

# digest

October - December 2015 Issue



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### WELCOME TO THE TUM FAMILY

Orientation activities bonding students from different programmes



### STUDENTS MAKE FIELD TRIPS

A practical educational approach that stays relevant to the industry



### DAAD-TUM ASIA SPEAKER SERIES

Scientific research talks foster unique transfer of knowledge

## ON THE COVER

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This newsletter is published by:

**Office of Corporate Communications**  
**Technische Universität München Asia**  
SIT@SP Building  
510 Dover Road #05-01  
Singapore 139660

**Tel:** +65 6777 7407  
**Email:** [info@tum-asia.edu.sg](mailto:info@tum-asia.edu.sg)  
**Website:** [www.tum-asia.edu.sg](http://www.tum-asia.edu.sg)  
**Facebook:** [www.facebook.com/tum-asia](http://www.facebook.com/tum-asia)

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# director's message



**S**taying true to TUM's values, TUM Asia has been dedicated to excellence in research, teaching and interdisciplinary education. Our commitment to empower the young generation while forging strong links with the industry has enabled graduates to apply their practical education in their career paths.

Engineers are important to advancements in our society. Ideas and inventions developed at TUM significantly shape new technologies in many sectors. With that being said, stereotypes continues to plague the industry and a female engineer took to social media to address the issue that many people of different genders and ethnic backgrounds face in the science, technology, engineering and mathematics (STEM) industry. Our university, TUM, is known for fostering an open, culturally diverse mindset and welcomes talent from all over the globe. We speak to three of our Master students to learn more about how they challenge the stereotypes of the industry. Learn more about their unique stories in pages 4 - 7.

This past quarter, we welcomed our newest cohort of Bachelor and Master students to the TUM family. They kicked off the start of their educational journey with orientation games organised by the current Undergraduate students. It was heartening to witness the different cohorts and programmes bonding with one another. To find out more about the fun that our new students had, turn to pages 8 - 9.

Cooperations within the industry has been crucial in TUM Asia's programmes. These mutually beneficial relationships enables our students to be more prepared for the industry. Recently, our students were invited to renown German companies and given the opportunity to witness their education being used in real life applications. Through visiting Daimler, Rohde & Schwarz, and SSI Schaefer, the students gained a better understanding on their contributions to the industry. Read more about their experiences on pages 12 - 13.

We also had the pleasure of collaborating with the German Academic Exchange Service (DAAD) to jointly organise a series of research talks; 'Speaker Series'. Reputable speakers were invited to address hot topics across the different industries. Such exchanges of knowledge is critical to ensure greater awareness of new challenges and opportunities. Turn to pages 14 to 15 to find out more.

We hope that you will have an insightful read.

**Yours Sincerely,**

A handwritten signature in black ink, appearing to read 'M. Wächter', written in a cursive style.

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

FEATURE

# Breaking Stereotypes



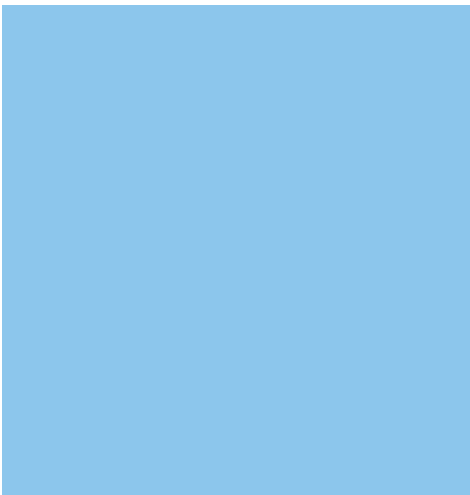
**Fabian Schramm**  
Germany

Master of Science in  
Transport & Logistics



**Li LinJiao**  
China

Master of Science in  
Integrated Circuit Design



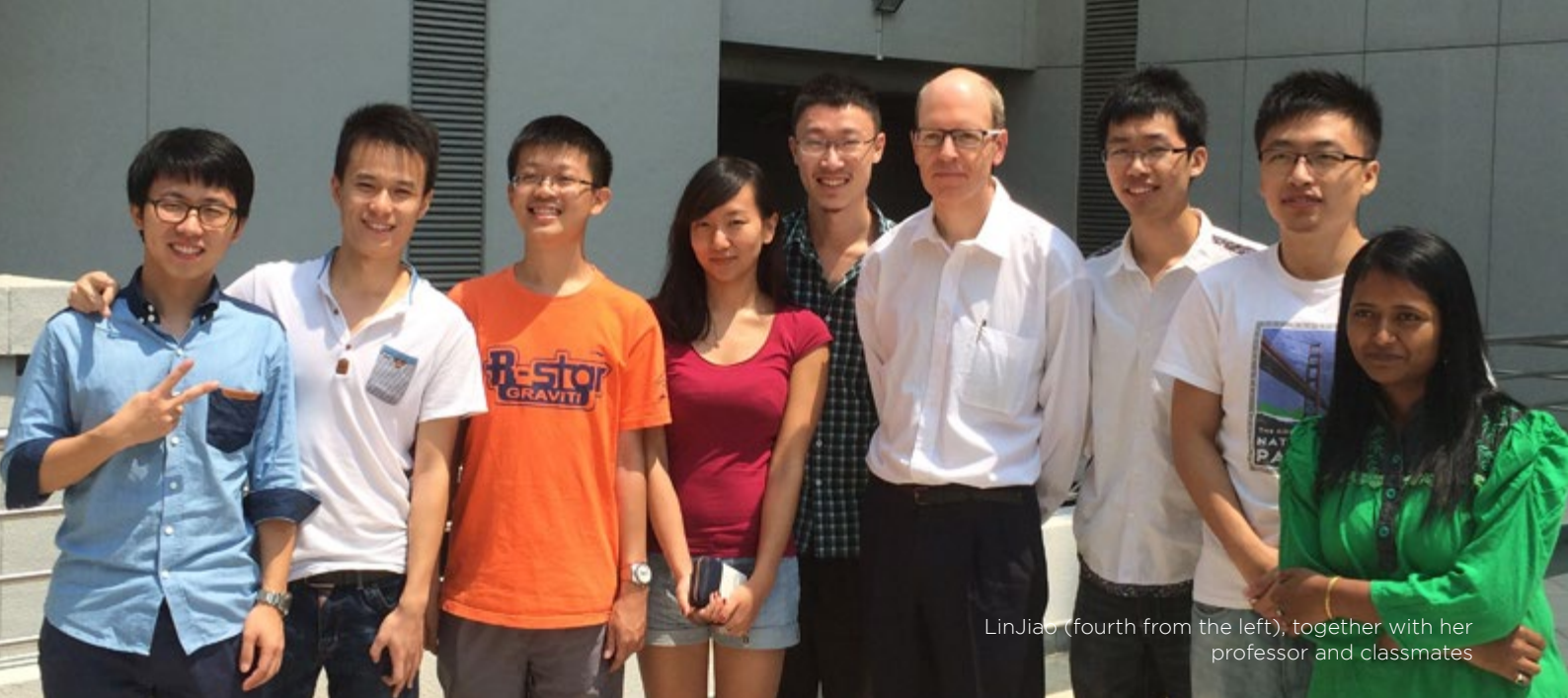
**Daniele Sirigatti**  
Italy

Master of Science in  
Aerospace Engineering



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Recently, female engineers took to Twitter to tear down gender stereotypes that engineers are men. Women working in Science, Technology, Engineering and Mathematics (STEM) fields used social media to post selfies of themselves and described what they do. The viral campaign has since expanded beyond just gender stereotypes, to stereotypes faced by people of all diversities across the STEM industries. DIGEST speaks with a few of our outstanding students to find out more about their opinions on this matter.



LinJiao (fourth from the left), together with her professor and classmates

**Hello, tell us a more about yourselves!**

**LinJiao:** I grew up in Mongolia, China, and spent most of my life there. After graduating from Nankai University with a Bachelor in Engineering, I came to Singapore to pursue my Master degree in Integrated Circuit Design. Currently, I have completed all my courses in Singapore and I will be heading to Germany to complete my internship and thesis.

**Daniele:** I am originally from Naples, a city in the south of Italy. I did my undergraduate studies in Aerospace Engineering at the University of Naples (ITALY) and moved to Munich, Germany, to work for Airbus Helicopters. I stayed in wonderful Munich for 4 years before deciding to continue studying and undertake my graduate studies with TUM Asia.

**Fabian:** I am from Wiesbaden, Germany. In 2011, I completed my Bachelor's degree in International Business Administration with a specialization in Logistics. I worked as a team manager in supply chain management and logistics at ALDI, one of the leading grocery retailers in the world, where I was responsible for the planning and distribution of coffee. In 2014, I made the decision to quit my job at ALDI in order to pursue my graduate studies in Transport and Logistics at TUM Asia.

**Home is thousands of miles away. Making that decision to study in Singapore, was it a difficult decision?**

**Daniele:** My time in Munich made me well aware of the reputation that TUM has; one of the leading institutions in Europe for engineering. The only M.Sc course in Aerospace Engineering offered in English was at TUM Asia. Thus, I took the opportunity to travel to Singapore. It is never easy to go so far from home and leave behind family, girlfriend, and friends, but I am an explorer and I think there are few things in life better than travelling and getting to make new experiences.

**Fabian:** It was not a difficult decision to study in Singapore. Having lived abroad in New Zealand, Zambia and Peru it was important to me to earn a master's degree in an international environment,

preferably in Asia. I have never had the opportunity to experience the life and culture of an Asian country. Singapore is a fantastic starting point to explore Asia. Singapore is a fascinating city with the colourful mix of people and ethnic groups that live in peaceful coexistence. The modern high-rise buildings along with the light Asian charm coupled with a Western atmosphere make Singapore so attractive and liveable. In rankings, Singapore appears as one of the most expensive cities in the world, yet the city can be affordable and easy to live in even for students.

**LinJiao, as a girl with an Electrical Engineering background, did people question your choice of being an Engineer?**

**LinJiao:** Yes, people often questioned my choice of pursuing engineering as my major. After all, with engineering being a male dominated industry, becoming a successful engineer is not an easy feat for females. Maybe people feel that women should pursue areas such as finance, art and law as they are more suitable choices for women to excel in. However, I firmly believe that only you have the power to shape your own path. Even though female engineers are a minority group, the contributions they make to society are indispensable.

**Fabian, you were previously studying in a business related field before pursuing your masters. What made you decide to go on and pursue a technical type of Masters?**

**Fabian:** Globalisation, challenges in the marketplace, and contemporary challenges are further changing the corporate environment. Intense competition has made companies focus on improving their overall logistical processes. Thus, employers, particularly worldwide operating corporations with various international production facilities, expect at least a graduate education, intercultural competencies and in-depth logistical skills in dealing with the dynamics and complexities of this new interdependent business environment. I consider these challenging trends as an opportunity both for my professional development and my personal growth. However, I felt that my bachelor's degree was not sufficient enough to

be competitive in the international labour market. Therefore, I made the decision to pursue a higher degree by attending an international, specialised technical master's programme at a distinguished university such as TUM Asia.

**Studying at TUM Asia, meeting all the German professors and friends from different countries, how has this experience been able to benefit you as an engineer?**

**LinJiao:** It was a new start for me to study abroad. It was challenging for me to adapt to switching my primary language medium from Chinese to English. The teaching styles vary from professors to professors, which makes it more interesting and difficult at the same time. However, I am thankful for all the classmates whom have all been nice and allowed me to learn from them. Currently, my engineering background allows me to bravely face the difficulties in life. At times when I am dealing with electronics, I am constantly challenged with tough problems and it makes me strive hard to find suitable solutions to overcome them.

**Daniele:** The breadth of diversity at NTU and TUM Asia campus is a huge eye opener. Since the courses

are taught by both NTU and TUM professors, we get to experience a variety of ways of teaching with professors coming from the research and industry sectors. Meeting other students from around the world gave me many new perspectives. The aerospace field is booming in Asia and as an aerospace engineer, there is no better place in the world to be right now.

**What is something important that your Masters has imparted you with?**

**Daniele:** The skills that I learnt are "organisation and scheduling". With so many classes, labs, and projects happening at the same time, I have learnt how to organise my everyday life in a structured manner. This is an approach that I have experienced in the German culture as well, but I never really got into it until I started my Masters with TUM Asia!

**Fabian:** The programme perfectly complements my professional experience within the retail and logistics sector, and equips me with a reasonable and transferable academic degree. TUM enjoys an excellent academic reputation and the degree will serve as a valuable stepping stone for my professional life in an international career within the transport and logistics industry. I can picture myself working in the transportation industry, preferably in the area of sea- or airfreight, or alternatively in the retail or logistics sector.

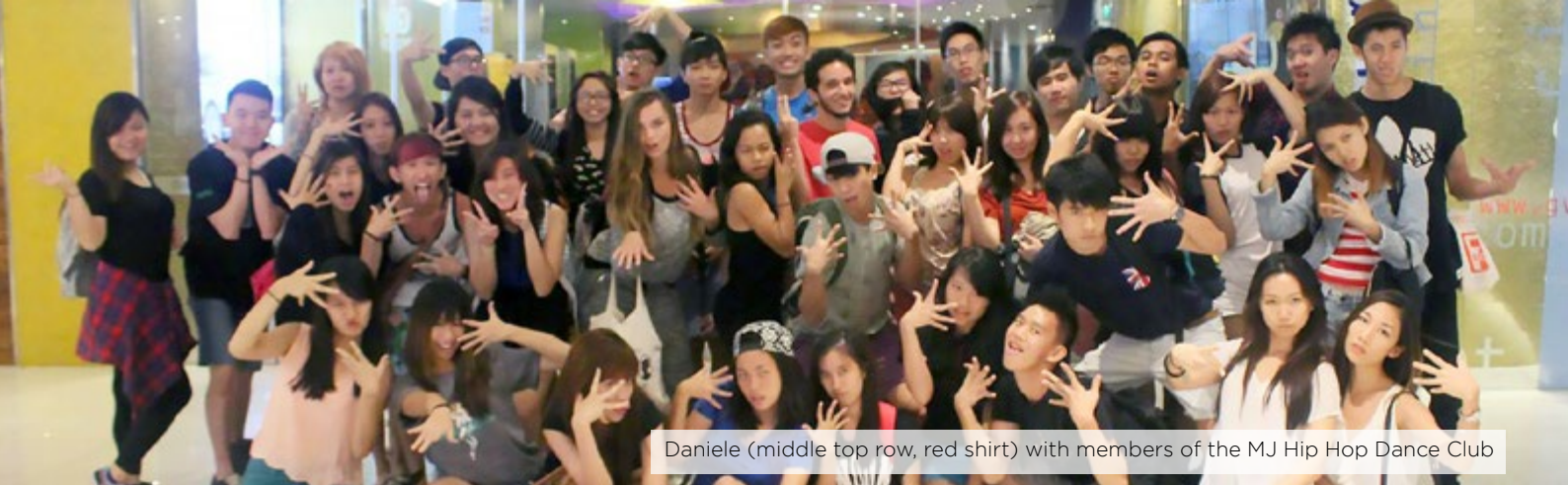
**There has been a social media campaign on the Internet, where engineers of different backgrounds have stepped up saying that engineers are not what the stereotypes say it is. How do you feel about stereotypes in the engineering industry?**

**LinJiao:** I have come across many scenarios involving stereotypes in my life; however I am definitely not like that. An engineer can be devoted to the major and vivacious to life at the same time. During my free time, I engage in different areas of passion, such as dancing and travelling. They enable me to enrich my life with other worldly activities. Engineers are just like everyone else!

**Daniele:** I believe that the stereotype of the engineer as the "nerd" and "specialised" type is well past us. In fact, engineers are hired in every kind of industry and their strength lies in their versatility. I have seen aerospace engineers being employed in Finance, Marketing and possibly every other field you could think of. I believe that this social media campaign would spread the word about the impact that engineers have around the world, especially for under represented categories like women. I hope that some day, engineering will be seen as an equal opportunity employment field for every gender and nationality.

**Fabian:** The world of engineering, especially in Germany, is still considered a "men's world". However, there is little truth in any stereotype. I have met many interesting, ambitious and intelligent people that have a technical background, male and female, not geeky, dorky, or nerdy at all. We should not forget that any student who completes their studies in a technical field, especially in engineering, has very good job prospects and can work in almost any industry.





Daniele (middle top row, red shirt) with members of the MJ Hip Hop Dance Club

**Daniele, what is something unique about yourself that most people don't know about you?**

**Daniele:** One thing that many people do not expect me to be is a hip hop dancer. I am part of the MJ Hip Hop Club at NTU and I have been dancing since I was 13 years old. The funny fact is that I am the only European and one of the few engineers in the club.

**Fabian, I heard that you have contributed to economic development programmes for local farmers and health incentives against HIV. Can you elaborate more on that experience?**

**Fabian:** In 2006/07 I completed an international voluntary service in Zambia, Africa. It was considered a substitute for the mandatory German alternative service; civil service. I decided to do my German alternative service in Africa in order to improve my intercultural skills, broaden my horizon, gain communication skills, self-reliance and a sense of responsibility. It was a chance to gain practical first-hand experience. One can profit from a voluntary service abroad on a personal level – however, it also significantly benefits the local people. Intercultural exchange promotes mutual understanding, respect and tolerance, which imparted to me a completely new perspective for my own life in an exotic country.

**What advice would you give to prospective students who are interested to pursue the field of engineering?**

**LinJiao:** Be yourself and do what your heart desires. The future is yours to make!

**Daniele:** Firstly, choose a field that is of big interest to you, and with interest, it means being very passionate about it. Secondly, set goals for yourself, no matter how high or impossible it seems to you. I believe that with the right motivation anyone can work towards what they want in life. Thirdly, do not give up. The road to becoming an engineer is full of ups and downs, but every mistake and success will be as important in shaping your professional and personal growth.

**Fabian:** When considering a career path in engineering, one needs to possess an entrepreneurial spirit, willingness to develop and realize innovative ideas, and to question and continuously improve the status quo. In my opinion one should also have a strong interest in science: biology, chemistry and especially physics. Mathematical skills are also essential. The same applies to the knowledge of computers and modern software.

Photos: Daniele Sirigatti, Fabian Schramm, Li LinJiao, TUM Asia



Fabian (fourth from the right in blue) with his professor and classmates at TUM Asia's Campus

# Orientation 2015: Welcome To The TUM Family



Every third quarter of the year, orientation has been a highlight for TUM Asia as we welcome the new students to the Bachelor and Master programmes. The orientation activities, which took place on 31<sup>st</sup> July 2015, were specifically designed to integrate new students into the TUM family.

The students were able to listen to talks by the key people responsible for their education journey. By introducing students to the different faculty members and staff, they were able to gain a deeper understanding of what they should expect and receive tips should they face any issues.

The orientation game activities allowed the new students to get to know each other better while maximising a sense of belonging among them. It was a rare opportunity for students from the different classes to interact with one another, something that would be difficult once classes commenced. Additionally, these interactive activities fostered greater teamwork within the cohort.

The successful run of the game activities would not have been possible without the current undergraduate students. They spent time ensuring that the games were well thought out and would be enjoyed by the new students. Thank you to the undergraduate students for your hard work and time to ensure the success of this orientation!







Photos: TUM Asia

# CLASS OF 2015: Graduation



**O**n 24th July 2015, TUM Asia graduated its 12th and largest cohort of students in the Singapore Institute of Technology (SIT) Auditorium at Dover. This year saw over 125 students from seven different programmes donning their graduation robes. This has been the largest graduating cohort since TUM Asia's establishment in Singapore.

Dr. Markus Wächter, managing director of TUM Asia, aligned the significance of this year's graduation with Singapore's jubilee year. "You are the next generation that will take this nation even further

in the next 50 years, to make it the Smart Nation it can be. Or you can take what you have learnt in your time in Singapore and apply it on the global economy, because this is the pioneering and entrepreneurial spirit of Singapore."

Approximately 500 guests were present to witness this milestone, including guests from TUM Asia's educational and industrial partnerships. It was an extremely significant day for many and TUM Asia wishes all graduates the very best as they continue their paths, be it in furthering their education, or working in the industry.



Photos: Playground Pictures

# STUDENTS MAKE FIELD TRIPS



Leveraging on a practical educational approach that moves beyond classroom lectures is what TUM Asia does to ensure that its curriculum stays relevant and practical to the needs of the industry.

Close cooperation with key industry players gave TUM Asia students a chance to visit renowned German companies; Daimler, Rohde and Schwarz, and SSI Schaefer. Visiting these companies gave students the opportunity to yield insights into how they can apply what they learnt to the workforce in the future.

**“Not only were we able to gain a unique first hand encounter with the warehouse processes and technologies, but we were able to make our first business contacts which will help us in our future career path.”**

Nicholas Bischoff  
Student, Master of Science in Transport & Logistics

The Bachelor of Science in Electrical Engineering and Information Technology students visited Rohde & Schwarz and learnt more about their Research and Development departments as well as their service centre.

“I was surprised that they only had 3 head engineers to assemble the high demand products”, mentioned Karen Kang, a student who went for the company visit. It was an extremely enriching and enjoyable experience for the students to learn more about what Rohde & Schwarz does and how they contribute to the industry.

**“We learnt about the functions and operations at Rohde & Schwarz, and witnessed the technology and equipment used to test products such as hand phones and televisions. This shows how much confidence they have in their own test equipment.”**

Karen Kang  
Student, Bachelor of Science in Electrical Engineering & Information Technology

TUM Asia’s Master of Science in Transport & Logistics students were able to visit Daimler and SSI Schaefer, gaining direct exposure to leading companies of the industry. “The company visits introduced us to the functions and challenges in warehouse operations and enlightened us to the usage of technology in warehouse management systems”, said Kunal Thakkar.

**“I was impressed when comparing a Daimler non-automated warehouse to the automated systems of a SSI Schaefer warehouse. We were able to picture the opportunities for future storage handling systems.”**

Lotte Schmidt  
Student, Master of Science in Transport & Logistics

Students were also able to witness the differences between the two warehouses and their contributions to the industry. “With two completely different types of warehouses, we were able to see the possible opportunities for future storage handling systems.



Photos: TUM Asia

“Providing new insights on challenges in the industry,”



2015 saw the launch of four Speaker Series research talks in August and September, which was jointly organised by the German Academic Exchange Service (DAAD) and TUM Asia to commemorate 50 years of bilateral relations between Germany and Singapore. These speaker series aimed to gather high-level and prominent public speakers from Germany and Singapore in their respective fields of expertise, who are able to share first-hand information on addressing current issues.

The issues addressed at these speaker series ranged from cybersecurity, renewable energy, sustainable transportation, and the future of aerospace. The participants were able to gain new insights into trending topics of the industry and were addressed by the speakers on the opportunities and challenges. The continuous exchange of knowledge in Science and Engineering is one aspect that Germany and Singapore has enjoyed over the years, positively contributing to the successes of both countries.



Photos: TUM Asia

# Hugging The Roads On Bends



A new drive system developed by researchers from TUM is set to make electric vehicles a lot more attractive to drivers. The compact and lightweight drivetrain not only optimizes brake energy regeneration, it also increases stability on bends and makes for a more enjoyable ride.

Electric vehicles (EV) have a lot going for them. They move silently through busy city streets and don't emit noxious fumes. There are even some good-looking models on the market now – a far cry from the no-go designs that first appeared ten or twenty years ago. The German federal government is encouraging commercialization of electric cars with measures such as tax incentives. Nevertheless, in 2014, only **21,000** electrically powered vehicles were being driven on German roads. A drop in the ocean compared to the number of conventional cars, which stands at **43 million**. It is doubtful that the target of **one million electric vehicles in Germany by the year 2020** will be achieved. The high price tag is one factor; another drawback is the limited range of vehicles powered by a battery. Many engineers around the world are working on a solution to the EV range challenge. But it does not come down to just one technical detail. Rather, the developers will have to optimize the entire car.

In November last year, the Visio.M consortium presented a possible answer. A team of developers from industry and various chairs of TUM produced a completely new electric vehicle model. Thanks to its cutting-edge efficiency, its estimated total cost of ownership, including initial investment and operating costs, will be lower than that of a comparable combustion engine car. Decisive for the exceptional energy efficiency of the Visio.M is its light weight. At the same time, the car fulfills all significant requirements of a normal mass market car, from passenger safety to infotainment and navigation assistance to climatization. With its smart design, the Visio.M attracted plenty of media attention when it was unveiled to the public last fall.

## Regenerating Brake Energy

As is customary in electric or hybrid vehicles, the Visio.M recuperates energy when it brakes. When the driver brakes, the motor switches to generator mode. The wheels turn the motor like a dynamo and thus apply braking power. The efficiency of regenerative braking could be increased even further if the braking energy could also be recuperated when driving around bends. However, conventional regeneration systems are not very effective when it comes to handling curves. In standard cars, the left and right wheels of a driving axle exert different pressure on the road surface when going around a corner. There is more load on the outer wheel because the vehicle is veering more to the outside. This wheel can exert a strong braking force on the road. At the same time, there is less pressure on the inner wheel, so it is less effective in braking. Brake energy regeneration has basically not been very effective on bends up to now. In theory, this problem could already have been solved with a torque vectoring drive. Torque vectoring varies the power – or the torque – delivered



to each wheel. The same applies to the braking power recuperated from each wheel. This means that just the right amount of braking power gets to each wheel during cornering. Up to now, however, torque vectoring systems were too heavy, too large and indeed too expensive to install in mass-produced electric vehicles. They are currently to be found in only a handful of models, mostly high-end sports cars. But this is set to change. Researchers at TUM's Gear Research Centre (FZG) have developed **a torque vectoring drive system that is sufficiently lightweight and compact for future EVs.**

Torque vectoring is a particular form of differential gear. A "differential" is located at the center of almost every vehicle's driving axle and is responsible for moving the latter together with the wheels. An ordinary differential gear drives the entire axle and therefore uniformly drives the left and right wheel. Torque vectoring gearboxes do this differently. Depending on the type of bend, more torque can be distributed to the left or right wheel. In conventionally driven axles, that would not be possible. With the new torque vectoring drive, TUM engineer Philipp Gwinner and his colleagues have realized their aim of a compact design. **The gearwheels inside the gearbox have been designed and arranged with a view to fitting as much into as small a space as possible.** They are closely linked to a small electric motor. This selectively increases the rotation of the left or right axle end, delivers more torque to the left or right, or in the case of cornering, applies the required braking power to individual wheels. Some experts have long favored wheel hub motors as the future EV drive system of choice. With this concept, **each wheel has its own motor that turns or brakes each wheel individually.** The effect is therefore similar to that of a torque vectoring drive. With torque vectoring, however, you can get this effect with a single central drive, which is more economical and safer than individual wheel hub motors. A torque vectoring drive offers automakers a range of potential applications – not just better recuperation. "They could also use the drive to improve driving stability," maintains Philipp Gwinner. "If a car becomes unstable when cornering, the individual wheels will be decelerated so that the vehicle restabilizes." If the torque of the wheel at the outside of the bend is increased, it pushes the car into the bend, so to speak. The new drive can also compensate for crosswinds or slippage on wet leaves and ice.

It took several development stages to achieve the end result. The first task was to arrange and design the gearwheels so that the gear system could fit inside a compact aluminum housing. Stahl and Gwinner then went one step further. They used lightweight glass fiber reinforced plastic to make the housing. Only the shaft bearings are mounted inside an aluminum structure, which is extrusion-coated with the liquid plastic. "With this small and lightweight torque vectoring drive, we are offering auto manufacturers a powerful component to integrate in electric car designs of the future," proclaims Stahl.

### **A Lightweight Gearbox Housing Made Of Plastic**

Normally, though, plastic housings are scarcely able to withstand the strong forces of a gear system. This was another problem that Gwinner had to overcome. As a rule, the forces of the gearwheels under high load result in severe deformation of the plastic. This happens because the gear teeth are usually arranged at an angle to reduce noise and increase the load-carrying capacity. A normal housing made of plastic is not able to withstand the forces that occur in helical gearing. That is why Philipp Gwinner uses a "double helical gear," in which the axial forces of each half cancel each other out. This enables the use of plastic material for the automotive gearbox housing. With a number of benefits incorporated into the new gear design, Stahl is optimistic: "We cannot wait to see how the automobile industry will respond to and eventually use what we have developed." In any case, the team has proved that it is possible to design a small, lightweight and economical torque vectoring drive. Philipp Gwinner adds: "I firmly believe that this development has huge potential." The drive is one of the features that make the Visio.M so efficient. The car requires just around a quarter of the energy equivalent consumed by a conventional small car. "It is of course possible to drive a car axle without torque vectoring and to do without the highly complex differential we have used," admits Gwinner. But that would mean settling for much less functionality, less energy efficiency and less driving pleasure on bends. Above all, this innovative development will make electric vehicles of the future a much more attractive proposition for drivers.



This article was written by Tim Schröder. All photos are courtesy of Kurt Bauer / TU München. All information are courtesy of LargeNetwork for Technologist.

To view online, visit <http://www.technologist.eu/hugging-the-road-on-bends/>

# The Chatter

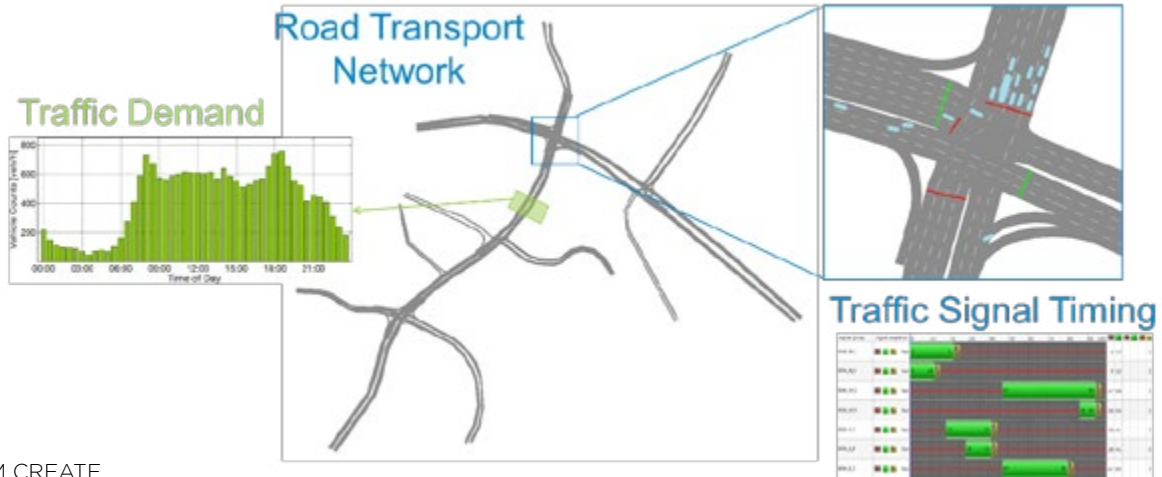


Photo: TUM CREATE

## Urban Traffic Control, Engineering For Everyone's Daily Life

While driving on the roads and enjoying the smooth all-green traffic lights, have you ever thought about whether this all-green traffic is just a coincidence? Have you ever thought whether the signal timings always vary?

Traffic lights, currently one of the most common elements of everyone's daily life, are not as simple as they seem to be. There are many considerations when setting up the signal timings. Safety is obviously always the first consideration. Besides this, traffic efficiency, social impacts, and public transport operations are also considered to achieve an optimised urban traffic control system. There is a lot of engineering work behind the green, amber, and red lights.

### Development history

The story of the red-green lights started on the 9th, December 1868, as the very first traffic light was installed in London. The idea was proposed by a group of railway engineers and railway signal engineers. The traffic light was gas-lit for night-time operation and manually operated. However, with doubts about the safety of the gas-lit system, the concept was abandoned until the electric lights became available.

The development of urban traffic control systems was parallel to the development of the automobile industry. A rapid growth of traffic control systems was seen after the World War I as the automobile traffic was increased. From 1910s to 1930s, the fundamental elements of the urban traffic control were shaped. These include, for example, the warning feature of signal changing, interconnected intersection, detector for isolated intersection operation, and automatic pre-timed control system. After the World War II, with the fast development of electronic engineering and computer science, the idea of computer-aided control was introduced to the urban traffic control systems. The 1980s and 1990s saw a boom in adaptive urban traffic control systems advancement. Several systems were developed worldwide, namely SCOOT from the UK, SCATS from Australia, UTOPIA from Italy, and OPAC from the US.

Ever since the new millenium dawned, this industry has been seeking to make another step forward with the integration of vehicle automation and communication systems.

### An interdisciplinary industry

As mentioned above, the urban traffic control systems were never developed in isolation, and has always been a very interdisciplinary industry.

The urban traffic control industry requires strong collaboration between engineering areas. With traffic engineering as the core, others disciplines, such as civil engineering, electrical engineering, electronic engineering, and computer science are necessary to support this industry.

### Urban traffic control in Singapore

To cope with the increasing traffic demand, the first computerised urban traffic control system in Singapore was introduced in 1981. It was based on fixed time plans, but replaced by an adaptive system, SCATS in 1988. The system originated from Sydney, Australia and is called GLIDE locally. The system has been integrated to the i-Transport platform for better operation. Singapore currently is investigating advanced technologies, such as vehicle automation and communication to further improve its urban traffic.

Info: TUM CREATE Ltd. [www.tum-create.edu.sg](http://www.tum-create.edu.sg)



Photo: TUM Asia

## First Biologics Master Class For Professionals

The National Trades Union Congress' (NTUC) e2i (Employment and Employability Institute) partnered with the Technische Universität München Asia (TUM Asia) to launch the "Biologics and Process Technology" Master Class for professionals in the Biologics Manufacturing industry. The launch of this course comes after a push for more skilled labour in the industry. The course includes both theoretical and practical modules, which will grant attendees a comprehensive overview of the biologics industry and manufacturing processes as well as exposing them to different classes of biologics applications, preparation and operations. From a field trip to a dialogue session at a biopharmaceutical manufacturing facility, the participants had a well-rounded experience and were kept up-to-date on the new developments in the industry.

Due to popular demand, there will be a second round of the "Biologics and Process Technology" Master Class being conducted from 16 – 17 November 2015. For more information, please visit: <http://tum-asia.edu.sg/biologics-process-technology-master-class-2/>



Photo: TUM Asia

## TUM Asia Welcomes Students To Its Inaugural Summer School Programme

As an institution that believes in an industry-relevant education, TUM Asia held its first two week long Summer School, which aimed to provide a holistic learning journey to foreign students who are looking to gain some first-hand experience on studying abroad. The programme was specially designed to suit the needs and levels of study of the Bachelor students from the University Of Electronic Science & Technology of China (UESTC), focusing on topics in Electronic Engineering. The participants not only sat in lectures, but also visited companies to gain first-hand knowledge of the semiconductor industry. On top of the industry visits, participants were also able to experience a career workshop and a career talk by a company.

# Engineering The Smartphone Revolution



Smartphones have transformed the way we live and do business. Did you know that every smartphone is fundamentally improved on by **Chemical and Electrical Engineers**, who harness the power of engineering to advance these well-crafted devices to the next level. As **Germany's leading technical university**, Technische Universität München (TUM) is no stranger to these engineering breakthroughs. **Learn how you can attain the next engineering feat with a degree from TUM Asia**, the branch campus of the TUM, situated in the bustling heart of Asia.

- Bachelor of Science\* (Chemical Engineering) by Technische Universität München
- Bachelor of Science\* (Electrical Engineering and Information Technology) by Technische Universität München
- Master of Science (Green Electronics) by Technische Universität München and Nanyang Technological University
- Master of Science (Industrial Chemistry) by Technische Universität München and National University of Singapore
- Master of Science (Integrated Circuit Design) by Technische Universität München and Nanyang Technological University

**Admissions for Master Degrees open on 1st November.**  
Visit [www.tum-asia.edu.sg](http://www.tum-asia.edu.sg) to find out more.

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