MANUFACTURING MATTERS

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NOTE FROM EDITOR...

Dear Friends and Industry Partners,

One year on since the launch of the SIMTech Digital Transformation & Innovation™ (DTI™) Programme in October 2018 yielded strong participation from industry. To date, 7 batches of the programme trained 86 participants from 10 Multinational Corporations, Large Local Enterprises, public listed companies and Small and Medium Enterprises have embarked on, or are in the midst of their DTI™ journeys.

The A*STAR Singapore Institute of Manufacturing Technology (SIMTech), a research institute of the Agency for Science, Technology and Research (A*STAR), and SkillsFuture Singapore (SSG) initiated the Digital Transformation & Innovation™ (DTI™) Programme to train and guide key personnel of organisations to be **Digital Transformers** in leveraging digital technologies to reinvent the business value proposition, organisational processes, and staff, using the SIMTech-developed **Digital Transformation & Innovation™ (DTI™) Methodology.** The programme enables companies to embrace fast evolving digital technologies to respond to Industry 4.0 needs and increasing customers' expectations in order to remain competitive and relevant in future.

Read on in the opposite pages on the positive experience and benefits for Teckwah Industrial Corporation Limited, a pioneer of the DTI™ Programme journey.

Yours sincerely

Swee Heng
Editor, Manufacturing Matters
Email: shlee@SIMTech.a-star.edu.sg

FUTURE-READY TECKWAH INDUSTRIAL CORPORATION LIMITED

The ongoing digital transformation and innovation journey enables the company to thrive in an increasingly competitive environment

In April 2018, Teckwah Industrial Corporation Limited (Teckwah) engaged SIMTech to accelerate its journey towards Industry 4.0 for its Packaging Printing and Logistics business units, in the pilot batch of the Digital Transformation and Innovation™ (DTI™) Programme. Teckwah has a long history. It evolved from a producer of paper boxes in 1968 to become the leading provider of customised supply chain management solutions from packaging, printing, global fulfilment to reverse logistics solutions, operating in more than 90 locations across 20 countries in Asia-Pacific, North America and Europe. In 2019, Teckwah acquired majority stake of Profoto Digital Services Pte Ltd adding value for its customers through a new business segment named Lifestyle, and extending its value chain capabilities into new markets.

> " The DTI™ programme provides Teckwah with a more structured way of digitalisation by invoking a step-by-step thinking process, which culminates in a set of deliverables integral to our future success "
>
> Mr Ng Chee Mun, *InfoComm Technology Director, Teckwah Industrial Corporation Limited*

The Journey

Nine key staff were trained to be Digital Transformers. A total of 20 top and senior management, and support staff from various departments of Teckwah Group were involved in the DTI™ journey.

Armed with Digital Leadership skills, they identified hotspots, initiated ideas and developed the To-Be Business Model to create a new set of value propositions offering Digital Solutions in the areas of Smart Factory, Smart Warehouse and Smart Logistics. Riding on the successful formulation of SIMTech's Digital Value Mapping tool and EDB's Smart Industry Readiness Index, Teckwah's staff were motivated to design new ideas, develop digital solutions and deploy digital technologies with the following outcomes:

- Robotic Process Automation (RPA) solutions to automate its repetitive end-user operations
- Nerve Centre system for control tower operations
- Project 2020 for Smart Warehouse to automate inventory management in warehouse
- Manufacturing Execution System (MES) to connect shop floor manufacturing machines to its Enterprise Resource Planning (ERP) order processing system for seamless flow of orders and real-time status updates

> " SIMTech has the expertise to benchmark the best manufacturing practices. With the partnership and collaboration with SIMTech, we are confident that Teckwah will become a Smart Factory, adopting the advanced manufacturing practices to stay relevant and ahead of the competition in our industry "
>
> Mr Ng Nai Ping, Executive Director, *Teckwah Industrial Corporation Limited*

Benefits

As a result, benefits were substantial. By implementing RPA to automate its end-user operations, Teckwah Logistics has achieved some Quick Wins. An estimated more than S$40,000 annual cost saving was realised.

Teckwah's Smart Warehouse is a revolutionary change. The warehouse will be organised into multiple rows. Goods, previously carried manually which was a time-consuming process, will be retrieved electronically by an automated storage process. It will enhance business values significantly, saving manpower, improving supply chain efficiency for the customer, increasing inventory accuracy and enabling a smarter Worker 4.0 workforce.

Way Forward

Moving forward, after completion of the DTI™ Programme in 2019, SIMTech continues to support and participate actively in Teckwah's Digital Transformation Journey to further the company's DTI™ initiatives' implementation.

One of these is the Overall Equipment Effectiveness (OEE) programme where the OEE solution is being implemented for Packaging Printing. Another is the Data Mining programme where the data mining techniques enable Teckwah to improve yield and reduce waste paper allowance in packaging printing process through correlation analysis and predictive modelling. Also, SIMTech continues to support Teckwah's bi-lingual Mass Communication for Digital Transformation and Innovation & Ideation (I&I) Events to help Teckwah achieve both Industry 4.0 and Worker 4.0.

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MPTC **Manufacturing Productivity Technology Centre**
Enhancing Manufacturing Productivity

Scan for more information on Manufacturing Productivity Technology Centre

IMPROVING CLADDING CAPABILITIES WITH LASER AIDED ADDITIVE MANUFACTURING

A possibility achieved through Tech Access

Oilfield Services & Supplies Pte Ltd (OSS), which manufactures and services high quality down-hole tools and drill stem components used by the oil, gas, and mining exploration and production industries, has been facing increasing customer demand to clad corrosion resistant material on impeller blade surfaces which meets required hardness values.

To fully clad impeller blades, clad material has to be deposited within 1.5mm fillet radius of the impeller root with a 90-degree straight wall. However, most current cladding systems are unable to perform this in such space constraints.

Hence, OSS worked with SIMTech through Tech Access to make use of the Laser Aided Additive Manufacturing (LAAM) system to achieve a fully cladded corrosion resistant impeller blade.

The LAAM is a high power laser system for welding and metal additive manufacturing which is mounted on a 6-axis robot with an external rotary table. Applications includes large area surface deposition and 3D fabrication, as well as multi-material deposition to achieve enhanced wear and corrosion resistance.

The LAAM system uses a powder nozzle with a double tapered design, reducing the tip region to 6mm in diameter. This enables the coaxial nozzle to operate with a smaller tilt angle while having the laser beam centre positioned 0.5mm away from the impeller root. Hence, the LAAM nozzle is able to access the intersection root region and deposit materials with the required dimensions and hardness values.

OSS also managed to determine cladding process parameters and create the LAAM tool-path for laser cladding deposition.

Through making use of the LAAM system via Tech Access, OSS was able to produce high quality cladding for the entire impeller blade surface, restoring the blade to original dimensions with enhanced surface wear and anti-corrosion properties.

> "By exploring and implementing new processes with the LAAM through Tech Access we're able to solve and improve laser cladding to the next level"
>
> Mr Moh Idris, *Sales Manager*
> *Oilfield Services & Supplies Pte Ltd*

Cladding restores the original dimensions of impellar blades
due to wear and tear after heavy usage over time

*Note: A*STAR Tech Access helps SMEs explore and exploit advanced equipment to boost manufacturing processes. SMEs can gain access to these equipment to prototype new products, qualify new processes and test out new applications. The hands-on learning and experimenting process is a cost-effective way for SMEs to identify the technologies needed to bring their businesses to the next level.*

For more enquiries, please contact
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AUTOMATED INTELLIGENT VEHICLE FOR SHOP FLOOR MATERIALS TRANSFER

SIMTech Scalable Mobile Platform (SMP) Technologies for Automated Intelligent Vehicle

Material transfer, a common shop floor activity, can be automated through the implementation of mobile robotics solutions. The productivity improvement by freeing manpower from mundane material transfer tasks to more value-added activities can be significant. The liberated workforce can be retrained to address areas where automation is difficult or costly to implement.

SIMTech has developed the Scalable Mobile Platform (SMP) Technologies which are critical for developing an Automated Intelligent Vehicle (AIV). These include the 'Decoupled Powered Caster Wheel Module', 'Low Level Software for Mobile Robot', 'Modular Autonomous Navigation Software', 'Distributed Computing Engine and Console', as well as 'Compliant Vehicle Auto-Charging Mechanism'.

Pisces Technologies Pte Ltd, a system integrator and a subsidiary of PBA Group, has embarked to develop their own AIV in collaboration with SIMTech for commercialisation. Their AIV sets itself apart in three ways. It is more precise, easier to navigate, and can be customised to meet different needs.

The company gains quick capabilities of building AIV by adopting the SIMTech path planning and localisation solutions, as well as the SIMTech powered caster wheel technology that enables all directional movement.

It is an advantage over commonly used differential wheels which are limited in movement as robots using differential wheels cannot move sideways. The dexterity and fluidity of its movement enables the AIV to perform in physically constrained environments. Finally, the beauty of the modular building blocks of SIMTech SMP Technologies allows AIV customisation and re-configurability to suit various operational needs.

Committed to innovation, Pisces has invested in R&D since it partnered with SIMTech to build the AIV technological capabilities. Armed with the new product, Pisces and its AIV products will position the company as a one-stop shop for AIVs, now that it has capabilities in design, system integration and manufacturing capabilities. Pisces is commercialising the AIV products in the near term.

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> ❝ **It's a wonderful experience in collaborating with SIMTech and within no time we attained up-to-date design knowledge and technology in Autonomous Intelligent Vehicles** ❞
>
> Mr A S Sundaram, *Director, Pisces Technologies Pte Ltd*

PE COI Precision Engineering Centre Of Innovation
Sustaining and Advancing PE Industry

Scan for more information on Precision Engineering Centre of Innovation

MEASURING SINGAPORE'S ENVIRONMENTAL IMPACT OF KEY CONSUMED FOOD ITEMS

The study aims to optimise strategies to reduce environmental burden

Together with Deloitte Singapore, SIMTech was commissioned by Temasek International's Sustainability and Stewardship Group (SSG) for the study.

This study was initiated as global food production contributes to about 19–29 per cent of the total greenhouse gas (GHG) emissions, due to agricultural production activities and food processing (Consortium of International Agricultural Research 2019, CGIAR). Although the global food production industry is a major source of environmental impact contribution, these studies are not representative of Singapore's actual emissions. To reduce the environmental impact of food consumed locally, a Singapore-specific study was initiated by Temasek International-an investment firm committed to generating long-term sustainable returns.

The Life Cycle Assessment (LCA) methodology based on ISO 14040/44, which is a systematic transparent way to provide visibility and insights on the environmental impact of any product, was used. By quantifying GHG emissions, energy and water consumption, the study presented existing challenges on

how Singapore's food consumption contributed to these environmental impacts and provided answers on how food contributes to climate change.

With this, SIMTech presented opportunities as to how sourcing fresh food from nearer countries with lesser air transportation and sourcing from countries with cleaner electricity generation can potentially reduce the environmental impact of food in Singapore. Findings also show how shifting to a lower meat consumption diet by substituting with alternative meat or plant-based diet also helps in reducing greenhouse gas emissions.

Coupled with the current food supply and demand trends in Singapore, different future scenario analyses highlight how the opportunities recommended above may reduce the environmental impact in Singapore by 2030.

These insights to lower environmental burden by optimising different import strategies, investing in local production and influencing food consumption behaviour for different food items will help policy makers and businesses in the F&B space make better decisions.

> **By having a better understanding on the environmental landscape of the food items in Singapore, businesses are able to focus their sustainability efforts while aligning with national climate change reduction targets**

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SMC **S**ustainable **M**anufacturing **C**entre
Embracing Sustainable Manufacturing

Scan for more information on Sustainable Manufacturing Centre

Printed electrodes

Sportswear with printed electrodes

Printing of micro heaters (left), Printed heater (right)

GROWING THE FUNCTIONAL PRINTING ECO-SYSTEM

Collaborative Industry Project opens up innovative business opportunities

Exciting possibilities emerge with the launch of the Collaborative Industry Project (CIP) on Capability Development of Functional Printing of Printed Electronics, Heater and Other Printed Sensor & Electronics for Smart Wearable & IOT Eco-system Development by SIMTech in September 2019.

> **We are excited to be part of the CIP 2019. I am sure my team will benefit from all the sharing on the different topics. This programme will equip us with adequate knowledge and opportunity for us to work with other industry partners. With the networking opportunities, we are confident that it will help SME like us to grow**
>
> Mr Kelvin Lim, *CEO, Honsen Printing Industries Pte Ltd*

To equip the local industry and expand the eco-system to be ready for the explosive growth in printed electronics, SIMTech launched the CIP which is also aligned to positioning Singapore for the future via innovation. This 2nd CIP follows from the success of its 1st CIP launched in February 2018. From this CIP emerged commercialisation successes. One of these is the Coldwear Heated vest which is selling fast in retail outlets since May 2019. A second round of production for heated vest is now underway. Texline and Kaha are working with the Singapore Health Promotion Board on the smart wearable t-shirt which monitors heart rate and ECG. More importantly, KPP Packaging successfully developed capability to produce Printed Electronics, Printed Electrodes and Printed heated module for Smart Packaging and Smart Wearable. The traditional printing Small and Medium Enterprise was transformed from graphical printing of packaging boxes and collaterals to functional printing of printed heater and electrodes for smart wearable with higher value-add.

Eight technologies are covered:

- Printed Lighting - Electro luminescent Lighting, light strip and segmentation for animation
- Printed electronics for ECG, EEG and EMG monitoring
- Printed pressure sensor for pressure distribution monitoring
- Printed circuit and component attachments such as Flexible Hybrid Electronics and Interconnection
- Printed heater and its warming application
- Wireless connectivity, tracking and transaction using Bluetooth, RFID and Near Field Communication
- Printed circuitry and other printed sensor including stretch sensor and temperature sensor
- Manufacturing process of printed electronics, printed heater, printed lighting and other printed electronics

The participating companies are diverse, ranging from electronics, electronic manufacturing services, garment, apparel, textile, sensors, materials to application development sectors.

This CIP comprises two phases. In the Learning phase, 11 workshops and hands-on training will enable participating companies to learn about various printed electronics technologies.

On completion, SIMTech staff will engage participating companies in 1-1 sessions to innovate and create prototypes of smart products based on technologies learnt in phase 1.

On completion of the CIP programme, CIP member companies participate in various exhibitions to promote CIP members' newly acquired capabilities to find business opportunities in functional printing. Partnerships are formed to create a vibrant eco-system for smart IoT and products in Singapore.

For enquiries, please contact
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EAC **E**merging **A**pplications **C**entre
Seeding and Growing Emerging Industries

Scan for more information on Emerging Applications Centre

IMPACT OF TRAINING FOR INDUSTRY

More than 5,000 Professionals, Managers, Engineers and Technicians have been trained and about 7,000 Statements of Attainment have been achieved, benefiting over 1,600 companies

Digitisation, technology developments and disruptions, changing global economic trends including the ongoing journey towards high-value and more complex advanced manufacturing activities are changing today's manufacturing landscape and job functions. To cope, companies and professionals, managers, engineers and technicians (PMETs) are acquiring new skill sets or capabilities continuously. Upskilling and organisations' upgrading is a way of life. To date, SIMTech-SSG launched 24 WSQ training programmes. Of the companies which have benefited from the programmes, 70 per cent are Small and Medium Enterprises (SMEs). Highlighted are some graduates who are recipients of the Best Trainee Award for the joint SIMTech-SkillsFuture Singapore (SSG) Precision Engineering (PE) Workforce Skills Qualifications (WSQ) Programme at the SIMTech-SSG Graduation Ceremony 2019.

> " **We have enjoyed the LEAN Programme despite the hard work and came up with 50 improvement initiatives. I implemented one of the initiatives to reduce my leadership team meeting time by 33 per cent which is channelled to other productive work. We feel highly empowered and energised to take Michelman to the next level of Operational Excellence as we continue our learning journey** "
>
> Mr Phillip Choo, *Vice President & Managing Director, Michelman Asia-Pacific Pte Ltd*

> " **I am very happy to have led 12 members of my StemCord team in the OMNI Programme. We are now equipped with OMNIMethodology™ which we have since applied in operations improvement to increase our sales volume by 10 per cent. Most importantly, I see teamwork in my team. They are now aligned with the company's strategy to move towards a common goal** "
>
> Ms Valerie Wong, *Chief Executive Officer, StemCord Pte Ltd*

> " **My colleagues and I have formed a team to explore the opportunities of 3D printing in our company. We have submitted a proposal for our management review. We hope to improve the development of 3D printing in our company using the available components and latest 3D printing technology** "
>
> Ms Chen Yet Shin, *Senior Product Development Engineer, TechnipFMC*

Industry partners who are recipients of the Best Industry Partners' Award also shared their positive responses.

> " **With the partnership and collaboration with SIMTech, we are confident that Teckwah will become a Smart Factory, adopting advanced manufacturing practices to stay relevant and ahead of the competition in our industry** "
>
> Mr Ng Nai Ping, *Executive Director, Teckwah Industrial Corporation Limited*

> " **After completing LEAN, 16 of our associates continued with SIMTech's Digital Transformation & Innovation™ (DTI™) course. This has enabled us to build a clear roadmap for our Digitalisation and Industry 4.0 journey** "
>
> Mr Phillip Choo, *Vice President & Managing Director, Michelman Asia-Pacific Pte Ltd*

> " **SIMTech's Manufacturing Data Mining Techniques course had received great support from our management. 15 shop floor engineering staff have been trained, with 5 actual case-studies used for the course projects. After the training, pilot projects are being proposed to apply "Data Mining and Machine Learning Technologies" into the actual production line to realise the real benefit** "
>
> Mr Kelvin Looi, *IT Department Manager, AFPD Pte Ltd*

For more information, please contact:
***Dr Goh Kiah Mok** at kmgoh@SIMTech.a-star.edu.sg*
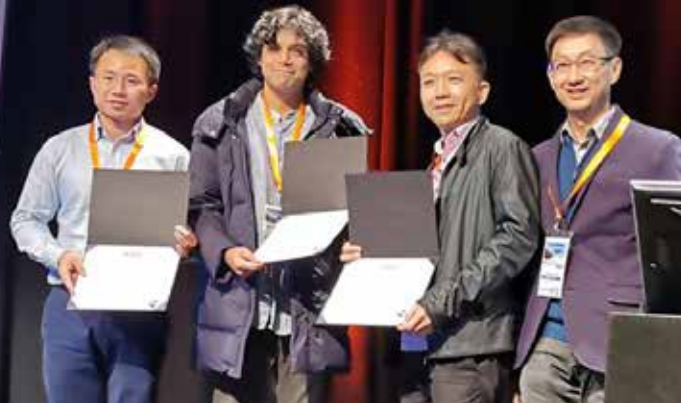
DATA-DRIVEN MULTIFACTORIAL EVOLUTIONARY METHODOLOGIES

Approach overcomes current challenges in complex systems optimisation via multitasking

Optimisation methodologies support decision-making by searching through large spaces of possible solutions, identifying the ones that satisfy the constraints of an application while simultaneously maximising desired payoffs. However, even in today's era of artificial intelligence proliferation, a regular feature of existing optimisation techniques is that they do not learn with experience. Unlike humans, who generally become smarter with experience, known methods of optimisation lack the cognitive ability to learn from the data generated by different problems. When faced with complex real-world situations, their inability to automatically draw upon relevant knowledge can cause these methodologies to take too long in finding and returning good solutions; often slowing down the speed of decision-making.

With this in mind, a new class of data-driven optimisation techniques have been developed by SIMTech and its collaborators at the Nanyang Technological University. The salient feature of the invention is to instill human-like cross-problem learning into optimisation solvers, boosting the efficiency of decision-making processes they support. In particular, the inventors demonstrated that through specific enhancements to a well-known family of methodolgies, they could be transformed into effective multitasking engines. The resultant Multifactorial Evolutionary Algorithms are able to solve multiple optimisation tasks in unison, integrating data generated by related tasks to significantly speedup search. As illustrated in the schematic, the data integration idea allows for solution building-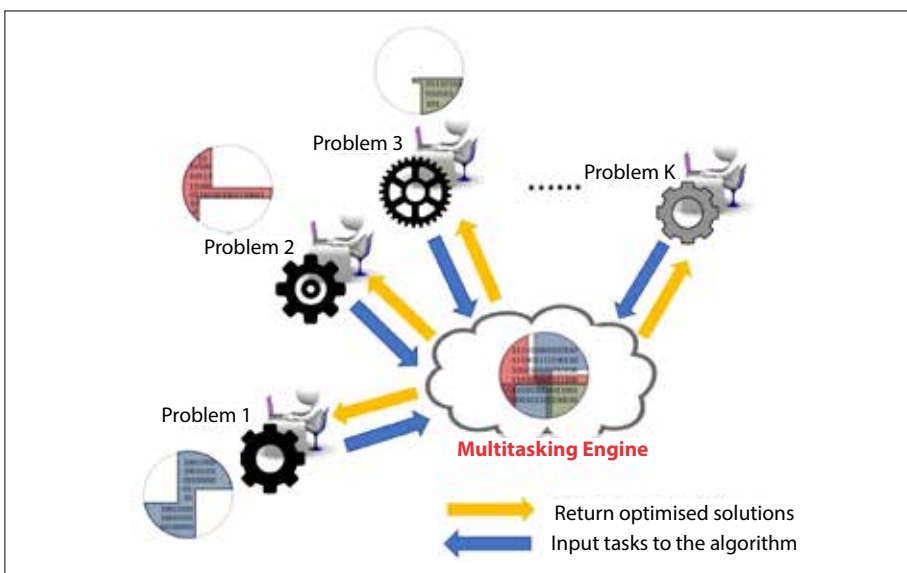blocks from different tasks to be combined, eliminating the time needed to re-compute what has already been computed for another task.

> **The efficacy of the method has been showcased for logistics route optimisation, path planning of autonomous aerial vehicles, and the design of advanced composites manufacturing processes**

Their method was applied for simultaneous training of multiple neural network models, achieving better performance by leveraging similarities between related machine learning problems. It has also been shown that by jointly solving hard simulation-based optimisation problems together with related but simpler tasks via multitasking, high quality solutions could be achieved at a significantly lower cost – as compared to solving the hard problem alone.

In recognition of its scientific novelty, as well as the potential for real-world application, the inventors' first published work on Multifactorial Evolutionary Algorithms has recently been bestowed the prestigious 2019 IEEE Transactions on Evolutionary Computation Outstanding Paper Award by the IEEE Computational Intelligence Society.

For more information, please contact **Dr Abhishek Gupta,** *Planning and Operations Management Group at abhishek_gupta@ SIMTech.a-star.edu.sg*

Schematic: Multitasking optimisation engine: combining solution building-blocks drawn from different tasks to speedup search

Major corporate event was organised to engage industry and forge partnerships


SIMTech-SSG Graduation Ceremony 2019, 5 September

SIMTech celebrated its 8th SkillsFuture Singapore Graduation Ceremony at Stephen Riady Auditorium@NTUC with a turnout of 300 graduands and 80 industry guests. The joint-effort witnessed 652 graduands from 17 Workforce Skills Qualifications (WSQ) Training Programmes, consisting of 16 full qualification participants and the rest of the modular course participants from 163 companies.

Graced by its Deputy CE, Mr Tan Wee Beng, the event was held in partnership with SkillsFuture Singapore (SSG). SIMTech Executive Director, Dr David Low welcomed the graduands and guests, followed by a welcome message from Prof Tan Sze Wee, Executive Director, Science and Engineering Research Council, A*STAR. Three industry partners and industry trainees were bestowed the SIMTech Best Industry Training Partners and Most Inspiring Trainees Awards respectively (refer to Skill Matters in Page 8 for details).

Collaborative Industry Projects (CIPs), initiatives, programmes and ready-to-go technologies are available to assist industry
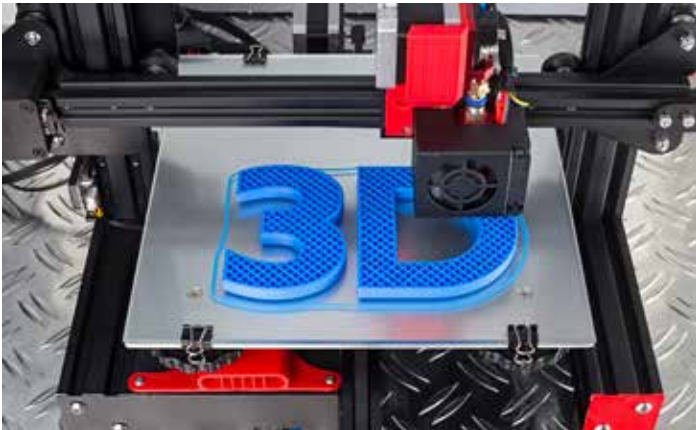
3D Additive Manufacturing (AM) Capabilities of Metal and Polymer Parts

This programme aims to demonstrate 3D AM process capability from design and process optimisation, material preparation and handling, product processing to secondary operations, and to provide a platform for quicker adoption of 3D AM technology.

*For enquiries, please contact **Mr Tan Lye King** at tanlk@SIMTech.a-star.edu.sg*

Advanced Machining Dynamics Analysis Technology for Productivity and Quality Improvement

This programme aims to improve the machining productivity and quality of local manufacturing industry in precision machining of steel and non-ferrous metals through technology transfer and customisation.

*For enquiries, please contact **Ms Charlotte Lim** at charlotte-lim@SIMTech.a-star.edu.sg*

SIMTech Scalable Mobile Platform (SMP) Programme

This programme aims to enable the development of customised mobile platform to suit different needs, and to realise high mobility critical for easy maneuvering in cramped spaces and for effective docking.

*For enquiries, please contact **Mr Tan Chee Tat** at cttan@SIMTech.a-star.edu.sg*

eDataLogger+ for Electronic Form Creation, Tracking and Report Generation

This programme aims to equip companies with electronic data logging and reporting capability with eDataLogger+ Android APP and Windows-based Data Analysis Software to create high-quality reports on their mobile devices.

*For enquiries, please contact **Mr Chai Lai Sing** at lschai@SIMTech.a-star.edu.sg*

Last Mile Logistics

A planning and tracking solution to improve the management of drivers/vehicles to effectively meet customer-imposed pickup and delivery requirements amidst resource contraints.

*For enquiries, please contact **Mr Gary Kwok** at gary_kwok@SIMTech.a-star.edu.sg*

Functional Coatings for Glass and Ceramics

SIMTech's portfolio of functional coatings for glass and ceramics with easy-clean, IR-shielding, anti-microbial and anti-mould properties help asset owners, glass suppliers or maintenance providers to better manage maintenance cost, supply chain and quality. The collaboration will also involve customisation of solutions to meet specific requirements, training in coating preparation and application as well as technology transfer.

*For enquiries, please contact **Mr Goh Chee Chien** at gohcc@SIMTech.a-star.edu.sg*

Real-time Dashboard

A real-time dashboard that is customised to suit the company needs and to connect to multiple sources for congregation and analysis of real-time data.

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EVENTS

MPTC Annual Conference 2019

9 October 2019 | 8.30am-5.00pm | Four Seasons Hotel Singapore, Level 2, Ballroom

Packed with high-profile speakers and impactful agenda, this event is expecting a whopping 480 attendees from industry and agencies.

With the theme, **Digital Eco-systems: Accelerating Growth through Deep Partnerships**, speakers will shed light on customers' journeys, best practices and sharings from enterprises, confronted with digital challenges, and their collaborations with SIMTech to achieve digital advantage.

For enquiries, please contact **Ms Connie Ng** *at yyng@SIMTech.a-star.edu.sg*

For SIMTech upcoming events, look out for our next issue in January 2020!

Scan for
more events

COURSES

PE WSQ Graduate Diploma in Industrial Automation
Module 3: Control in Automation System
16 October 2019 | 6.30pm - 9.30pm | Fusionopolis 2

PE WSQ Graduate Diploma in Advanced Welding Technologies
Module 1: Evaluate Advanced Metal Welding Processes
22 October 2019 | 6.30pm – 9.30pm | Fusionopolis 2

PE WSQ OMNI Programme
23 October 2019 | 8.30am - 1.00pm | Company Premise, Wah Son

Master Class in Supply Chain Analytics – Descriptive, Predictive & Prescriptive Analytics
11 - 12 November 2019 | 8.30am - 5.30pm | Fusionopolis 2

PE WSQ Graduate Diploma in Advanced Welding Technologies
Module 2: Design Arc Welding
2 January 2020 | 6.30pm - 9.30pm | Fusionopolis 2

PE WSQ Graduate Diploma in Additive Manufacturing
Module 2: Review Powder-bed Additive Manufacturing Processes for Complex Functional Metallic Components
7 January 2020 | 6.30pm - 9.30pm | Fusionopolis 2

PE WSQ Graduate Diploma in Mechatronics
Module 1: Design Precision Machines
14 January 2020 | 6.30pm - 9.30pm | Fusionopolis 2

For course details and registration, please visit http://KTO.SIMTech.a-star.edu.sg

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About SIMTech

The Singapore Institute of Manufacturing Technology (SIMTech) develops high-value manufacturing technology and human capital to enhance the competitiveness of Singapore's manufacturing industry. It collaborates with multinational and local companies in the precision engineering, medtech, aerospace, automotive, marine, oil & gas, electronics, semiconductor, logistics, and other sectors.

SIMTech is a research institute of the Agency for Science, Technology and Research (A*STAR). With a pool of more than 450 researchers, we are committed to serving the manufacturing industry to develop the human, intellectual, and industrial capital in Singapore.

SIMTech A*STAR

for Industry

10/2019