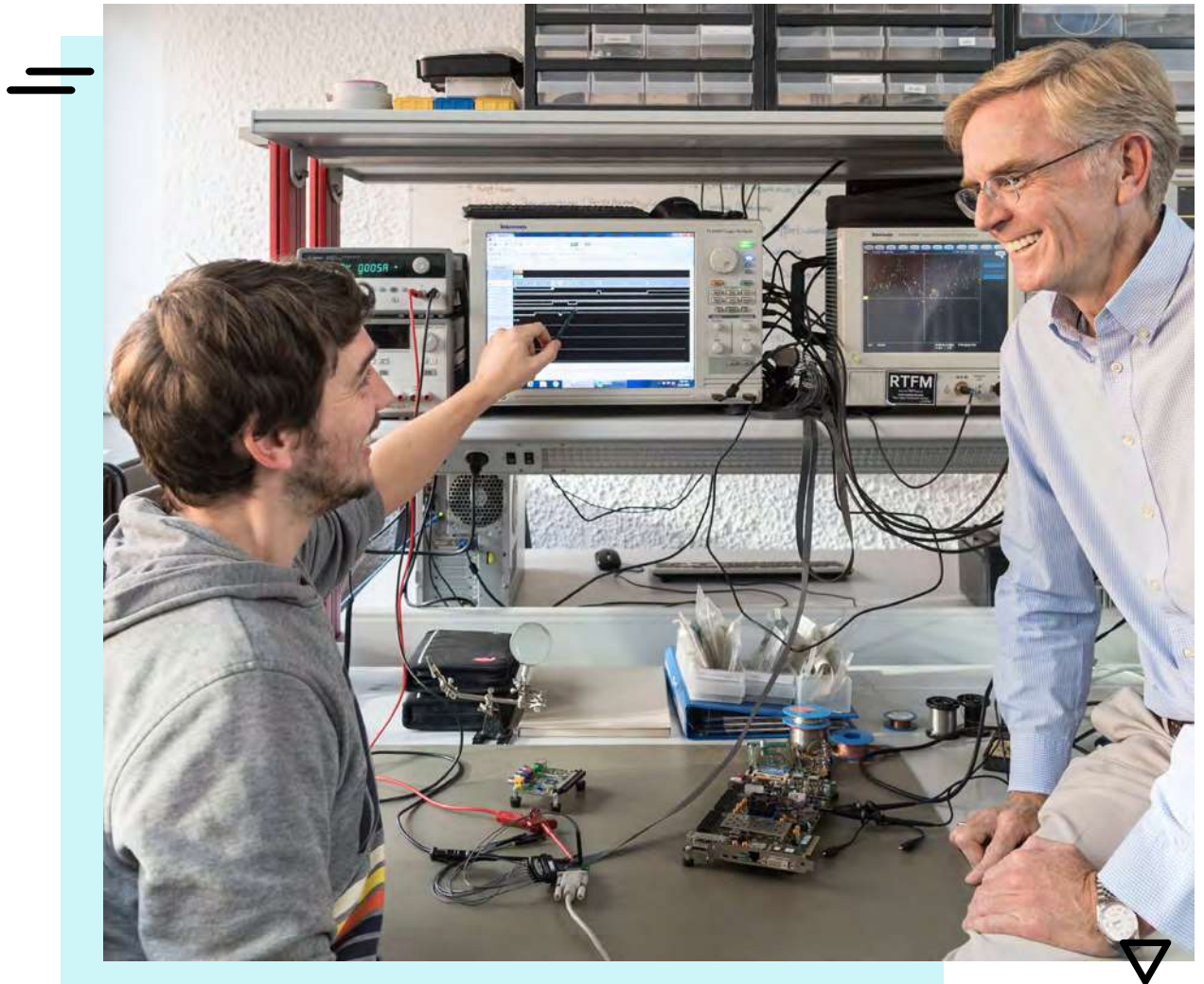
Greeting the news with both eager anticipation and apprehension, I packed my bags (and my thoughts) and prepared myself for Singapore where I was due for quarantine for 14 days before beginning my learning journey officially. Not long after, classroom lessons in Singapore gradually became part of my routine. Apart from the perpetual wearing of a mask, everything seemed to be no different from my experience at home.

The spate of events – the lockdown, the transition from remote lessons to physical lessons, and the miles of travel to Singapore – certainly caught me by surprise. Even though the daily commute might be rather draining, I was nonetheless grateful for the opportunity to be able to study even in the midst of a global pandemic. As the famous saying by Robert Schuller goes, “Tough times don’t last, tough men do”. I believe we would be able to emerge from this global pandemic stronger and more resilient. Stay safe, stay healthy and stay curious, everyone!





# REINVENTING LEARNING: KEEPING ONLINE TEACHING ENGAGING & RELEVANT AMIDST COVID-19



► Professor Andreas Herkersdorf (right) is a professor in the Department of Electrical and Computer Engineering and also affiliated to the Department of Informatics at TUM.

The pandemic has certainly thrown us all a curveball with many of us immersed in a collective level of unprecedented change. At TUM and TUM Asia, with classes being held online, teachers have also valiantly embraced the change and switched their teaching methodologies. How have they reinvented learning to fill curious minds with knowledge, inspiration and motivation?

We speak with TUM professor, Prof. Dr. Andreas Herkersdorf, who teaches in the Master of Science in Integrated Circuit Design, as he shares with us some of his unique ways to support his students, even from afar.



### **How has it been like for you working from home?**

It has either been way different from being in the office / in the lecture hall, to almost identical, or becoming quite similar after getting used to it. When being in the office, I spend a significant amount of my time responding and writing emails. There is no difference doing this from home or in the office - same situation for writing new research project proposals and funding applications. Smaller technical meetings (three to four people), e.g. with my scientific staff, to my initial surprise, seemed similarly effective with Zoom as when being in the same room (with white board “scribblings” as an exception). So are project meetings with other academic colleagues in Germany, or worldwide, as well as with industry partners. You save the travels and daily commute (which in my case takes at least 90 minutes per day). Saving on travel time has a negative aspect though: virtual conferences are not as effective as personal get-togethers, at least under networking considerations. Networking very often triggers new interactions and projects.

### **How is it different from teaching in person?**

The biggest difference during lecturing obviously is the lack of personal interaction and

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*“The pandemic forced us to change and adapt our daily working processes abruptly. To my positive surprise, existing IT and Internet infrastructure allowed us to keep the ‘academic business’ operational. We are very fortunate in comparison to other business sectors, that are severely endangered in these times.”*

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visual feedback from the students. In a lecture hall or seminar room, you have the entire, or at least a big portion, of the class within your visual field and you get visual feedback in the form of either nodding heads, or faces expressing doubts or questions. Personal interaction with students is much easier in a classroom than when talking to a screen where students typically have their cameras switched off during Zoom sessions. However, even if their cameras are on, it is not the same experience for both sides. During online classes conducted at TUM during last spring and summer as well as during my last Integrated Circuit Design (ICD) lecture at TUM Asia, I got way fewer questions than usual. I consider this lack of personal interaction as the biggest drawback of online teaching. On the other hand, there are also new opportunities coming out of online teaching, and the bottom line is, when comparing the learning outcomes with the examination responses (and grade distributions) from previous years, I would say the knowledge adoption is very much comparable.

### **Could you share us some of the teachings you have modified to suit the learning needs of our students since it's mostly conducted online now?**

I practised various forms of online teaching since March 2020:

1. Pre-record lecture videos which can be consumed by the students according to their personal time schedule. In addition, I offered a limited number of live question-and-answer

*“Encourage students repetitively to ask questions, both during lectures and tutorials. Also offer offline chat or discussion channels for questions which come up after the lecture or during tutorials.”*

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(Q&A) sessions with a fixed time slot in order to compensate the missing opportunities for asking questions during the lecture videos. Here, specific care must be taken (particularly when students have multiple classes per day with weekly iterations) to make sure that the videos and the Q&A do not exceed the time quota students are expected to dedicate to an individual course. A disadvantage of this form of teaching is that if a student did not grasp a basic principle, which could have easily been clarified in a spontaneous question, he/she may have a hard time to follow the material built onto this basic aspect. The advantages are that each student can follow his/her individual speed and pre-knowledge to consume the video material. One can watch perceivably more difficult parts two or three times and, if students participate in the Q&A, one can then have a dialogue or discussion on the subject between students and professor (complementing beneficially the one-directional teaching). I was following this model for two TUM Master's courses last spring/summer.

2. Record live-conducted lectures (TUM Asia's ICD model during this summer). This form provides the chance to immediately ask questions, either in the form of written chat entries or via audio interaction, during the lecture. All students hear the questions and answers, and students (if wanted or needed) can view parts of the recorded sessions again during preparation for the examinations. Besides the ICD course at TUM Asia, I use this model for the Digital Design Freshmen class as well as for one Master's-level course at TUM. This has been a strong request from our students in order to have the chance for asking questions during the tutorials.

3. What also turned out to be a very welcome augmentation to the regular teaching and tutorial slots is to produce short (five to ten minutes) videos on specific aspects of the course content or related, new research results. They may not be relevant for the purpose of

examinations, but offer interested students the opportunity to deepen their understanding on specific subjects.

**What are some of the unique things you do to keep the students engaged?**

1. Encourage students repetitively to ask questions, both during lectures and tutorials. Also offer offline chat or discussion channels for questions which come up after the lecture or during tutorials.

2. Encourage students to form small online groups for joint learning or tell each other what they have problems with, and what/how they understood the different aspects. If students can clarify other students' doubts with their own words; that would be a very effective way of learning and beneficial for all parties involved. TUM Asia's classes, with the list of classmates distributed, makes this group building way easier than the bigger classes at TUM where students do not have a list of their classmates.

My bottom line is: The pandemic forced us to change and adapt our daily working processes abruptly. To my positive surprise, existing IT and Internet infrastructure allowed us to keep the “academic business” operational. We are very fortunate in comparison to other business sectors that are severely endangered in these times. We work differently, and we need to accept compromises, but overall, universities are well “in business”. Certain newly introduced processes, more web-based project meetings, or enhanced lectures with selective video material in order to discuss the content later with students in the classroom (flipped classroom), will certainly be kept by me for post-COVID-19 times (hopefully coming soon)!

# INTERVIEW WITH MR ANDREAS HERMANUTZ



Mr Andreas  
Hermanutz,  
Assistant Faculty  
Head of Aerospace  
Engineering, TUM  
Asia

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We speak to our Assistant Faculty Head of Aerospace Engineering (AE), Mr Andreas Hermanutz, who is living the time of his life as he immerses himself in the science of Aerospace Engineering while inspiring the next generation of inquisitive students. Mr Hermanutz studied Aerospace Engineering at TUM and in 2014, he worked as a Research Associate at the Institute of Lightweight Structures under Prof. Baier. Andreas then continued his work at the Institute of Aircraft Design under Prof. Hornung. He is currently helming the role of Assistant Faculty Head of Aerospace Engineering at TUM Asia.

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## **What inspired you to be in the field of study?**

I think there are many points, but first and foremost, I am interested in engineering technology, especially when I am able to apply the engineering knowledge to fulfil highly complex tasks. In short, what inspired me was making the impossible possible.

## **How did you decide to study Aerospace Engineering?**

I think almost every Aerospace Engineer has an enthusiasm for flying in addition to a certain affinity for technology. The decision to become an Aerospace Engineer came rather late, in fact, I started studying Mechanical Engineering

at first. Since the basics are the same, there is no difference to me in the beginning. Then I noticed that my elective study subjects focused more and more on Aerospace Engineering due purely to interest. Accordingly, I then switched the study programme to be accredited as an expert in Aerospace Engineering.

## **What do you like best about teaching?**

I like inspiring motivated, curious, and ambitious students who want to walk the study path with me and learn new things. It makes me feel good when I can help the students achieve their goals, and see them successfully complete their Master's degree or go into their dream jobs.

### **What is the best way to study for your class?**

The best way to learn is by understanding the issues and not by memory. I am trying to teach the students fundamental knowledge and methods which can be applied to different Aerospace problems. When the students start their career in Aerospace, the examples from the lecture might no longer be applicable or up to date, but the fundamentals they have learnt could help them to be successful in solving new problems.

### **What strategies would be useful to do well in Aerospace Engineering?**

Solid fundamental knowledge coupled with a practical approach, and the mentality that “there’s no such thing as I can’t”. Those who do not accept the challenge have already lost.

### **What is the best thing about being an Aerospace Engineer?**

There are many things, but reading the question, somehow, I remember a story that happened a few years ago on a flight to Singapore. We ran into quite a lot of turbulence along the way and the passenger beside me was scared. I told her that I was an Aerospace Engineer specialising in wing loads. If I could be sitting there calmly, it would mean that everything was fine and that helped her calm down. As an Aerospace Engineer, you might be an all-rounder and sometimes even a psychologist.

### **What are you studying in your current research?**

Broadly speaking, one research topic is about elastic wing structures. With the latest generation of Boeing and Airbus aircrafts, it has already

become apparent that wings have become much more elastic. Anyone can check on this by looking out of the window during take-off. You may see that the wing tip does bend quite considerable upwards. The cause of this can be, for instance, new materials in combination with an extreme lightweight structural design. Another research example is high aspect ratio wings, which are designed to reduce induced drag to make flying more efficient. Due to the high elasticity, there are increased interactions with the air flow, which is extremely interesting in terms of both understanding and designing wings. In summary, I deal with simulations that correctly represent these phenomena in order to understand and study them better.

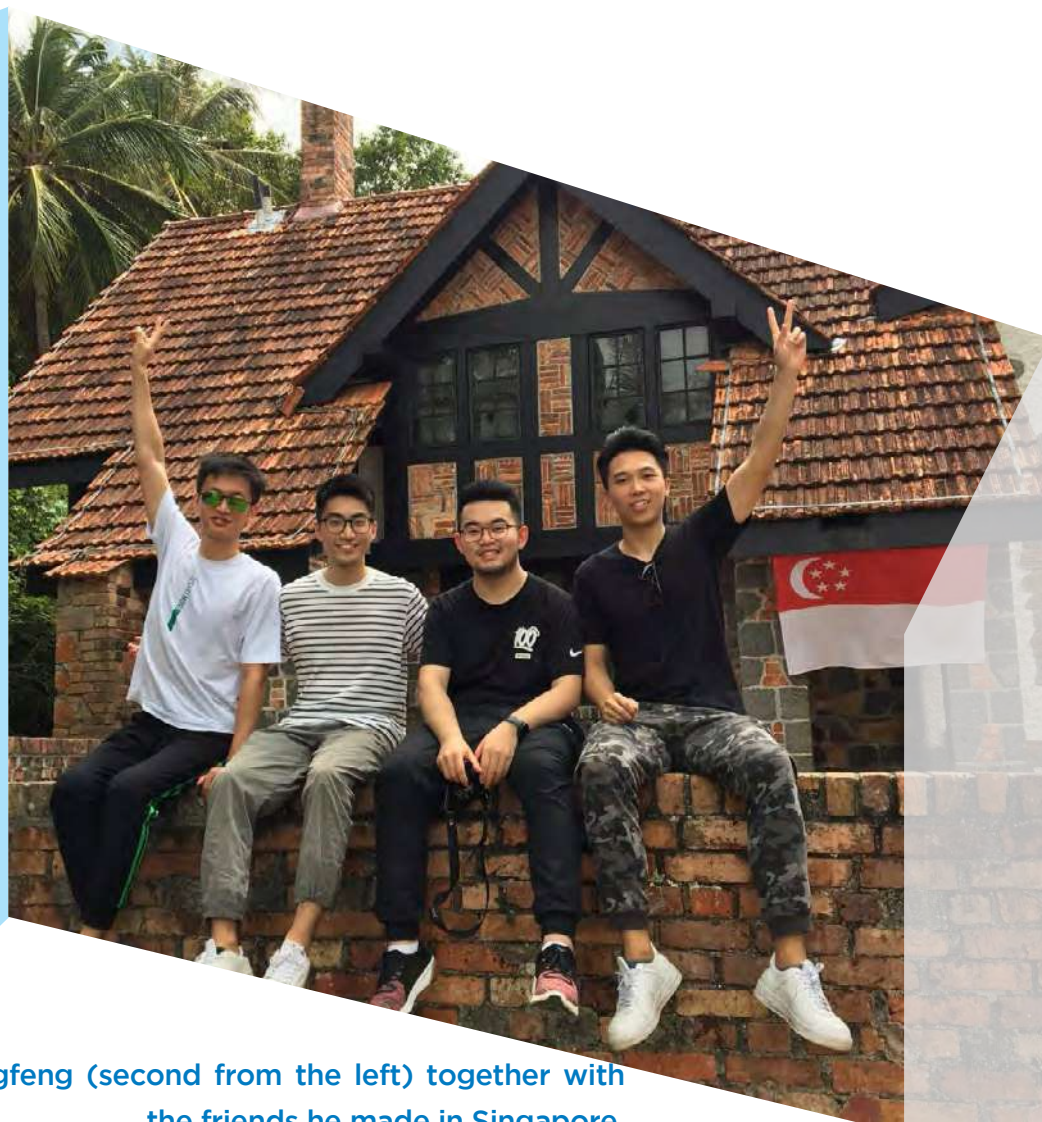
### **What is the one thing you would like to share to debunk some of the bigger myths of Aerospace Engineering?**

Oh, that is a good question. Whether it is right or wrong, I am a supporter of Gustav Weisskopf. With all due respect to the Wright brothers and their achievements, if there would be enough evidence, history would have to be rewritten and the first motorised flight would have to be credited to Gustav Weisskopf instead. At least I think so, because Gustav Weisskopf’s aircraft is a naturally stable aircraft in the sense of flight stability. The configuration of the Wright brothers is difficult to control, which was perhaps the reason why many trials did not work at the beginning. In the present day, we also have such configurations, but our advanced knowledge and computers can better stabilise aircraft with flight controllers.

► In his course of studying Mechanical Engineering, Mr Andreas Hermanutz found himself unwittingly developing interest in the AE topics.



# DIARY OF AN INTERN: MA GANGFENG, MSc IN INTEGRATED CIRCUIT DESIGN



▶ Ma Gangfeng (second from the left) together with the friends he made in Singapore.

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We have the privilege of having our Best Thesis graduate of MSc in Integrated Circuit Design, Mr Ma Gangfeng, pen his heartfelt thoughts after having spent nine months working at Intel as an intern. Here are his words.

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Sometime ago, I was chatting with my long-time friend in China when the topic of my learning journey at TUM Asia innocuously popped up. Initially I waved off the topic as there was little to share. With the rash of events that had happened – the onset of COVID-19 pandemic that turned to a full-fledged pandemic and drove many of us back to our hometown in China – my study experience seemed comparatively uneventful. Yet as I began to share, memories came unbidden. I realised, there were truly more remarkable memories than I had imagined.

**Striking an affinity with Singapore**

Two years ago, I enrolled in the Master of Science in Integrated Circuit Design jointly conferred by Technical University of Munich (TUM) and Nanyang Technological University (NTU). Comprising a year’s worth of classroom learning and nine months of internship and master’s thesis project, the study programme gave me a rare opportunity to learn from eminent professors from different parts of the world while gaining practical experience that would go a long way in boosting my credentials. It was precisely the opportunity to gain practical experience in the working world, that placed my fickle mind and heart to mastering this.

Singapore is not new to the semiconductor

industry. Comprised of design, packaging, manufacturing and testing field, the industry chain is really well-established too. Being heralded as one of the key pillars of the economy, the electronics industry accounted for over a quarter of Singapore’s manufacturing Gross Domestic Product (GDP) in 2017, with more than 2,900 key activities in semiconductor, consumer electronics and information technology. This is well-illustrated by the staggering number of international corporations who have chosen to establish their regional presence in tiny Singapore, including Intel, AMD, Marvell, Infineon, MediaTek, Xilinx, Global Foundries, etc. Although the semiconductor industry has moved beyond its heyday, there are still many promising career and internship opportunities available covering analog, digital and radio frequency. This course was perhaps, the missing piece I have been looking for to fit into the plan I have carved out for myself.

**Internship: a tumultuous ride**

Securing an internship is not difficult as there are many avenues to source from. While you can look for one yourself, you can also seek internship opportunities from TUM Asia or



**“It was precisely the opportunity to gain practical experience in the working world, that placed my fickle mind and heart to mastering this.”**

► **The time at Intel was a challenging yet an unforgettable one.**

**“More importantly, I was given a rare glimpse into the inner workings of a multinational corporation. It enabled me to appreciate the synergies between the various departments and navigate through the intricacies to pull off each and every project successfully.”**



professors since some companies might approach the school with opportunities for students. I guess I was quite lucky to have landed a spot at Intel with the help of my senior. Hearing lots of good things about the work culture and environment, I began my journey with trepidation and anticipation.

As the famous Chinese proverb goes, “plans cannot catch up with changes”. Months into my internship, there was a number of restructuring within the organisation. A couple of my supervisors were transferred to other departments while my department, mainly focusing on System-on-Chip (SoC) power analysis, dwindled to just myself and a specialist engineer. Being thrust into a foreign environment with little guidance, exacerbated by the abrupt organisational changes was a heady experience for me. I did my best to take things in my stride, and tackled every challenge head-on with every wit and courage I mustered.

Although my internship journey got off to a rocky start, I remained optimistic – if I could not change the situation, then I guess the only thing I could change was the way I dealt with it.

The silver lining was that my supervisors and colleagues were very nice to me. Even though I was a rookie, my supervisor was very patient as he listened to some of my lofty-often-bordering-on-impractical ideas and even helped arrange meetings with the relevant parties so that my ideas could be put into action.

It was not long before nine months flew past; and I managed to establish a proper SoC power analysis flow with advice from my colleagues and supervisors along the way, who schooled me through the various programming languages (Python), software and internal protocols and procedures.

Despite the uncertainties and foreign terrain I had to tread, I was still grateful to have had such an invaluable opportunity to learn and acquire technical skills and knowledge. More importantly, I was given a rare glimpse into the inner workings of a multinational corporation. It enabled me to understand the synergies between the various departments and navigate through the intricacies to pull off each and every project successfully.



# VIRTUAL GRADUATION CEREMONY 2020:

Class of **2020**



► Various esteemed guests, university partners, and professors shared their heartiest congratulations to the Class of 2020 online.

The Graduation Ceremony has always been one of the most highly anticipated events of the year. It bears the significance of the unique learning journey every graduate has taken with TUM Asia, and the culmination of the hard work and academic success of every student. This year, the Graduation Ceremony of Class of 2020 may have taken on a different space yet the meaning it held was no lesser.

**“Never fear  
to go beyond  
your comfort  
zone.”**

**Niu Ruixin  
Class  
Valedictorian,  
Master of Science  
programmes**



Streamed live on TUM Asia’s Facebook and Youtube channels, the graduation ceremony kicked off with a heartfelt message from Prof. Dr. Thomas F. Hofmann, President of Technical University of Munich (TUM), whose speech struck a chord in many graduates. Despite the grim outlook looming ahead, the message spoken by Prof. Dr. Wolfgang A. Herrmann, President Emeritus of TUM, touched the hearts of graduates as he spurred them on to further their studies so as to stay relevant and competitive in the evolving landscape.

Representatives from university partners such as Singapore Institute of Technology (SIT), National University of Singapore (NUS) and Nanyang Technological University (NTU) joined in the chorus of congratulations and gave words of inspiration that uplifted the spirits of many graduates.

2020 might have been a year of unprecedented times, yet in the midst of chaos, lies a reservoir

of opportunities waiting to be fulfilled. The speakers have hit the nail on the head with their words of wisdom.

The virtual ceremony continued with the conferment of the various degrees, beginning with Bachelor of Science in Chemical Engineering and Bachelor of Science in Electrical Engineering and Information Technology. Ms Wynn Koo, Class Valedictorian of the Bachelor of Science programmes, took the opportunity to thank her classmates and professors for all the support they have rendered thus far. Ending off her speech with a familiar drumming that signalled the end of yet another amazing lesson, it harked back to many fond memories that graduates shared.

Ms Niu Ruixin, Class Valedictorian of the Master of Science programmes, shared her life experience. Despite having graduated from Master of Science in Transport and Logistics, Ruixin chose to carve a career in programming



***2020 might be a year of unprecedented times, yet in the midst of chaos, lies a reservoir of opportunities waiting to be fulfilled.***

back in her hometown at Xi'An. Through her own life story, she hoped to encourage her fellow classmates to never fear to go beyond their comfort zones.

Mr Nitin Gokhale, Class Valedictorian of the Specialist Diploma in Advanced Digital Manufacturing programme, too, delivered a touching speech as he recounted his own life story of returning to the classroom after 24 years.

In unprecedented times like these, music can bring about hope, comfort and inspiration. The virtual rendition of Beethoven's famous composition, "Ode to Joy", led by Kahchun Wong, chief conductor of the Nuremberg Symphony Orchestra, did just that. Pieced together with submissions from world-class instrumentalists and singers across countries and continents, this virtual performance also featured 1,000 participants, including TUM's choir, singing to the renowned "Ode to Joy" segment of Beethoven's 9<sup>th</sup> Symphony.

The graduation ceremony ended with a walk down memory lane reviewing the fond corners and study spaces of TUM where graduates took delight in when they were in Germany.

We may have come from different corners of

the world and traversed different time zones, national and cultural spaces, but our passion to better the world and penchant for seeking new knowledge and learning experiences brought us together here at TUM Asia. From once doe-eyed students, our graduates have since grown, and emerged with deeper knowledge, newer skills and broader perspectives that will infinitely sail them through their next exciting adventure.

Congratulations once again to Class of 2020!

▶ **The graduates were also treated to a virtual performance of "Ode to Joy" - an assembly of local and overseas musicians to perform Beethoven's well-loved work.**



# HALL OF FAME: 2020

Class of

**Bachelor of Science in Chemical Engineering**



**KOO WEI JING, WYNN**  
Best Student



**CHEW YAO JUN, FREDDY**  
Best Thesis



**LEE SENG HWEE**  
Best Thesis  
This award is kindly sponsored by Rohde & Schwarz



**NICHOLAS LEONG WEI JUN**  
Best Student  
This award is kindly sponsored by Rohde & Schwarz

**Bachelor of Science in Electrical Engineering and Information Technology**

**Master of Science in Aerospace Engineering**



**GOKHALE ANUBHAV**  
Best Thesis



**MÜLLER LUCA ALEXANDER**  
Best Student  
This award is kindly sponsored by TUMCREATE



**LIM KEN CHOONG**  
Best Student  
This award is kindly sponsored by ASM Pacific Technology



**ZHANG YANJUN**  
Best Thesis

**Master of Science in Green Electronics**

**Master of Science in Industrial Chemistry**



**HUI JINGYUN**  
Best Student  
This award is kindly sponsored by DELO Industrial Adhesives (Singapore) Pte. Ltd.



**OSTUDIN ALEKSANDR**  
Best Thesis



**MA GANGFENG**  
Best Thesis  
This award is kindly sponsored by Intel



**RRAMA PADIYAR SIKHA PADIYAR**  
Best Student  
This award is kindly sponsored by Nations Innovation Technologies Pte. Ltd.

**Master of Science in Integrated Circuit Design**

**Master of Science in Rail, Transport and Logistics**



**PRASOMSUK NUTCHANON**  
Best Thesis  
This award is kindly sponsored by TUMCREATE



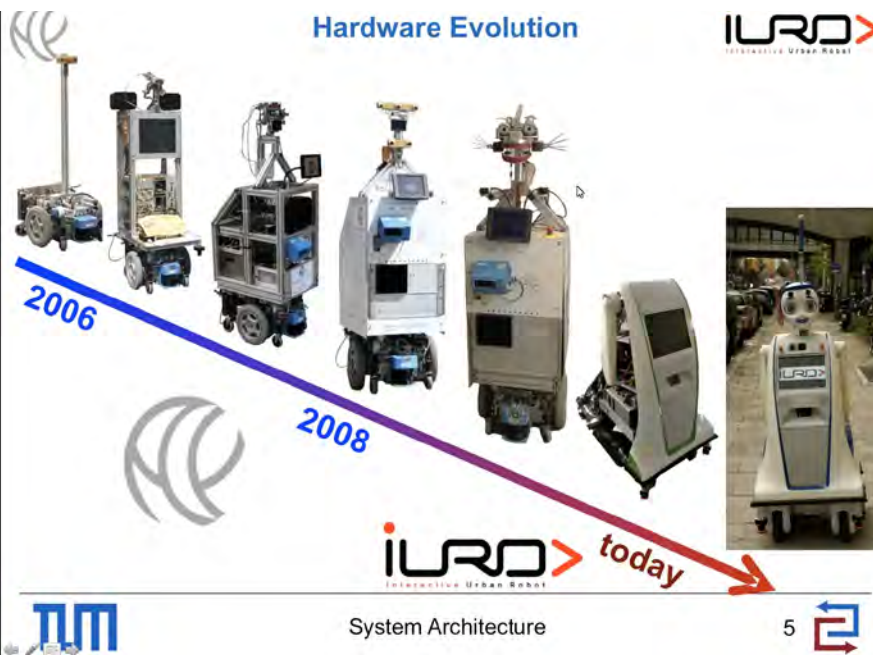
**NIU RUIXIN**  
Best Student  
This award is kindly sponsored by Emerson



**NITIN MADHUKAR GOKHALE**  
Best Student  
This award is kindly sponsored by Festo

**Specialist Diploma in Advanced Digital Manufacturing**

# LEARNING ABOUT ROBOTS OF TODAY: THE INTERACTIVE URBAN ROBOT IURO PROJECT



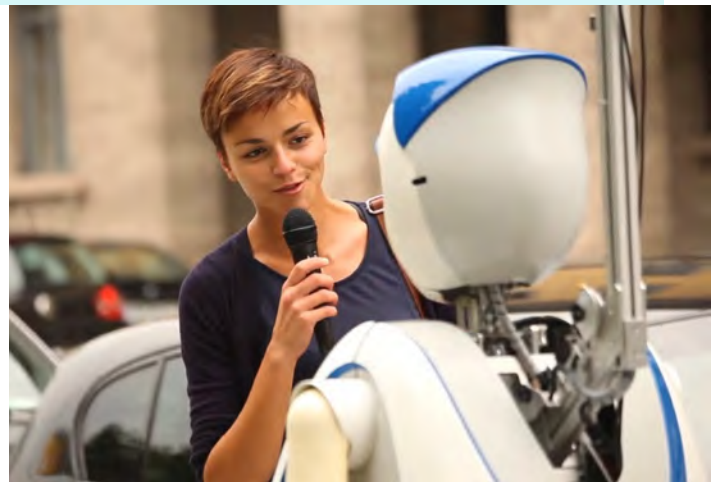
► Students of the German European School Singapore (GESS) were completely hooked on to the tale of the evolution of the Interactive Urban Robot.

The news of AlphaGo’s victory, an artificial intelligence programme, against the world’s best Go player, Ke Jie, took many by surprise. It was a mark of AI’s superiority over the human mind. Gone are the days where robots were designed to solely perform what they were tasked to do. Today, robots are designed to learn on their own. In TUM professor, Prof. Dr.-Ing./Univ. Tokio Martin Buss’ lesson for students of German European School Singapore (GESS), this particular robot that he and his team designed learnt to find its way to the centre of the city in Munich.

Finding our way to the city centre is not difficult for any of us – we just have to look at the map and follow the signs, or simply ask passers-by for directions along the way. But for this groundbreaking project, there were many considerations – both major and minute details – that had to be carefully evaluated and built into the robot.

Installing the hardware was one. Apart from fixing wheels and batteries to allow ease of mobility on roads, the robot was designed with human-like features such as animated lips to encourage passers-by to interact with it. In the midst of refining the robot’s design, Prof. Buss also shared that the team was careful to avoid designing it to look too human so as to

Source: All photos taken from IURO Project  
<http://engineering.accrea.com/iuro-robot/>



refrain from slipping into the “uncanny valley” phenomenon where people tend to be repulsed by robots’ uncanny resemblance to humans.

Over the years, the interactive urban robot underwent several makeovers as part of the refinements the team made as they unravelled some interesting social aspects. To encourage helpfulness in passers-by, Prof. Buss shared that the robot learnt to pick up some prosocial behaviours such as approaching passers-by from the side, picking up social cues like analysing the helpfulness of individuals through the intensity of their gaze, and instilling unique personality traits of the robot, to improve interactions.

Apart from this, the robot also learnt to handle miscommunications - when people provided contradicting instructions or wrong instructions - by asking another passer-by to correct the information received and running stochastic analysis to calculate the probability of the accuracy of the directions.

Despite being a virtual talk, it left many GESS students equally intrigued by the wonders of technology. It is exciting to witness the extraordinary feats that robots can accomplish in the future.



# TUM VIRTUAL DIALOGUE : THE NEW FRONTIER OF FOOD SAFETY IN INDUSTRY 4.0



Prof. Dr. Michael Rychlik  
TUM School of Life Sciences,  
Technical University of Munich (TUM)



Dr. Alson Chng  
Assistant Faculty Head (Chemistry),  
Technical University of Munich (TUM) Asia



Associate Professor, Huang Dejian  
Department of Chemistry,  
National University of Singapore (NUS)



Dr. Thorsten Clausing  
German Embassy Singapore

TUM Asia participated in the first-ever TUM Virtual Dialogue 2020, with the dialogue topic as the New Frontier of Food Safety in Industry 4.0. The speakers included Prof. Dr. Michael Rychlik, Technical University of Munich (TUM); Associate Professor (A/P) Huang Dejian, National University of Singapore (NUS); with TUM Asia's Assistant Faculty Head, Dr Alson Chng, as the moderator.

The TUM Virtual Dialogue 2020 drew to a successful close convening some of the eminent speakers in the food safety and technology field where they addressed poignant issues that closely revolve around Singapore.

Amid bouts of intense discussion, participants were given an incisive portrait of the food safety landscape in the context of Singapore and Europe by A/P Huang Dejian, and Prof. Michael Rychlik.

Dr. Thorsten Clausing from the German Embassy of Singapore, delivered the opening speech and provided a succinct overview of the opportunities and challenges that arise in the food safety landscape.

"I grew up in a small village of Northern Germany. When I went to school, I would see little piglets basking in the sun at the side of the road and there would be chickens running around the road. Throughout the years, the way food is put on our table is pretty much unchanged. But with the Industry 4.0 revolution, this has changed dramatically," said Dr. Clausing in his opening speech.

## Relevance of food safety and technology in Singapore's context

In a country like Singapore where food is heavily imported, A/P Huang lauded Singapore for

its assiduous efforts in ensuring food safety throughout its food supply chain. Yet the rules of the gameplay have changed dramatically. As the goal to realise 30% of local food produce by 2030 is set in motion, Singapore faces a plethora of opportunities and challenges - how is Singapore going to produce so much food locally where land is extremely scarce? This challenge is exacerbated by the uncertainties of how the usual food safety regulations are keeping the latest food inventions in check. The answer naturally points to technology.

A/P Huang elaborated that technological breakthroughs in the development of lab-grown meat, indoor farming, and more, has not only resulted in better food, it has also helped Singapore to overcome its biggest challenge - land scarcity, enabling the country to move in leaps and bounds closer to its goal.

### Impact in technological advances in food toxicology and safety

In the years of mankind studying the nature, properties, effects and detection of toxic substances in food and their disease manifestation in humans - food toxicology - the relationship between food and humans continue to play a complex role. Micro-toxins and other contaminants continue to be a concern in food safety. However, scientific advances such as the use of fast screening method of raw materials, has given the food industry the window of opportunity to select the right materials to produce food, and even be free of micro-toxins.

More burning questions had arisen: Are there adequate safety assessments of novel metabolites? Are these products of the same exact quality as its original twin?

With COVID-19 accelerating the adoption of digitisation, there were concerns if online grocery stores faced the same amount of scrutiny that ensured the integrity, authenticity, safety of food. Providing a secure yet globalised food supply chain is an intricate balancing act that not only Singapore, but other mega cities also have to perform continually.

### Incorporation of technology in the global food system

Echoing the same views as Prof. Rychlik, A/P Huang also explained that as the relationship between humans and food, as well as the nature of food are extremely complex, it can be

challenging to correlate the causes and effects. In addition, chronic toxins or toxic compounds may be present in food and can take many years to act.

Currently, agriculture and food are fairly separated industries. With the new way of producing food, A/P Huang is optimistic that there would be more synergy as these industries work closer than before. This would benefit consumers in the long run as transport costs would be reduced, hence minimising cross contamination when food is being transported from place to place.

### Organisational readiness for future trends and needs in the food industry

To stay ahead of these novel food trends, companies need the expertise, skills and competencies of food safety experts. As leading learning institutions, TUM and NUS are at the forefront of nurturing the next generation of food safety leaders in charting a sustainable future in food safety and technology. In view of this, TUM has also set up the TUM Institute of LifeLong Learning to foster a culture of lifelong learning in its students so as to keep pace with the scientific advances.

Not every job has withstood the test of time. As the world continues to progress, technology becomes a springboard for greater success to overcome the evolving challenges of tomorrow. "There is nothing to fear with technological advancements as people would still be required to assume roles and responsibilities that technology cannot," commented Prof. Rychlik.

The screenshot shows a presentation slide with the title "Technology in the Global Food System". The slide features a diagram of a globe with red and blue lines representing trade routes and a central cluster of red dots. Below the diagram, the text reads: "Technology is the basis for a global trade system, but Globalization vs. Resilience: Local solutions required, e.g. urban farming Flexibility required for supply chains". The TUM logo is visible in the bottom right corner of the slide. A small video inset in the bottom right corner shows Prof. Rychlik speaking.

▲ Prof. Rychlik shares how globalisation has become a double-edged sword. With the advent of technology, how has it come into play in solving some of today's challenges?



**Prof. Dr. Michael Rychlik, TUM School of Life Sciences,  
Technical University of Munich (TUM)**

**Novel solutions addressing challenges of tomorrow**

One of the novel solutions that has arisen to address the challenge of food safety is big data management. As a new analytical method, big data could be leveraged to monitor exposure to toxins, food quality and even the entire food supply chain, which enables users to identify the exact food source.



With every laboratory having their own foodomics, and diverse analytical methods, Prof. Rychlik called for standardisation in food safety. He illustrated his point by sharing about an initiative in Europe, the METROFOOD-RI, which provides high level metrology services to enhance food quality and safety, and support the traceability and sustainability of the agri-food systems, in view of a circular economy.

**Future trends of food industry**

Prof. Rychlik shared that consumers today are able to order and customise food at the comforts of their home. As consumers continue to be in the throes of digital transformation, it will not be long in the foreseeable future before complete personalisation of food according to our palate and diet is readily available and accessible.

Prof. Rychlik also added that traditional food processing technology and techniques would be continually refined to reduce or even substitute critical components with safer ingredients.

**Associate Professor Huang Dejian, Department of Chemistry,  
National University of Singapore (NUS)**



**Incorporation of additive manufacturing in food**

Additive manufacturing is highly popular due to its ease of customisation and formulation of food according to individual's preference and nutritional requirements. On the other hand, additive manufacturing raises concerns in terms of food safety. With additive manufacturing being a vastly unconventional food preparation method, there is no established playbook to regulate it.

A/P Huang posited that additive manufacturing might yet to be suitable for mass consumption as the current technology only allows food to be 'printed' one serving at a time. However, additive manufacturing is extremely useful and cost effective for food manufacturers to create prototypes as it can control parameters and optimise ingredients.

# THE UNITED FIGHT AGAINST COVID-19

*The COVID-19 pandemic has upended the lives of many with devastating effects on the global health and economy. In this period of uncertainty, TUM Asia has launched free alumni credits to encourage its students to continue to upgrade themselves through lifelong learning. While many are still reeling from the repercussions of the pandemic, how has TUM continued to push the frontiers of science as they collaborated to learn more about the unknown SARS-CoV-2? Find out more here.*

A research team which includes Prof. Dr. Mikael Simons of TUM recently published findings in the journal "Science" on the protein neuropilin-1, that facilitates SARS-CoV-2 cell entry. Such findings would be important in understanding the spreading of SARS CoV-2, the virus that causes COVID-19.



Kinexon, a start-up founded by graduates of TUM, develops hardware and software that traces the movements of athletes, but which can also be used to automate production processes in the industry. Using ultra-broadband technology to facilitate more precise timing and distance measurements, the system issues a warning in case of inadequate social distancing, and which also supports contact tracing.



Funded by the Bavarian Research Foundation (BFS) with around €1.5 million, TUM is starting five new research projects that focus on the coronavirus and the search for new active ingredients.

The Bavarian Ministry of Science established the Bavarian research alliance FOR-COVID as a response to the coronavirus SARS-CoV-2. Providing about €800,000 in funding, several prestigious universities including TUM will be participating in this endeavour.

Viruses are infectious organic structures that spread by transmission and can only multiply within a suitable host cell. To understand how new viruses are created, it is necessary to determine the position of the individual genes precisely and comprehensively and to clarify what these genes do. A research team at TUM has found a previously hidden gene that may have contributed to the unique biology of SARS-CoV-2 and thus to its rapid spread.



## Free Alumni Credits for Students of TUM and TUM Asia amidst Pandemic



TUM Asia launched its free alumni credits to boost the skills and competencies of its alumni in technology-related skills, enabling them to stay ahead of the evolving landscape - a crucial lifeline to boost one's competency level amidst the pandemic. All TUM and TUM Asia alumni regardless of nationality, are awarded a one-time course credit worth \$1,500. This can be used to offset up to 50% of course fees from a curated suite of executive education courses aimed to address new and emerging needs of the economy.

## Keeping COVID-19 at Bay at TUM and TUM Asia



Employees of TUM and TUM Asia, whose job activities are suitable for remote working and where on-site presence is not required, remain working from home as a rule to minimise the risk of widespread emergence of COVID-19 in the community. Online instruction during lockdown - examinations and other deadlines were extended for the winter semester (More on studies, teaching and examinations: [www.tum.de/corona/studies](http://www.tum.de/corona/studies)). All employees and students are encouraged to use the Corona-Warn-App of the Robert Koch Institute at TUM or TraceTogether App at TUM Asia.

Source: Technical University of Munich  
<https://www.tum.de/en/about-tum/news/coronavirus/>

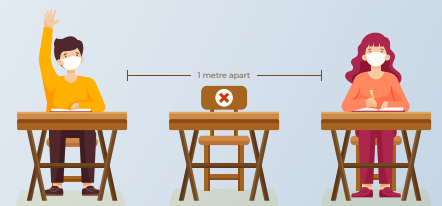
## Keeping COVID-19 at Bay in Singapore



Learning is mostly conducted remotely.



Masks are worn at all times except when eating or drinking.



Safe distancing (1m apart) measures are implemented at all times.



Community contact tracing is done via TraceTogether app.



Handle Door

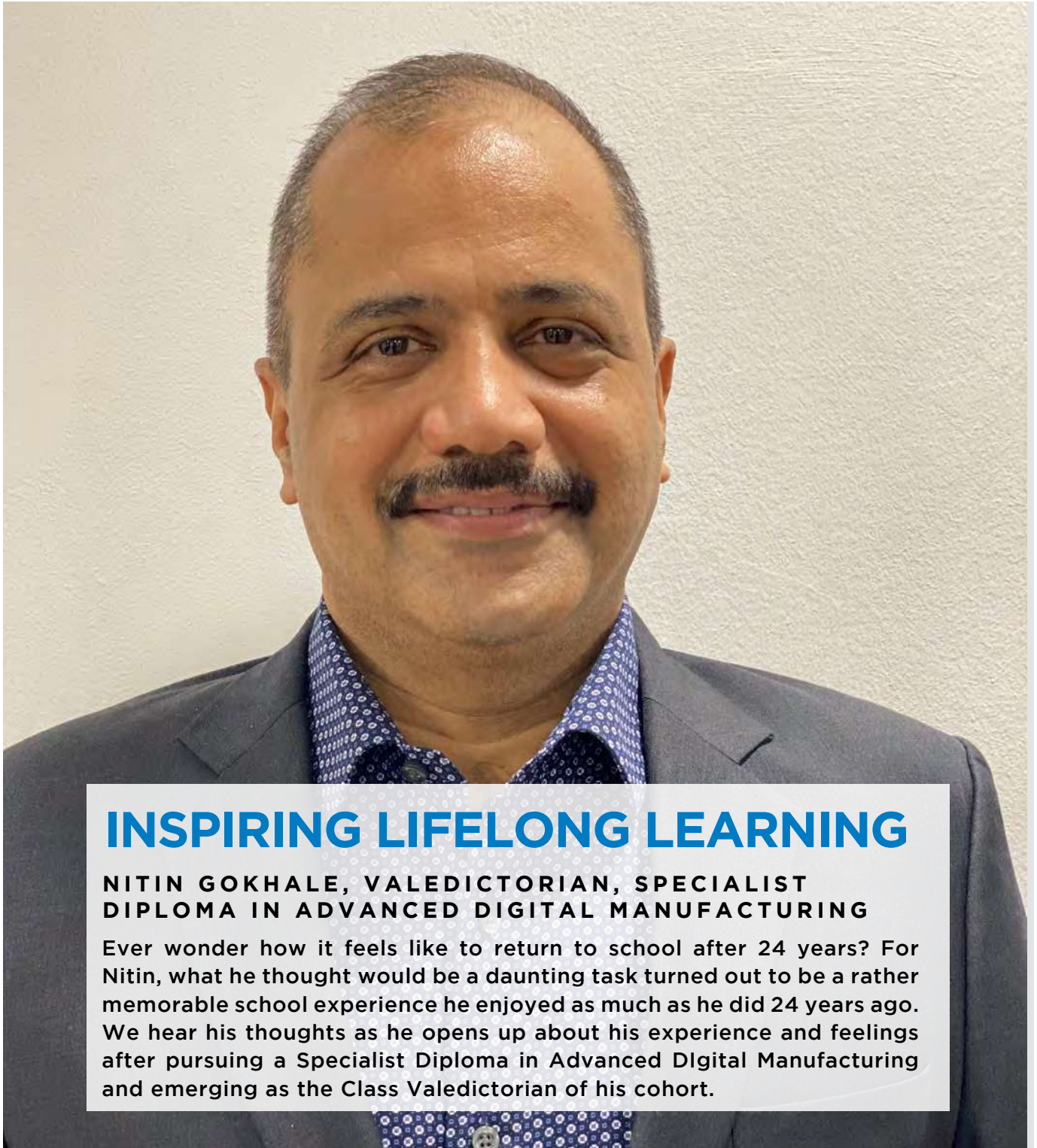


Lift



Elevator

Frequent cleaning, disinfecting and sanitising of common areas.



## INSPIRING LIFELONG LEARNING

**NITIN GOKHALE, VALEDICTORIAN, SPECIALIST  
DIPLOMA IN ADVANCED DIGITAL MANUFACTURING**

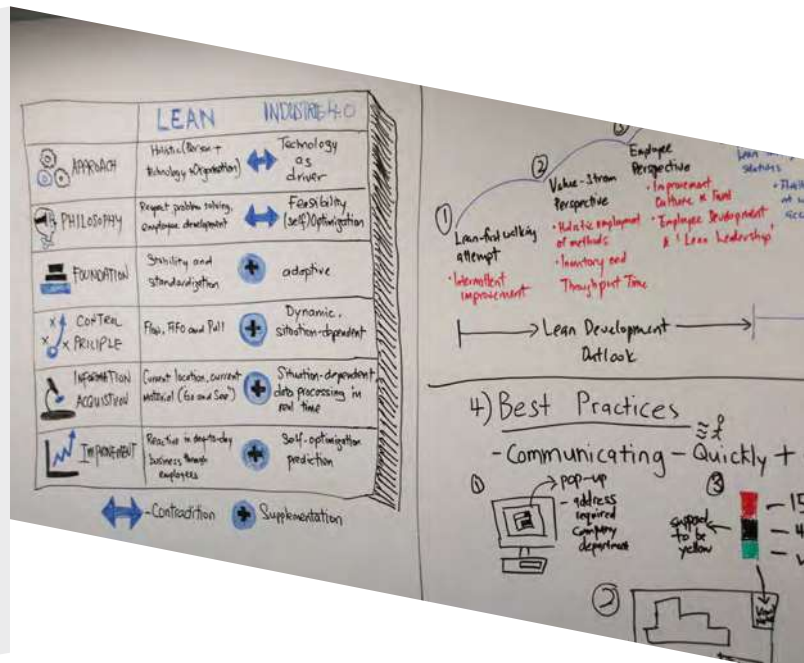
Ever wonder how it feels like to return to school after 24 years? For Nitin, what he thought would be a daunting task turned out to be a rather memorable school experience he enjoyed as much as he did 24 years ago. We hear his thoughts as he opens up about his experience and feelings after pursuing a Specialist Diploma in Advanced Digital Manufacturing and emerging as the Class Valedictorian of his cohort.

I would like to begin by saying that I am extremely grateful and thankful for the opportunity and time spent in acquiring the knowledge and expertise in this course.

I am Nitin Gokhale and I am a Business Solution Architect at Cisco Systems APJC Manufacturing and Oil and Gas. It might seem odd - why would a Business Solution Architect

be pursuing a Specialist Diploma in Advanced Digital Manufacturing? Well, as a Business Solution Architect, I might have the expertise in technology, but I lacked the manufacturing experience. Due to that, I was unable to effectively communicate with factory managers and resonate with them. I wanted to find a programme that has a good balance between core manufacturing and technology that allows

“Not only had I learnt about the theoretical aspect that the course aimed to deliver, I had also developed a sense of camaraderie with my teammates, who eventually become my bosom friends. It felt no different from my school days.”



me to help factory/manufacturing managers see how technology can solve real manufacturing problems, in order to get buy-in and succeed in the Industry 4.0 digital transformation. In addition, I wanted to upgrade myself and keep myself on par with the job demands of today. Thus, I did not waste a second and started looking at programmes and courses that would help me to achieve this goal of mine, especially since I am a great believer of this famous quote that goes, “we keep learning till our very last breath”. Soon enough, I stumbled upon this course and after knowing what I would gain from this, I enrolled myself in. To my surprise, it was not so much of fear I felt, it was more of a nostalgic feeling that brought me back to my student life days.

I still remember how nervous I was when I stepped inside the lecture theatre for the first time. The last time that I was in a lecture theatre was 24 years ago back when I was in university with my friends. At that point in time, there were many questions going on in my head. Will I be able to even concentrate? Will I be able to balance my work and studies?

Thankfully, my lecturers were very warm and welcoming. My classmates became really good friends throughout those nine months of the course. We would work together, learn from each other, teach one another and make sure that we progress as one. As the days went by, I was very much in awe with what the lecturers had taught. The lecturers for each module - manufacturing management, cyber physical systems, advance manufacturing systems from TUM Asia - were extremely knowledgeable in their field of

study. I have never met such a passionate and knowledgeable team of educators who have such solid experience in the industry in my life. I would like to thank these lecturers for spending the time to make sure that we understood the course materials, and for putting in their genuine efforts in helping my classmates and I learn and better understand the concepts and theories. I really look up to them.

I am a very hands-on person. I learn better when I visualise and do things practically. This course has definitely helped me to explore my strengths. I truly enjoyed the practical sessions. They were so interactive, it almost felt like my lecturers and I were having a casual conversation rather than a traditional student-teacher interaction. One project that stood out to me was the project at Festo. It was such an eye-opening experience that I felt I had learnt so much just by being there. I would like to thank and appreciate those who made these practical sessions possible.



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*“As a Business Solution Architect, I might have the expertise in technology but I lacked manufacturing experience. Due to that, I was unable to effectively communicate with factory managers and resonate with them. I wanted to find a programme that has a good balance between core manufacturing and technology that allows me to help factory/manufacturing managers see how technology can solve real manufacturing problems, in order to get buy-in and succeed in the Industry 4.0 digital transformation.”*

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Overall, the environment of the classroom became full of life, filled with questions, discussions, positivity, curiosity, and knowledge gained. Not only had I learnt about the theoretical aspect that the course aimed to deliver, I had also developed a sense of camaraderie with my teammates, who eventually become my bosom friends. It felt no different from my early school days. I would go for class, no matter how far I travelled, or how tired I was from work. The positivity would keep my mind going, knowing my aim and goal were getting closer and closer, day by day.

I would like to take this time to give a special shout-out to my project team members for making my study experience such an unforgettable one. I have learnt so much from all of you and I hope I was able to teach you something as well. I hope you are flourishing well and are successful, not only business-wise, but also as an individual.

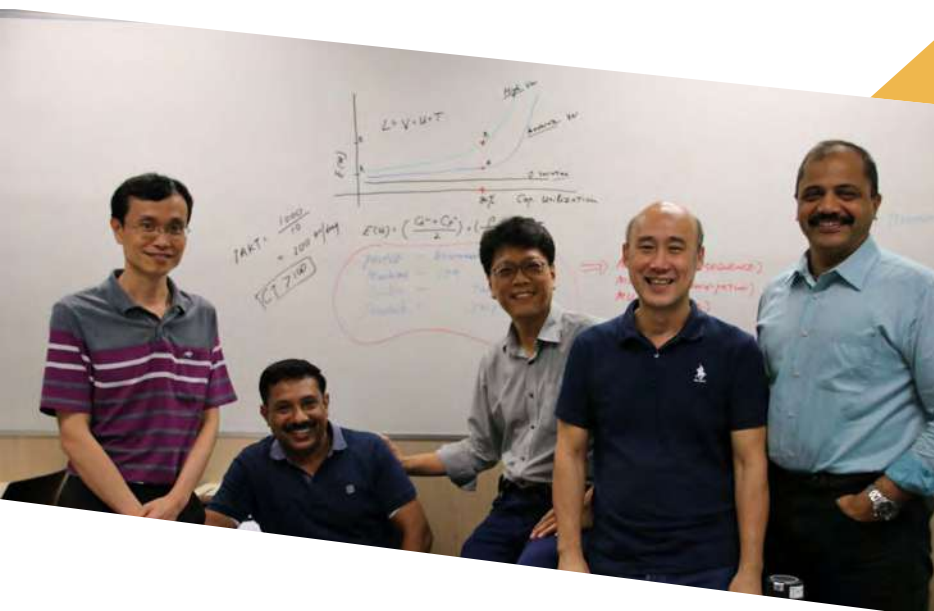
Balancing my career and studies was undeniably challenging. There were days I would be out of Singapore with assignments to complete and business meetings to attend. However, I pressed on for I knew that this course would bring me much value.

Those nine months had been one of the most wholesome, wise, valuable, and knowledgeable experiences in my life. I am happy that I got a chance to attend this course with such amazing people from all walks of life and was able to share a personal bond with my lecturers. It has been an honour being their student and I hope the feeling is mutual. I hope we will continue learning and never stop changing for the better.

All the very best to all of us and once again, thank you for giving me the opportunity to address this on behalf of the cohort. It has been my utmost pleasure!

**“The environment of the classroom became full of life, filled with questions, discussions, positivity, curiosity, and knowledge gained.”**

▶ Learning never stops: Nitin together with his teammates.



# AN ONGOING QUEST FOR KNOWLEDGE



**Aleksandr Ostudin, Best Thesis graduate, MSc in Industrial Chemistry together with Professor Khan, NUS, and his laboratory group members**

**For Aleksandr Ostudin, Chemistry is not simply a subject of interest. If passion could be measured in scales, then Aleksandr's passion for Chemistry would certainly have topped the charts. Since young, he has always aspired to be at the forefront of generating new knowledge and braving new frontiers in the field of Chemistry, specialising in Industrial Chemistry.**

Pursuing a Master of Science degree in the same field of study upon his graduation from Gubkin University of Oil and Gas, is a natural course that would stretch Aleksandr's life into wonderful alignment.

"I've always wanted to further my studies in Industrial Chemistry. This is also why I took more elective modules of my own volition to understand more about the mysteries of the world," quipped Aleksandr.

## **Singapore as the destination of study**

As a global hub for innovation, Singapore presents itself as an attractive choice of study destination for international students. Regarded as an

innovation hub at the leading edge of modern businesses, Singapore is also home to world-class autonomous institutes and research centres. In the latest Global Innovation Index, Singapore retains the top spot as one of the most innovative nations in Asia Pacific.

"Asia sounded exotic to me, evoking a starkly different culture from the European region. It is exciting to be studying here and witness how the future turns out. Besides, I find that the programme has a good balance of management and technical modules. It also has a good focus on catalysis, which is a huge draw for me because I am really interested in catalysis. We rely on catalysts to make everything. It is involved in every chemical process and undergirds the human civilisation," explained Aleksandr.

## Striking an affinity with Microfluidics

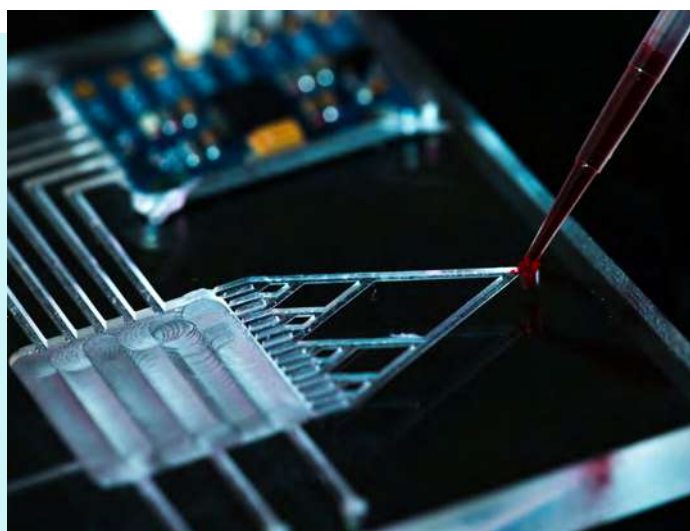
Despite having a deep interest in catalysis and its applications, he chose to do his thesis on microfluidics instead.

A learned professor at the department of Chemical and Biomolecular Engineering in National University of Singapore (NUS), Professor Khan left an indelible impression on Aleksandr with his deep knowledge and expansive research on microfluidics. His passion for microfluidics is visibly imbued in his teaching as he brought his lessons to life with his insights and findings.

“Attending his lessons was like a holiday to me. During one of his lessons, I thought of an idea and pondered on it for a week before presenting it to him. He was so delighted with my idea that he asked me if I would like to work in his lab!” Aleksandr said, as he recounted fondly.

Microfluidics is the study of systems that can process small quantities of fluids by using tiny channels, having dimensions at the microscale. Despite it being in its nascent stage, microfluidics is rapidly emerging as a breakthrough technology that finds applications in diverse fields ranging from biology and chemistry to information technology and optics.

“Because of its precise nature, microfluidics enables the manipulation of small volumes of fluid, but it is not designed to be mass produced. My thesis was about creating multiple microfluidic environments in one big environment so that we could potentially scale up the production of fluids without altering its environment. It is interesting to observe how chemicals react in such an environment,” Aleksandr explained.



Aleksandr’s work with Professor Khan on microfluidics has garnered him the Best Thesis in MSc in Industrial Chemistry in 2020, at TUM Asia.

## Finding enjoyment in learning

The traditional educational paradigm of simple knowledge transfer from teacher to students may still be predominantly used in classrooms but professors take an effort to engage students in meaningful conversations that spark a healthy exchange of ideas and fresh new perspectives. This was the case with Prof. Dr. Johannes A. Lercher, Technical University of Munich (TUM), who taught Petroleum and Petrochemical Processes.

“I enjoyed the lessons with Prof. Dr. Lercher a lot. Attending his lessons feels a lot like having a conversation with my friends over some drinks,” quipped Aleksandr.

With his master’s degree in hand and passion in tow, it is thrilling to imagine the adventure that Aleksandr will embark on from hereon.

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## ALEKSANDR OSTUDIN

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*“I find that the programme has a good balance of management and technical modules. It also has a good focus on catalysis, which is a huge draw for me because I am really interested in catalysis. We rely on catalysts to make everything. It is involved in every chemical process and undergirds the human civilisation.”*

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# SOARING BEYOND AIR-CRAFT DESIGN

Chan Teng Hooi, MSc in Aerospace Engineering student



When the topic “Aerospace Engineering” comes to mind, many of us would think of design and construction of an aircraft or maybe a spacecraft. Few would connect it to Robotics - a niche area that becomes one’s calling in the midst of the COVID-19 crisis.

Despite working for two years as a Marine Fender Engineer after graduating from Embry-Riddle Aeronautical University, Teng Hooi’s fervour for Aerospace Engineering remains unabated. “My passion for Aerospace Engineering never faded. I have always wanted to be a part of the industry. At that point in time, a Master of Science degree in Aerospace Engineering seemed to be a very good choice for me. When I chanced upon the joint degree

in Aerospace Engineering by Technical University of Munich (TUM) and Nanyang Technological University (NTU) Singapore, I applied without hesitation!” Teng Hooi recounted fondly.

The learning journey for the last two years was not easy. Yet for Teng Hooi, it was an exceptionally rewarding one. “It opens up several doors of opportunity for me, which enables me to explore

various fields of study and deploy different disciplines to provide a sound solution,” Teng Hooi elaborated.

Traditionally, master’s students work on a thesis – a compendium of research devoted to a topic of interest – as a rite of passage into the completion of their learning journey. While most students work with their professors from school on their thesis, Teng Hooi had the fortuitous opportunity to expand his horizons working with Professor Henrik Hesse from University of Glasgow, Singapore, on his topic of interest: 3D scanning of building interiors using drones.

### The hard work begins: 3D localisation and mapping

Determining the measurements of large structures such as buildings, is one of the formative steps in doing any construction work, be it restoration, documentation, or archeological study. While measuring every nook and cranny itself can be a laborious task, technology has enabled this essential piece of work to be almost an effortless one through the deployment of 3D scanning with robots. One of the more common types of 3D scanning techniques involves Light Detection and Ranging (LIDAR) – using pulsed laser to measure ranges to the surrounding objects. A 3D representation of the environment can then be constructed and stored in the form of point clouds.

“This technology is relatively new yet crucial as it enables 3D mapping to be carried out accurately by autonomous robots,” Teng Hooi added.

### Finding opportunities in the midst of crisis

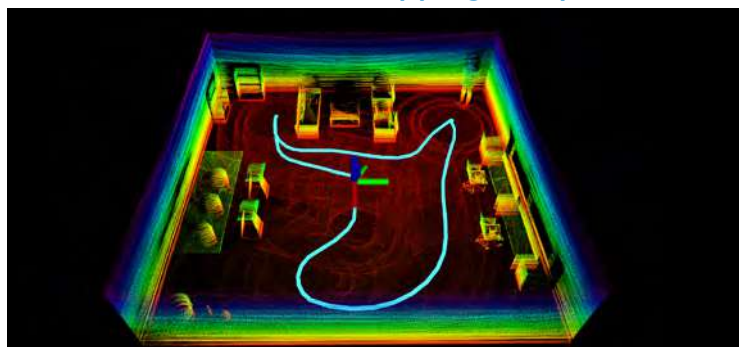
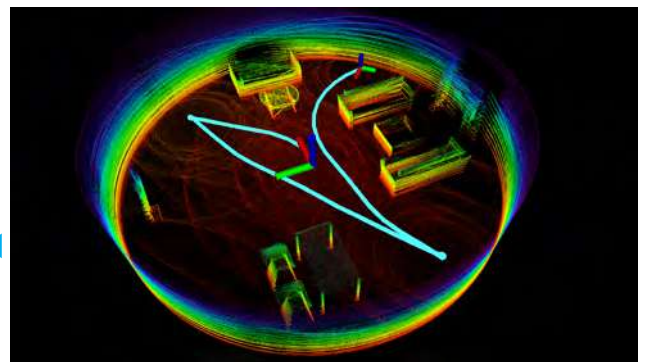
In retrospect, his final thesis was different from how he envisioned it. Teng Hooi initially wanted to use drones to perform 3D simultaneous localisation and mapping, but the pandemic has put that plan to a halt. This change in plan ultimately worked to his favour, as it offered him a window of opportunity to delve deeply into other fields of study.

“We used simulations instead to perform 3D simultaneous localisation and mapping. As the world evolves to an increasingly complex and interconnected one, what we learn in Aerospace Engineering and Computer Science, can also be applied across Robotics,” explained Teng Hooi.

With Industry 4.0 upon us, it brought Internet of Things (IoT), big data, and digitisation into various spheres of our lives. Measurements of indoor environments could be done even smarter by deploying autonomous robots to perform such tasks. Teng Hooi’s findings had straddled some of the latest technological advances, which can improve the way 3D simultaneous localisation and mapping is performed.

And his hard work certainly paid off; his extensive research in his thesis helped lay the

Teng Hooi’s findings had straddled some of the latest technological advances, which can improve the way 3D simultaneous localisation and mapping was performed.



*“We used simulations instead to perform 3D simultaneous localisation and mapping. As the world evolves to an increasingly complex and interconnected one, what we learn in Aerospace Engineering and Computer Science, can also be applied across Robotics.”*

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▲ Teng Hooi (middle, in a blue top), together with his MSc in Aerospace Engineering classmates.

essential groundwork for his paper on indoor 3D simultaneous localisation and mapping, which has been accepted for the 2021 7<sup>th</sup> International Conference on Control, Automation and Robotics. In Teng Hooi's research, he evaluated the performance of state-of-the-art LiDAR-based approaches for 3D simultaneous localisation and mapping (SLAM) in indoor environments, with the aim of developing methods for real-time 3D scanning of building interiors. A simulation framework using ROS and Gazebo has been implemented to compare different methods based on LiDAR odometry and mapping. The featureless environments typically found in interiors of commercial and industrial buildings pose significant challenges for LiDAR-based SLAM frameworks, resulting in drift or breakdown of the processes.

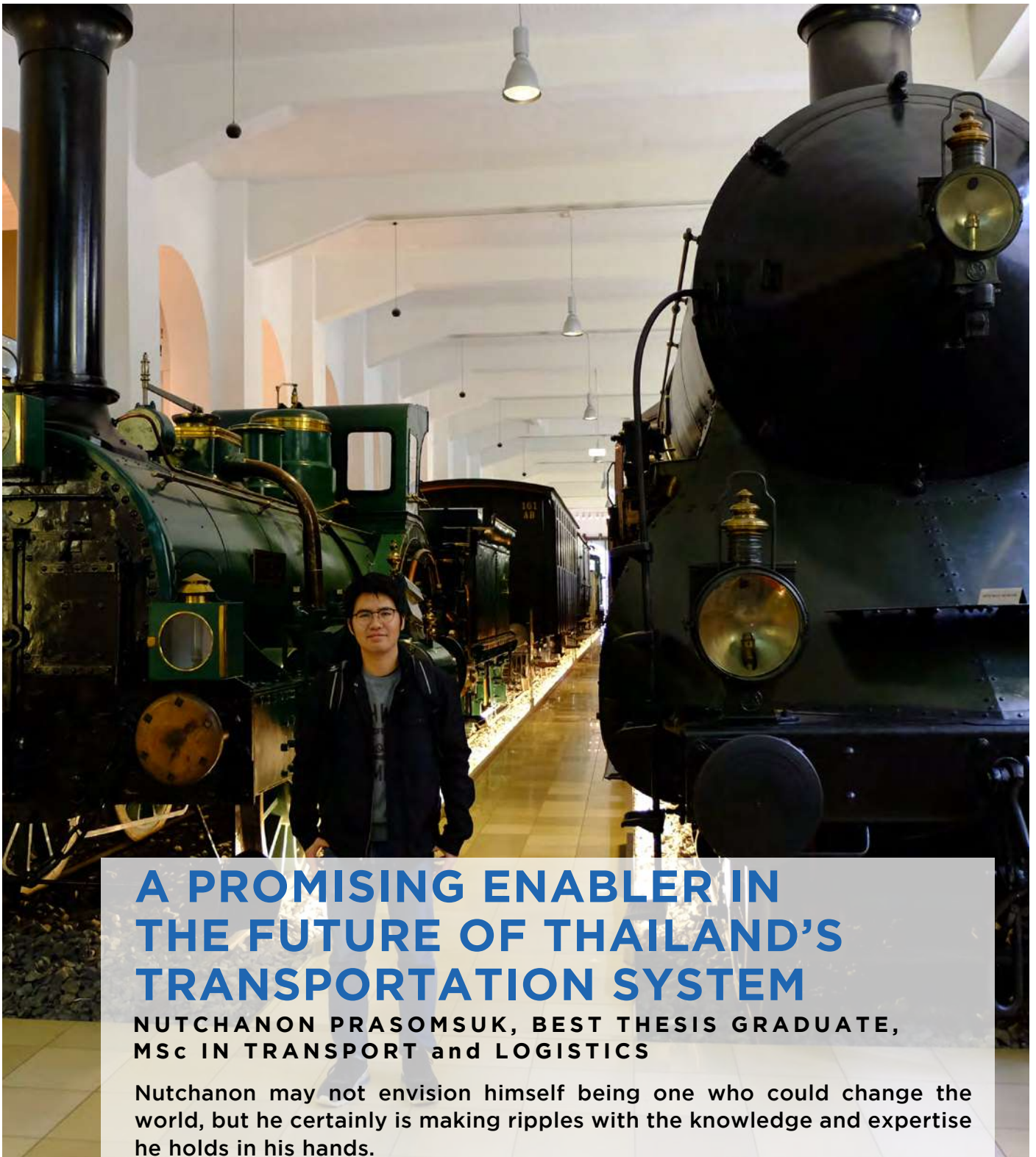
The results from this paper provide performance criteria for indoor SLAM applications, comparing different room topologies and levels of clutter. The modular nature of the simulation environment provides a framework for future SLAM development and benchmarking specific to indoor environments.

#### **A launchpad to greater success**

Co-sponsored by IEEE Robotics and Automation Society and to be held in April 2021, the 2021 7<sup>th</sup>

International Conference on Control, Automation and Robotics would be convening some international experts in the field of Robotics and automation for technical communications to present the latest findings and technological breakthroughs through presentations and online discussion. Teng Hooi would also be presenting his then. To him, the opportunity to present his own hard work is as good as success itself. It is a mark of the dawn of his career, serving as a launchpad to propel his career forward. It would enable him to connect with like-minded experts from other parts of the world too. More importantly, his research would ultimately benefit others in the field of Robotics.

With such dedication from Teng Hooi, we would be sure to hear more insights from him that would no doubt leave an indelible mark in the field.



## A PROMISING ENABLER IN THE FUTURE OF THAILAND'S TRANSPORTATION SYSTEM

**NUTCHANON PRASOMSUK, BEST THESIS GRADUATE, MSc IN TRANSPORT and LOGISTICS**

Nutchanon may not envision himself being one who could change the world, but he certainly is making ripples with the knowledge and expertise he holds in his hands.

After graduating from Mechanical Engineering, Nutchanon Prasomsuk, or endearingly called "Phai" by his friends, was offered a scholarship to continue his studies specialising in Railway Engineering. As part of the Thailand Transport System Development Strategy (2017-2036)

master plan, the country is set to increase its connectivity systematically within sub-regional frameworks and in ASEAN countries, and to strengthen its domestic networks, hence bringing people closer together.

*“I think it is a rare opportunity to be able to experience two starkly different cultures – the Asian culture in Singapore and the European culture in Germany. The different transportation systems and idea behind them are also very interesting and good practical lessons. It was an unforgettable learning journey for me.”*



For Nutchanon, the nation’s master plan in beefing up the transport capability has brought a desire in him to contribute and improve the nation’s railway transportation systems in his own capacity. Germany becomes a great stage possessing great wealth of engineering knowledge upon which he can learn from.

### **Imbibing the spirit of German Engineering**

To truly imbibe the spirit of German engineering and the technological intricacies in Railway Engineering, Nutchanon spent a year in Germany to first master the German language.

While he was at Germany, he searched for the ideal study programme. Choosing a master’s degree programme that offers a winning trifecta - broad-based knowledge with specialisation, skill development, and industry-relevant experience - was a priority for him. He wanted to specialise in Railway Engineering and fancied a course that could connect this new field of study with his previously acquired knowledge.

“The course (MSc in Transport and Logistics) draws specialisations from different fields of study and provides a good focus on equipping students with foundational knowledge in

Railway, Transport and Logistics,” explained Nutchanon.

“I think it is a rare opportunity to be able to experience two starkly different cultures – the Asian culture in Singapore and the European culture in Germany. The different transportation systems and idea behind them are also very interesting and good practical lessons. It was an unforgettable learning journey for me,” he continued.

### **Refining the simulation modelling in railway**

Highly inter-related by nature, railways commonly involve a complex network of fixed infrastructure, rolling stock, and precisely choreographed timetable. Careful planning holds the key to railway success. To achieve success, simulation modelling is popularly employed to assess many aspects of railway system in order to evaluate the operational reliability, capacity, and resource optimisation, safety, riding comfort, and the list goes on.

“Better understanding of the vehicle-track interaction will lead to improving safety and riding comfort. The current conventional railway simulations pre-define each railway system component as a simple rigid body to reduce

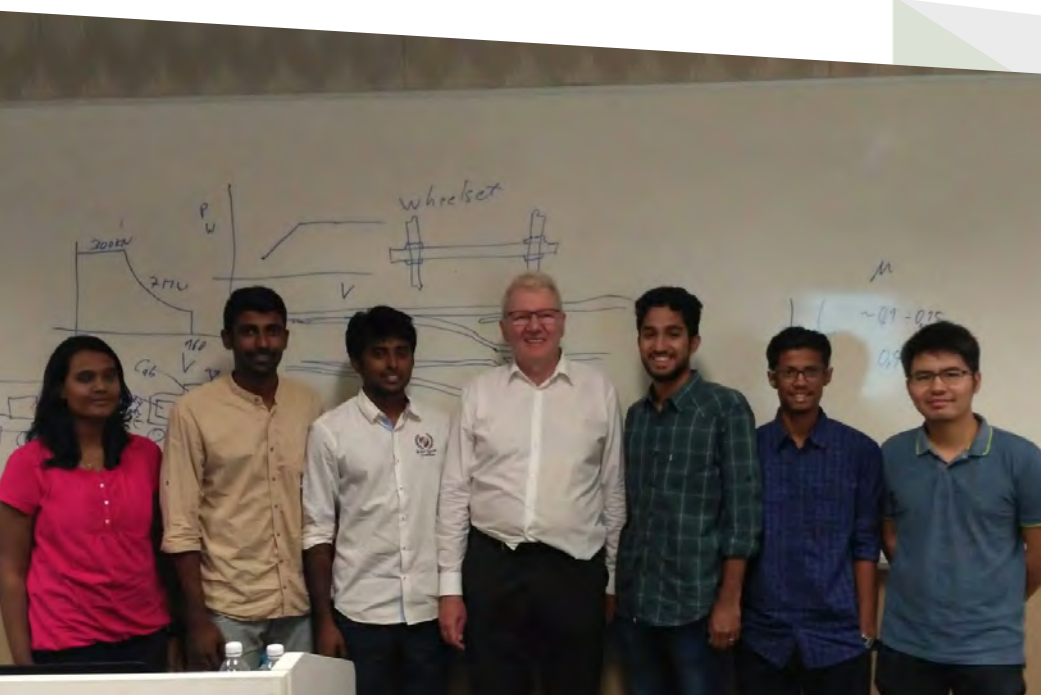


computational complexity. But there is more science to that. The flexibility of each railway system component can be included in the simulation to imitate more realistic behaviour of the vehicle-track interaction. My thesis explores if the use of a more sophisticated railway simulation that incorporates the flexible model would provide a more accurate depiction of reality,” Nutchanon explained.

His steadfastness and quiet determination have borne fruit, for he was awarded the Best Thesis for his course in his cohort.

### Learning is but a journey

As one says, learning is not a destination but a journey. For Nutchanon, attaining a master’s degree is not the end. Setting his sights to achieve the pinnacle of education attainment, he is already pursuing a PhD at a research university in Germany. Armed with deep knowledge and skills, he is certainly blazing a bright trail to reach his goal.



***“The course draws specialisations from different fields of study and provides a good focus in equipping students with foundational knowledge in Railway, Transport and Logistics.”***



# EDB-IPP Scholarship

for MSc. Integrated Circuit Design



## Monthly Allowance

Fixed monthly allowance of S\$3,500



## 100% Tuition Fees

100% of MSc in ICD tuition fees<sup>1</sup>



## Research Grant Funding

50% capped at S\$25,000 for the MSc in ICD<sup>2</sup>



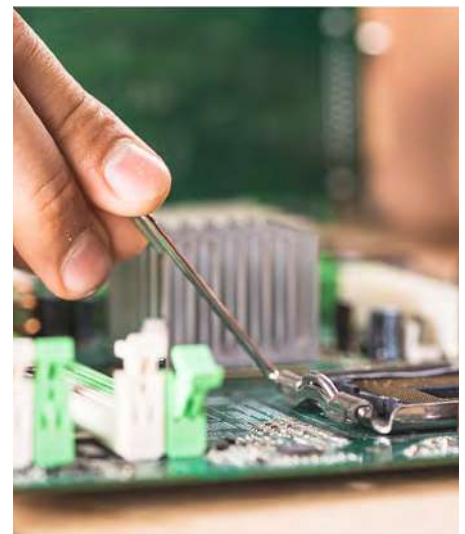
## No Bond Requirement

Can be either a new hire or existing employee of the company

Technical University of Munich (TUM) Asia is working closely with the Economic Development Board (EDB) and Singapore Semiconductor Industry Association (SSIA) to provide postgraduate students with industry relevant training in the area of Integrated Circuit Design. With the EDB-IPP Grant, students have the opportunity to take on Research & Development (R&D) roles in the industry while companies are able to attract talent to fulfil their R&D roles. TUM Asia is committed to support training positions which provide postgraduate training to eligible candidates, and to prepare students for research-intensive roles with strong industry relevance and focus.

## Trainee Eligibility

- ◆ The trainee must be a Singapore Citizen or Permanent Resident.
- ◆ The trainee must not be receiving concurrent funding under any EDB grant schemes, or, regardless of the awarding body, any bursaries or scholarships.
- ◆ The trainee must meet the prevailing admission criteria for the MSc in Integrated Circuit Design (MSc in ICD).
- ◆ There is no bond requirement. The trainee can be either a new hire or existing employee of the company.
- ◆ Each trainee will be placed under an ICD training position, in which he/she will be enrolled for the MSc in ICD, while undertaking a research project under their company's supervision for the purposes of completion of the Master's thesis.



Interested applicants please write in to [admission@tum-asia.edu.sg](mailto:admission@tum-asia.edu.sg)

<sup>1</sup> Items which may be claimed under this grant component include: tuition fees, examination registration fees, and fees for other mandatory academic activities. All taxes, including but not limited to GST, are not claimable.

<sup>2</sup> Items which may be claimed under this grant component must be related to the Project, and include: (i) funds paid to University for usage of lab equipment/consumables at the University R&D laboratory, or software procured for the completion of the academic degree; (ii) funds paid to University to cover overhead charges incurred at the University R&D laboratory; and (iii) funds paid to University and Trainee for publication of research work and participation in research conferences (including the overseas travel expense incurred for such conferences, such as travel insurance, accommodation, meals, local transportation). All taxes, including but not limited to GST, are not claimable.

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