

MANUFACTURING MATTERS

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FEATURE

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INDUSTRIAL ALLIANCE
THUMBS UP FOR A*STAR
COLLABORATIVE COMMERCE
MARKETPLACE

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PRODUCTIVITY

RESEARCH SPOTLIGHT
FREEFORM OPTICS DESIGN

NOTE FROM EDITOR...

Dear Friends and Industry Partners,

It is heartening to note that Small and Medium Enterprises (SMEs) are increasingly adopting emerging technology to differentiate and make their capabilities and offerings stand out. Smart Packaging products using Flexible Hybrid Electronics and Printed Lighting technologies by a SME for a Multinational Corporation (MNC) is a recent example (see Feature in opposite page). The Emerging Applications Centre (EAC), which seeds and grows emerging industries, is reaching out to broaden the applications of these technologies to illuminate the furniture and interior design markets.

To enable industry, especially the SMEs, to tap innovative Flexible Hybrid Electronics and Printed Lighting technologies, EAC has initiated varied Collaborative Industry Projects (CIPs) to build their technical capabilities for applications in smart packaging, print and media. The more recent CIP focuses on Application of Printed Electronics in smart furniture and smart home products using printed lighting and printed electronics including other emerging technologies from SIMTech.

Help is at hand to begin your journey of exciting possibilities...

Swee Heng

Editor, Manufacturing Matters

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TECHNOLOGY FOR SMART PACKAGING

SME used printed lighting and Flexible Hybrid Electronics in smart packaging for food giant

The Smart Packaging market size is huge at US\$39.7 Billion, growing at a Compound Annual Growth Rate of 4.8 per cent from 2014 to 2020. Smart packaging is used in food & beverages, automotive, healthcare, and personal care. Its increased shelf life, reduced counterfeiting, increased safety coupled with low cost, and easy implementation are an edge over conventional packaging. Europe is the biggest market as European Commission laws favour smart packaging over conventional packaging. USA and Asia Pacific Region are other growing markets (Source: MarketsandMarkets, 2015). Smart packaging innovations are enabled by Printed Electronics technologies which include printed lighting, printed antenna for Near Field Communication, touch and system/functional integration in smart packaging.

Honsen Printing Industries Journey

Honsen Printing Industries Pte Ltd, a converter of adhesive and non-adhesive labels and stickers, began its journey with SIMTech to develop its capability to design and manufacture smart packaging using printed electronics for the launch of new range of NESCAFÉ products in Thailand. In this collaboration, SIMTech partnered Honsen with Nestlé R&D Center Pte Ltd to develop a local supply chain for smart packaging. Consultancy was provided by SIMTech on smart packaging product design. It also established Honsen's in-house competencies to create smart packaging with printed lighting and printed electronics. This successful development of smart packaging for fast-moving consumer goods is the outcome of an Operation and Technology



Roadmapping ideation session between SIMTech and Nestlé R&D Center Pte Ltd, which is part of Nestlé's global R&D network.

Honsen seeds and reaps benefits from this partnership with SIMTech. The SME is able to cascade the technical capabilities to its vendors, creating a local supply chain in smart packaging. Honsen also commercialised the technology to create printed lighted packaging boxes for Nestlé. This type of smart packaging is the first to be used by Nestlé worldwide, and probably the first in the world for Fast Moving Consumer Goods.

“ In partnering with SIMTech, we are able to tap the use of Printed Lighting and Flexible Hybrid Electronics Technologies in smart packaging. This capability opens doors in new market for us ”

Mr Garry Ng, Director
Honsen Printing Industries Pte Ltd

Smart Packaging Assistance

Despite the vast market potential of smart packaging, not many local enterprises create sustainable smart packaging products. Not having sufficient knowledge in printed electronics is one challenge. Smart packaging design that works for customers is another major constraint. The lack of experienced integrators that can provide total solution in smart packaging and insufficient industry expertise to combine effective marketing strategy to maximise the impact of smart packaging are real issues.

To address these, SIMTech launched several Collaborative Industry Projects (CIPs) on Printed Electronics and Smart Packaging since 2014 for the packaging and printing industries, industry associations, system or software solution providers and integrators to build capabilities across the supply chain to capture value in printed electronics for smart packaging. Since then, 40 MNCs and SMEs from the Precision Engineering, Printing and Packaging industry and brand owners participated in these CIPs. Among them is Zephyr Silkscreen, a subsidiary of Honsen. It is the first step towards smart packaging for Honsen in this journey.

“ At Nestlé, we believe innovation is about creating value through relevant solutions that address the needs of our business and consumers. This collaboration was a great example of how working with a public institution and a local SME could enable Nestlé to rapidly progress from concept, prototype to launch in a short span of less than six months ”

Dr Tan Sze, Managing Director
Nestlé R&D Center Pte Ltd

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EAC Emerging Applications Centre
Seeding and Growing Emerging Industries



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SME EXPANDS AUTOMATION SOLUTIONS

AiTech Robotics and Automation, a brainchild of entrepreneurs with more than 20 years of automation and engineering experience, decides to offer Industrial Robot Arm solution. The company, which provides cost effective Automated Guided Vehicles (AGVs) and robotics solutions, took in a SIMTech researcher through the A*STAR T-Up scheme to provide industrial robot arm solution and integrate this with a mobile robot to create a more powerful offering to capture higher value market share. It also aims to build up a strong internal industrial robot arm development team to carry out its own R&D.

During the attachment, the SIMTech researcher helped set up and led a mechanical design team to support AiTech's strategy to expand into the integrative robotic solutions. The researcher also pioneered and led industrial design efforts for the robots. This T-Up enabled AiTech to investigate robotic design prototyping using 3D printing which is more efficient. As a result, new product prototyping time is reduced by 80 per cent as the design is now carried out internally. Furthermore, the cost of rapid prototyping of the aesthetic shell for new products is also reduced by 76 per cent arising from the use of 3D printing technology.

“ **The T-Up programme is beneficial to SMEs. For this T-Up, SIMTech's contribution to the development of new series of robotic solutions is immense. It complements AiTech's new business strategy as well as build and tripled our R&D team to continue the efforts** ”

Mr Eric Lee, Founder and Director, AiTech Robotics and Automation

*Note: The T-Up initiative, a multi-agency effort by A*STAR, the Economic Development Board, SPRING Singapore, IE Singapore and the then Infocomm Development Authority, involves seconding RSEs to local enterprises to enable them to access the pool of R&D talent in the Research Institutes.*

For more information, please contact **Mr Cedric Yon** at yoon@SIMTech.a-star.edu.sg



MOVING AHEAD WITH ENHANCED OTR

An Enhanced OTR (Operations Roadmapping) conducted by SIMTech facilitators for Feinmetall Singapore Pte Ltd in early 2016 developed a strategic plan for the company to be one of the few in Southeast Asia capable of designing and manufacturing customised solution for wafer probe cards. In this roadmapping, market research was also conducted by SIMTech's partner, HIS, to provide information on market size and segmentation, market share and growth for the company. On establishing from market intelligence that the Flip Chip market Compound Annual Growth Rate was more than 8 per cent, Feinmetall moved ahead in developing capabilities in this field.

Feinmetall launched five new initiatives focusing mainly on Master Class Training, skills upgrading and continuous training in wafer probe card manufacturing for its staff. Two courses on wafer manufacturing were launched in end-2016 with Employment and Employability Institute. These courses that aim to enhance performance are just the tip of the iceberg for Feinmetall's strategy moving forward. Maintenance e-Portals were also created to avoid reinventing the wheel of multiple problems that were earlier resolved. These aim to improve productivity by up to 20 per cent. A scientist from I²R (Institute of Infocomm Research) under the T-Up programme helped develop the e-Portals. The company has also expanded into a 627- square metre factory to house equipment and new manufacturing capabilities.

When these new initiatives bear fruit, Feinmetall's revenue is projected to increase by 10 – 15 per cent in 2017, cumulatively to 20 – 30 per cent by 2020.

“ **An important outcome of the Enhanced OTR process is the alignment/buy-in amongst senior and junior management on the company strategy. We would like to do another Enhanced OTR in the near future** ”

Mr Sam Chee Wah, General Manager, Feinmetall Singapore Pte Ltd

For more information, please contact **Mr Jeffrey Pan** at sppan@SIMTech.a-star.edu.sg



THUMBS UP FOR A★STAR COLLABORATIVE COMMERCE MARKETPLACE

Portal lists verified SMEs' capabilities and MNCs' requirements, A★STAR research institutes and universities to help companies grow business and bridge technology gaps

In less than a year since its launch last May, more than 350 companies and Singapore Precision Engineering and Technology Association and Singapore Manufacturing Association are members of the A★STAR Collaborative Commerce Marketplace (ACCM). About 80 per cent of these are Small and Medium Enterprises (SMEs). The rest are Large Local Enterprises and Multinational Corporations (MNCs).

The ACCM highlights local SMEs' capabilities for MNCs to source easily for prospective suppliers in Singapore. SMEs can also gain insights on

MNCs' needs. Through this network, ACCM facilitates greater business opportunities and partnerships across different sectors. It encourages companies to collaborate amongst themselves and with A★STAR RIs, and form interest groups. ACCM is open to all government agencies, suppliers and industry partners. It is a central data portal for Singapore government agencies to help the local manufacturing sector.

ACCM MNC member, Endress + Hauser (S.E.A.) Pte Ltd, a Swiss instrumentation company for the automation, chemical,

“ ACCM is clearly something Singapore's Manufacturing Industry has been waiting for ”

Ms Sabine Kempe, Marketing Director, In Mind Cloud Pte Ltd, a specialised Customer Relations Management Sales and Configure Price Quote software provider

“ ACCM is a great platform for SMEs to tap into the global markets ”

Mr Ooi Chee Kong, Senior Operations Manager, Jason Electronics Pte Ltd, a leading SME provider of integrated solutions in designing, supplying, installing, integrating, testing and commissioning solutions for the marine and offshore oil & gas industries

“ ACCM is a good platform for Endress + Hauser to be part of the ecosystem which is vital for our sustainable long-term growth. We can now connect with complementary partners among local SMEs and diversify our clientele. The portal can help us to form consortia bidding for overseas projects. As other manufacturing sector companies will be included in ACCM, this will greatly benefit us ”

Mr Lim Khay Guan, Managing Director, Endress + Hauser (S.E.A.) Pte Ltd

“ Through ACCM, SMEs are visible to MNCs. As companies listed on the ACCM are verified through a rigorous system, our chances of being successfully connected to MNCs as suppliers increase. With MNCs' needs specified, SIGENIC can expand our product offerings in a more targeted way. ACCM allows us to forge alliance with like-minded companies. The portal gives us access to a pool of valuable resources that greatly leveraged our position ”

Mr Koh Min Zhuan, Director, SIGENIC Pte Ltd

food & beverage, oil and gas, marine, life science and environment industry, learnt about ACCM through a Trade Association presentation in mid-March 2017. It wasted no time to be an ACCM MNC member the following week.

SIGENIC, an engineering solutions SME which provides real-time monitoring of machines' health using sensors, is another ACCM beneficiary. SIGENIC came upon ACCM on the Internet last December and contacted SIMTech to become a member.

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LASER OPTICS FOR MASS ADOPTION

Collaborative Industry Project on Customised Beam Shaping for Laser Material Processing

The laser processing market is estimated to grow from US\$6.40 Billions in 2015 to US\$9.75 Billions by 2022, at a Compound Annual Growth Rate of 6.13% from 2016 to 2022. With the rise in adoption of laser processing systems in precision engineering, microelectronics, medical, and automotive sectors, solid, gas, and liquid lasers are expected to play a key role in propelling the growth of the laser processing market in the next five years (Source MarketsandMarkets March 2016).

Laser beam shaping is a technique to redistribute the light energy by changing the light beam profile for a uniform intensity spot. This technique is useful to optimise laser-material processing to upgrade surface quality, control laser beam depth, enhance laser edge profile, and improve throughput.

Over the years, SIMTech has established a number of know-hows on laser-optics modules, high power lasers, and laser-optics characterisation. Lasers ranging from UV to Mid-IR are available in SIMTech as test beds for feasibility study of polymer and metal processing.

As an industry-focused institute, SIMTech is introducing the collaborative industry project (CIP) to work with optics component manufacturers, system integrators, laser material processing system manufacturers and end users. This CIP aims to help precision engineering companies to identify and enhance their competencies in developing new and high-value laser-based products and systems. Through this CIP, participants gain know-hows of surface quality control and processing speed improvement in material processing by the laser beam shaping technique. They also build up

competencies in design, engineering, and characterisation of customised laser beams.

In learning sessions of the CIP, the participants will be provided with customised software kits including online laser measurement and beam shaper design to understand laser and beam shaping principles and critical parameters. In practice sessions, one-to-one feasibility or case study will be conducted on a specific laser beam shaping problem statement provided by a company.

The CIP is expected to benefit the participating companies by building up their new competences in manufacturing of high-value added optical modules and adopting new laser manufacturing processes for product innovation. The CIP is supported by SPRING through the CDG scheme.

“ Customised beam shaping of laser output, for example from a curved to a flat profile of constant intensity, will enable us to improve the precision and yield of laser material processing. For instance, better control of heat zone will minimise the debris in laser drilling. Potential improvement of precision towards micrometre can be expected in laser marking, micromachining and cladding applications ”

Mr Damien Chen, Product Manager, Sintec Optronics

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PE COI Precision Engineering
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SOLUTION BOOSTS PRODUCTIVITY

Mobile Workflow, ready-to-go technology for immediate use, eases tedium and errors for SME

United Graphic Pte Ltd, a colour separation house, found a magic solution in SIMTech's Mobile Workflow (wfMOBILE™). wfMOBILE™ fills its digitalisation gap by enabling the SME to track their operations and job status on-the-go.

Since commencement of operations 30 years ago, United Graphic adopted a series of non-satisfactory manual solutions, ranging from using a hard cover exercise book to record the 100-200 incoming jobs at any one time, managed by 6 Sales Representatives, to relying solely on Supervisors' memory. An improvement 10 years ago used spreadsheet to record all the more than 100 jobs daily during peak periods. However, updating on spreadsheets was still tedious. In 2015, United Graphic further improved its job monitoring by listing all current jobs on a large white board. Although much better than previous methods, it required all Sales Representatives to list the job titles on the board. Whenever there is a change in status, the Sales Representatives have to update and monitor the job status. Production Leaders have to keep a close eye on every job movement

“ With the implementation of wfMOBILE™, we now have real-time visibility of job status. Job scheduling is tightened and unbilled jobs can be traced much more easily ”

Ms Foo Li Chiun, Managing Director,
United Graphic Pte Ltd

with corresponding updating of each job status. The accuracy of jobs status depends on all involved to update the white board whenever a change occurs.

SIMTech introduced an app that allows United Graphic to capture its job status in real-time. The company was excited about this magic solution to resolve its problems. A feasibility study was carried out to implement wfMOBILE™, followed by training for its staff and trial run of the app. The application enables quick creation of workflow tracking of the

jobs status in the Production and Sales Departments, from commencement to shipping to its clients. The Sales Representative enters incoming jobs into the app. Every of its 4 Production Divisions check-in to the app before starting work on the job. The Sales Representative signs off the completed jobs when these are ready for shipping. Search time to locate a job status is reduced by 80 per cent from 5 minutes to a minute. Supervisor updating job status is lower by 75 per cent, freeing the supervisor for supervisory work.

wfMOBILE™ is now extended for use by companies in the food and laundry businesses. More applications in other industry clusters are being explored.

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MPTC Manufacturing Productivity
Technology Centre
Enhancing Manufacturing Productivity



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NATURAL FIBRE COMPOSITES

Nature's solution for good sound proofing

These natural fibres — flax, hemp, jute and coir — are increasingly used in composite materials due to their good mechanical properties, lightness, environmental-friendliness and ability to absorb energy effectively. With these strengths, SIMTech has translated these natural fibre composites into applications by developing relevant processing techniques. One such development is the use of natural (flax and coir) composites for ear cups of earmuffs.

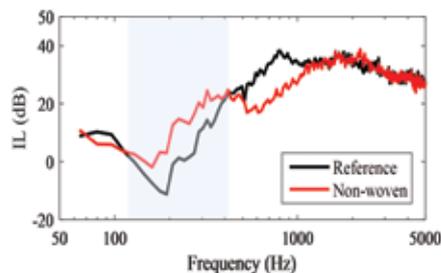


To do this, SIMTech examined the potential use of natural fibre composites in ear cups and ear plugs, carried out processing of composite preform (prepreg), manufacturing process for the ear cups and investigation of acoustic performance. The composite ear cups were manufactured by incorporating

flax fibres and coir fibres using compression moulding technique.

The resulting natural fibre composite earmuff was tested on a head and torso simulator (B&K Type 4100) for acoustic performance. An omnidirectional loudspeaker was placed in a reverberation chamber to transmit various types of noise signals for the tests. The experimental results showed that the inclusion of natural fibres was able to enhance the performance of the earmuffs in reducing low frequency noise compared to typical earmuffs.

An improvement in noise reduction is achieved by up to 16.6 decibel within the range of 128–416 Hz under booming noise and; up to 10.3 decibel



The comparison between the sound insertion loss (IL) of reference and non-woven flax fibre-reinforced PP earmuffs

within the range of 160–360 Hz under firing noise, compared to a popular off-the-shelf earmuffs.

This research work is a collaboration between Composite Processing team at SIMTech and the Department of Mechanical Engineering, National University of Singapore.

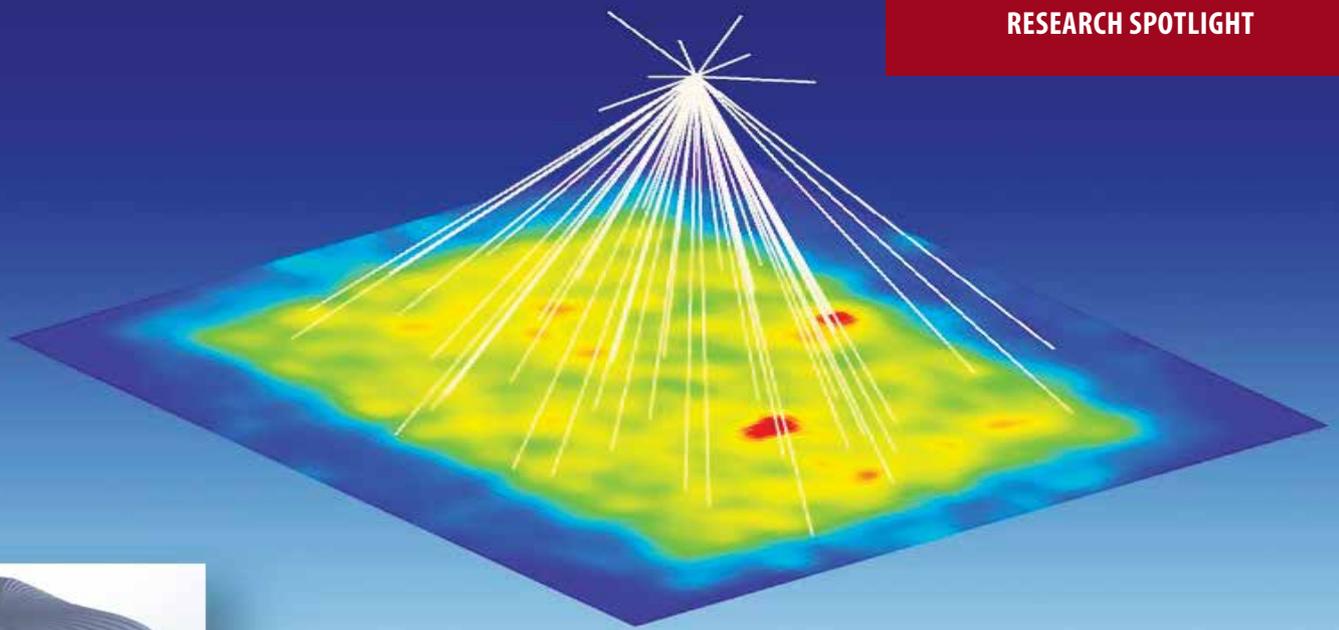
With these optimistic results, composite earmuffs are suitable for use in transient noise environments such as in automobile cabins, at airports and construction sites

For enquiries, please contact
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Freeform collimator and uniform distribution

FREEFORM OPTICS DESIGN

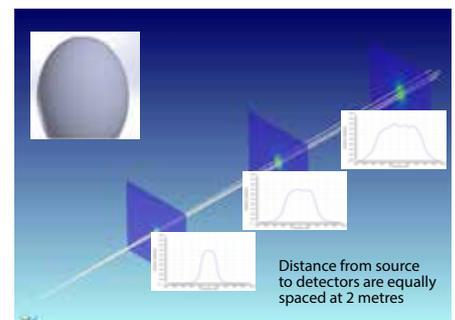
Freeform optics surfaces revolutionise high-tech applications

Traditionally, optical lenses are in the form of spherical surfaces and are called spherical lenses. Although these lenses are widely used in cameras, microscopes, telescopes or inspection systems, spherical lenses are usually bulky, limiting their applications in compact optical devices and systems. The advent of optics with freeform optics surfaces enable many compact optical systems such as Augmented Reality /Virtual Reality glasses, wearable biometric recorders which were previously available in sci-fi movies.

SIMTech methodology to design freeform optical surfaces that are capable of uniform illumination in various shapes

Freeform lenses can have arbitrary surfaces and do not need to be rotational symmetrical. The major challenge with freeform lenses is the lack of a systematic approach to design surfaces that can deliver the desired optical functions. It was only in 2012 with the invention of the nodal field theory that many other methods are available to design freeform lens for both imaging and non-imaging optics.

The SIMTech team developed a design methodology to design freeform lenses that are capable of generating uniform illumination in various shapes. In the title picture, the light distribution from a 1mm LED source is being altered by a freeform lens into a rectangle shaped illumination over an area of 10 meters by 8 meters. The CAD model of a rotational symmetrical freeform lens is shown at the bottom left of the photo.



Freeform optics for rectangle illumination

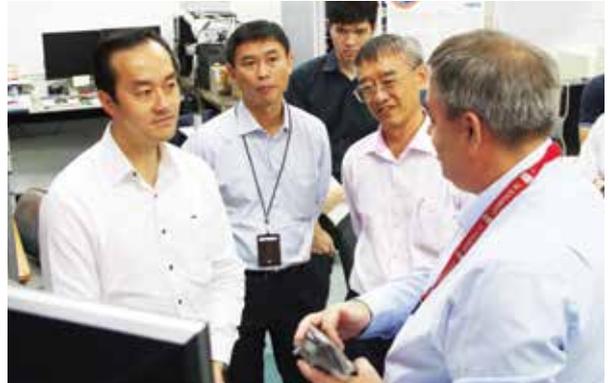
Another example is shown in the above picture, where a near parallel beam with a spread angle of 2 degrees and a flat top are being designed with a 1mm LED source. The flat top is visible throughout the light propagation and seen at each image.

For more information, please contact
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Major corporate events were organised to engage industry and forge partnerships.

Senior Minister of State for Trade & Industry, Dr Koh Poh Koon's Visit to SIMTech, 23 March

SIMTech welcomed Dr Koh Poh Koon for an update of the Model Factory@SIMTech. In addition, Dr Koh was briefed on SIMTech overview and industry engagement models. During the lab tours on advanced manufacturing technologies- Manufacturing Control Tower™(MCT™), Large Area Processing, 3D Additive Manufacturing and X-ray technologies - industry partners from CKE Manufacturing, Worldbizz Engineering, 3D Metalforge and Centiforce Instruments shared the benefits arising from the collaboration with SIMTech.



PE COI Annual Conference 2017, 4 April

This event, in collaboration with the Singapore Precision Engineering and Technology Association (SPETA), was held alongside the Manufacturing Technology Asia (MTA) 2017. The event attracted 251 attendees from 133 companies from industry, leaders from government agencies, SPETA and Association of Electronics Industry in Singapore.



The theme is Growing Singapore's Precision Engineering Industry through Technology Innovation. Aligned with this, the Precision Engineering Industry Transformation Map (ITM) and Landscape was shared by Mr Kelvin Zin, Head of Precision Engineering, Economic Development Board. An Overview of PE COI Initiatives and Strategy for Precision Engineering Industry was provided by Dr Alex Thoe, Deputy Director, Precision Engineering Centre of Innovation (PE COI), SIMTech as well as Strategic Plan: Enhanced Operation Technology Roadmapping/Business Transformation presented by Mr Jeff Pan, Senior Manager, Industry Development Office, SIMTech.



An industry leader, Mr Sam Chee Wah, General Manager of Feinmetall Singapore Pte Ltd shared on his company's experience in Business Transformation through Roadmapping with SIMTech. Mr Berne Chung, Managing Director, Component Technology Pte Ltd, enlightened the attendees on Business Transformation through Technology Adoption, a collaboration with SIMTech.

Upcoming Trends in Industry 4.0: Smart Manufacturing for Precision Engineering were highlighted by Mr Gerry Ong, Managing Director, SMT Technology Pte Ltd. A perspective on How Companies Can Leverage on Additive Manufacturing Technologies for Competitive Advantage by Mr Matthew Waterhouse, Chief Executive Officer, 3D Metalforge Pte Ltd was well received by attendees.

Senior Minister of State for Trade and Industry, Ms Sim Ann, who toured the SIMTech booth at the Capabilities Hub@MTA 2017 was briefed on the A*STAR Collaborative Commerce Marketplace (ACCM), an e-portal which highlights the capabilities of local Small and Medium Enterprises so that Multinational Corporations and Large Local Enterprises can easily source for prospective suppliers in Singapore. The GOH was also updated on SIMTech's 3D Additive Manufacturing and Machining Dynamics Technologies, to name a few.

Collaborative Industry Projects (CIPs) are cost-effective platforms, where companies facing similar issues work jointly with SIMTech, to develop capabilities and technology. In addition, there are some ready-to-go technologies which are ready for adoption.

Joining Technology Development for Lightweight Materials

Launch date: July 2017

This CIP aims to help companies develop and demonstrate various advanced joining techniques for lightweight materials, such as Al alloys, Mg alloys, Ti alloys, metal to polymer composites and hybrid structures. This CIP also lays the foundations for companies to adopt advanced joining capabilities and capture business opportunities in the area of lightweight materials manufacturing.

For enquiries, please contact **Ms Joyce Ling** at linglp@SIMTech.a-star.edu.sg

Corrosion Assessment of Materials Systems in Industrial Application

Launch date: July 2017

This CIP aims to help the companies tackle their corrosion problems through evaluation of their materials/corrosion system.

For enquiries, please contact **Dr Mehrdad Zarinejad** at mehrdad@SIMTech.a-star.edu.sg

3D Marking and Surface Engraving for Medical Devices

Launch date: August 2017

This CIP aims to demonstrate 3D laser marking and surface feature engraving on complex surfaces with various base materials for medical devices.

For enquiries, please contact **Mr John Lim** at kylim@SIMTech.a-star.edu.sg

Customised Tool Grinding, Edge Finishing & In-Situ Measurement

Launch date: August 2017

This CIP aims to enhance the effectiveness of local companies in interrupted cutting and high aspect boring of corrosion resistant alloys with innovative integrated grinding, polishing and in-situ measurement of high performance carbide tooling, drills and inserts.

For enquiries, please contact **Dr Lim Beng Siong** at bslim@SIMTech.a-star.edu.sg

Collection Delivery Management System (CDMS)

Ready for Adoption

This CIP aims to use a mobile NFC/barcode-based solution to ensure right items are collected and delivered to the right customer and on time.

For enquiries, please contact **Mr He Wei** at whe@SIMTech.a-star.edu.sg

Manufacturing Operations Management (MOM)

Ready for Adoption

This CIP aims to implement the MOM solution that manages the entire manufacturing operation from production planning, raw material management, mobile shop floor tracking, and delivery order generation. Through this programme, companies can better manage and improve their manufacturing operations.

For enquiries, please contact **Mr Chua Tay Jin** at tjchua@SIMTech.a-star.edu.sg

Electronic Data Logging for Job Tracking & Report Generation

Ready for Adoption

This CIP aims to train and equip companies with electronic data logging capabilities for job tracking and report generation, through technology and Android apps.

For enquiries, please contact **Mr Chong Wee Keat** at wkchong@SIMTech.a-star.edu.sg

Mobile Workflow (wfMOBILE™)

Ready for Adoption

This CIP aims to provide a platform for mobile workforce to perform user-configurable business/operational transactions using mobile devices.

For enquiries, please contact **Dr Justin Lim** at limkm@SIMTech.a-star.edu.sg

SIMTech Annual Manufacturing Forum 2017 (AMF'17)

27 July 2017 | 8.30am - 5.00pm | Grand Copthorne Waterfront Hotel Singapore, Grand Ballroom, Level 4

Join us to be inspired and connected by the array of innovations and business opportunities to be presented at AMF'17. With the theme, **Innovating with Flexible Hybrid Electronics (FHE)**, SIMTech AMF'17, in its 12th edition, brings together technology leaders and experts in FHE to share the global industry trends and developments that are driving the industry.

For enquiries, please contact **Ms Nadia Sekar Chandra** at sekarn@SIMTech.a-star.edu.sg

Emerging Applications Centre Annual Conference 2017

19 September 2017 | 8.30am - 5.00pm | Matrix, Breakthrough, Discovery and Creation Theatres, Level 4, Biopolis Singapore

With the theme, **Building Microfluidics Eco-system for Singapore Industry**, you are invited to this conference to discover and tap into this lucrative yet R&D-intensive market. An array of microfluidics/lab-on-a-chip technologies, services, products and related businesses as well as SIMTech Microfluidics Foundry (SMF) competencies will be exhibited.



Scan for more events

For enquiries, please contact **Mr Rick Yeo** at rickyeyo@SIMTech.a-star.edu.sg

PE WSQ Graduate Diploma in Manufacturing Operation Management (MOM)

Module 4: Advanced Planning and Scheduling

21 August 2017 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Improve Manufacturing Productivity through Energy Usage Pattern Monitoring and Analysis

4 September 2017 | 6.30pm - 9.30pm, Institution of Engineers Singapore

PE WSQ Graduate Diploma in MedTech Manufacturing

Module 4: MedTech Manufacturing and Supply Chain Management

4 September 2017 | 8.30am - 12.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Mechatronics

Module 4: Apply Industrial Robots and Automation

4 September 2017 | 8.30am - 12.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Precision Measurement Characterisation (PMC)

Module 1: Geometric Dimensioning and Tolerancing

5 September 2017 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Graduate Diploma in Precision Measurement Characterisation (PMC)

Module 2: Engineering Optics & Optical Measurements

7 September 2017 | 6.30pm - 9.30pm, NTU Valley Block

PE WSQ Graduate Diploma in Advanced Welding Technologies

Module 2: Implement Laser Beam Welding

12 September 2017 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Operations Management Innovation Programme - Public Batch

15 September 2017 | 6.30pm - 9.30pm, Fusionopolis Two

PE WSQ Apply Electro-chemical Processes and Coatings for Wear and Corrosion Protection

19 September 2017 | 6.30pm - 9.30pm, Fusionopolis Two

Master Class in Emerging Manufacturing Technologies - Composite Repair, Non-Destructive Testing & Training

26 - 27 September 2017 | 9.00am - 6.00pm, Fusionopolis Two

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

For general enquiries, please contact
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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 400 researchers, we are committed to serving the manufacturing industry to develop the human, intellectual, and industrial capital in Singapore.

