NOTE FROM EDITOR...

Dear Friends and Industry Partners,

"Industry 4.0" or "Digital Transformation in Manufacturing" is no longer a future trend. Commonly referred to as the fourth industrial revolution, the current trend of automation and data exchange in manufacturing technologies which include cyber-physical systems, the Internet of Things, cloud computing and cognitive computing, is already causing large-scale and sweeping transformation across multiple aspects of business, providing unparalleled opportunities for value creation, delivery, and capture. Companies need to embrace the fast evolving digital technologies to respond to the increasingly demanding customers' expectations in order to remain competitive and relevant.

Aware of this need, the 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. Its purpose is to train and guide key personnel of organisations to be **Digital Transformers** in leveraging digital technologies to transform the business value proposition, organisational processes, and sta□, using the SIMTech-developed **Digital Transformation & Innovation™ (DTI™) Methodology.**

The DTI Programme details and bene□ts are highlighted in the opposite pages.

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Editor, Manufacturing Matters
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DIGITAL TRANSFORMATION AND INNOVATION JOURNEY MADE EASY

P g a e h a be e e a e d be f e- ead

Companies today face ongoing daunting challenges in the business environment ranging from volatile global business trends, disruptive technologies to meeting increasingly demanding expectations of customers. To become more competitive, many industry and business leaders are looking for a structured approach in exploiting digital technologies to transform their business. Easier said than done, a successful digital transformation demands changes to several aspects of the business such as operating model, process, revenue stream, products and services.

Help is now at hand for local companies to navigate through the complexity of the digital transformation journey. SIMTech launched the Digital Transformation & Innovation (DTI) Programme. It uses a proprietary methodology for this purpose. Under this programme, the participants are trained to become Digital Transformers and systematically achieve digital transformation in □ve stages to integrate information □ow, systems and decision-making across the business value chain. The □rst stage of the

such as Heraeus Group and CIBA Vision Asian Manufacturing and Logistics Pte Ltd are in the pipeline for subsequent participations.

To help more local companies to embark on digital transformation, SIMTech is partnering with the Singapore Precision Engineering and Technology Association (SPETA) and the NTUC LearningHub to expand the outreach of the DTI Programme.

In addition, the NTUC LearningHub will launch a series of training programmes such as Leadership, Visioning and Change Management to complement the DTI Programme. These soft skills are equally critical, especially for businesses that have very deep legacy and cultural roots.

journey determines the objectives of the company's business. This is followed by understanding the business activity landscape and system architecture. Identifying transformation areas for the business is the next phase of the journey and initiatives are generated once the transformation areas are known. An action plan will be developed to initiate the transformation and innovation journey.

With the rapid advancement of Internet of Things (IoT) technologies and cloud computing, companies today have unprecedented access to a huge amount of data. The key challenge is to turn this data into actionable insights. Through the DTI Programme, participants will learn a methodical approach in analysing the information ow, generating business insights, and developing initiatives that will truly transform their business models. In addition, the programme provides a suite of digital use cases that help participants to think out of the box and envision how "technology can help businesses to do things di erently", which according to George Westerman, a Principal Research Scientist with the MIT Sloan Initiative on Digital Economy, re ects the true "value of technology" and the purpose of digital transformation.

The DTI Programme training is carried out in a learning environment where immersive learning Tw 024 and the pug T7t0mation.

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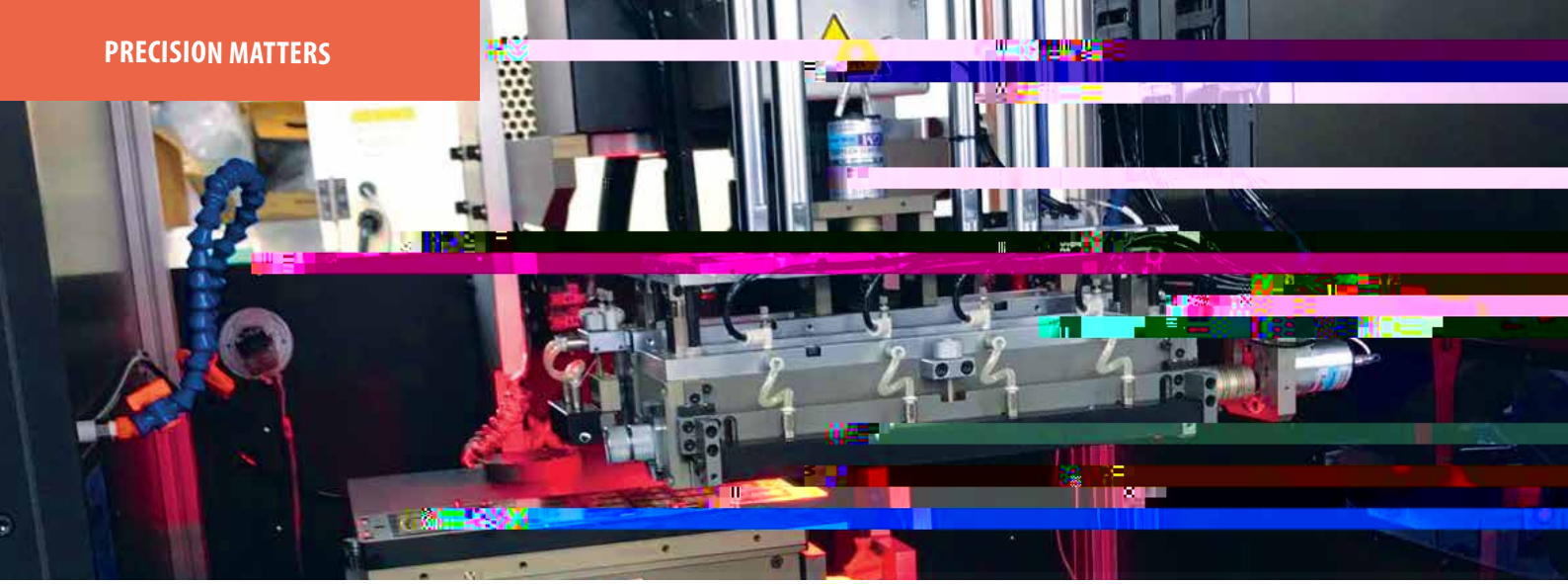

LASER MACHINING TECHNOLOGY FOR SINGULATION OF IC PACKAGES

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Singulation of IC package is one of the critical processes in its manufacturing. These include singulation of Quad-Flat No-leads strips, Ball Grid Array packages, MicroSD, Interposer attached packages, MEMS chips, ND fan-out wafer/panel level packages. However, the current mechanical sawing of mould compound substrate electronic packages causes edge chippings, edge cracks, copper smear, edge copper burr and solder bridging, etc. Importantly, wet chemical slurry or cutting water causes current leakage during sawing. Other issues are the mechanical saw wear which caused unstable chip dimensions and slow the dicing speed.

It is not surprising that laser has emerged as an attractive alternative to mechanical methods for singulation of IC packages. However, this solution gives rise to edge thermal e□ect, material burning and ablation causing ejected material re-deposition which are the barriers for dicing of mould compound electronic packages. To overcome these challenges, SIMTech has successfully developed a proprietary singulation process for singulation of various lead frame MEMS substrates.

SIMTech co-developed a pulse width tunable nanosecond Near Infrared (NIR) □bre laser singulation system with Genuine Solutions Pte Ltd (GSP) whose business is in the trading, as well as manufacturing and repair of semiconductor process and testing equipment. SIMTech transferred the technology to GSP for singulation of more than 15 types of lead frame packages.

> **“T jec SIMTec e ed GSP ga ed ec ca ec g f c .e a a e a de f a e a ca ad a ced ac age g a e ga d e d c de e .e ”**
>
> M Sa d Cha ı , D eç , Ge ı e S ı, P e ı d

The developed technology resolved the issues of copper lead smearing, edge burr, and edge chipping produced in conventional diamond sawing process. It is the □rst dry process to singulate Organic Land Grid Array (OLGA) □ashlight package which avoid wet dicing liquid seeping into the packages causing reliability issues.

The collaboration enabled GSP to set up a laser singulation system in their customer premises. This is a new technology adopted for singulation process by this customer.

Embracing Su

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Auto□uorescence image of unstained and unmodi□ed cells

TURNING ORDINARY CELLS INTO TINY LASERS

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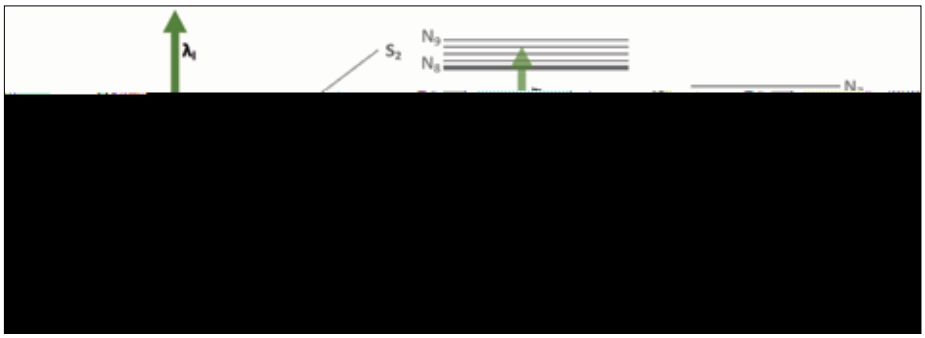
Ascertaining the quality of cells typically entails some form of destructive testing. This form of testing is essentially frowned upon if the cells are few in numbers or hard to come by. Fortunately, cells possess natural signals that can be probed to determine their state of health, without having to modify or break them apart. However, such signals – known as auto□uorescence – are naturally weak and di□cult to measure.

Lasing o□ers a means of amplifying such auto□uorescence signals through a repetitive stimulation process, but require that multiple stringent criteria be met. SIMTech researchers have developed a software capable of computing these strict requirements. The software takes into consideration the many energy states and possible transitions that the bio-molecules, responsible for auto□uorescence, can take. It then computes the minimum amount of input energy required to achieve lasing.

Theoretical studies were conducted with this software, using computational parameters mimicking the conditions describing ordinary cells. Parameters were related to three key components of a laser – quantity of input energy; quality of the laser cavity; and amount of auto□uorescing bio-molecules. Speci□cally, computations accounted for the maximum input energies before damaging cells; the losses induced by inconsistencies and imperfections in cells; and the highest available amounts of auto□uorescing bio-molecules naturally found in cells. From the studies,



A cell laser system with an energy level diagram describing the di□erent energy states and transitions of auto□uorescing bio-molecules (Ref: Yong and Ding, "Lasing with Cell-endogenous Fluorophores: Parameters and Conditions", Scienti□c Reports, 10.1038/s41598-017-12711-x)

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SIMTech researchers found that it is possible to turn ordinary cells into lasers, provided that a good enough laser cavity could be fashioned around or within cells. Cavities with such qualities are already available, but would require a fair amount of work for integration with cells.

Transforming weak auto□uorescence signals into strong laser signals provides an unconventional perspective to weak signal measurements. Instead of devising high performance instruments to capture scarce signals, enhancing these signals using well-established laser physics has been demonstrated to be a potential alternative.

For more information, please contact , Precision Measurements Group at derrick-yong@SIMTech.a-star.edu.sg

Ma c a e e, e e ga ed, e gage d, a d f ge a, e h

SIMTec A a Ma fac g F (AMF) 2018, 18 J

MOU Signing at SIMTech AMF'18

With the theme, **Technology Partnership for Impact,** SIMTech's agship conference was attended by 250 representatives from 175 organisations. In the Annual Manufacturing Lecture, Dr Lim Ser Yong, SIMTech's Executive Director, shared the Technology Extension Partnership Programme as the institute's future strategy.

The event also focused on the value capture of SIMTech-industry collaborations. Mr Ching Boon Khian, Senior Director-Garment Care Innovation, Philips Electronics (S), spoke on Material Innovation: Key Success Factors in Partnering to Build New Capability. Product Innovation: Partnership with SIMTech to build the world's rst 3D inspection system was presented by Mr Berne Chung, Managing Director, Component Technology Pte Ltd. A Memorandum of Understanding was signed with six Technology Extension Partners who adopt SIMTech's technology to develop products, solutions and services for end-users in di erent industries and domains.

SIMTec 25 A e a Ga a D e, 2 A g,

SIMTech 25th Anniversary Gala Dinner

SIMTech's Silver Jubilee Gala Dinner graced by A*STAR Chairman, Mr Lim Chuan Poh, was attended by 260 invited guests. In his welcome remarks, Dr Lim Ser Yong, SIMTech's Executive Director thanked partners, associations and related government agencies which contributed to the institute's growth and achievements.

A*STAR Chairman highlighted SIMTech has played a strong role in assisting industry through technology development, technology transfer and knowledge transfer in his address. Chairman was presented the SIMTech 25th Anniversary Commemorative Publication which highlighted some of the institute's collaborations with industry. Thirteen industry partners, featured in the commemorative publication, were honoured with the SIMTech R&D award for their impactful partnerships.

SIMTec -SSG PE WSQ G ad a Ce e 2018, 16 A g,

SIMTech-SSG PE WSQ Graduation Ceremony

Graduands who have completed their respective SIMTech-SkillsFuture Singapore (SSG) Precision Engineering (PE) Workforce Skills Quali cations (WSQ) Programmes and the Manufacturing R&D Certi cate Programme celebrated their graduation recently. Mr Ng Cher Pong, Chief Executive, SkillsFuture Singapore, graced this happy occasion.

Winners of the Most Inspiring Trainee Award were honoured. They are Mr Kwek Kok Kwong, Chief Executive O cer, NTUC LearningHub Pte Ltd; Mr Low Suan Teng Nicholas, EHS & Facility Specialist, Bell Helicopter Asia Pte Ltd, and Mr Sundaram Sampathkumar, QA Manager, Moveon Technologies Pte Ltd. The Best Industry Partner Award goes to NTUC LearningHub Pte Ltd, Mr Kwek Kok Kwong, Chief Executive O cer; Markono Print Media Pte Ltd, Mr Edwin Ng, Managing Director; ASM Technology Singapore Pte Ltd, Mr Kenny Kwan, Vice President, Technology and ZACD Group Ltd, Mr Darren Chew, Executive Director and Chief Operating O cer.

EAC A a C fe e ce 2018, 12 Se e be


EAC Annual Conference 2018

Industry attendees to this conference, themed **Building Flexible Hybrid Electronics Eco-system for Singapore Wearable Tech and Other Industries,** were kept abreast of the best practices and technological progress in Flexible Hybrid Electronics for Wearable Tech and other applications. Mr David Anthus, Senior Director of Engineering and Strategic Development, Jabil USA, presented on How Wearables are Driving Connected Health. Mr Abhay Bangi, Healthcare and Lifesciences Partner from Ernst & Young, spoke on the 1000 Wearables Medtech: Where the Future of Health is. Stretchable and Deformable Materials and Devices for Wearable Tech was shared by Prof Lee Pooi See, School of Materials Science and Engineering, Nanyang Technological University.

260 attendees from 140 companies also bene ted from the networking and learnt about the showcased Wearable Tech Products Innovation by the SIMTech Collaborative Industry Project (CIP) participants on Smart Wearable Product Innovation.

I e Pa g

Inventory planning development to control rightsizing inventory and maximise performance.

For enquiries, please contact at
lschai@SIMTech.a-star.edu.sg

Ma e Sc ed g

Manpower optimising tool to help planners in shift scheduling and manpower allocation to minimise labour cost.

For enquiries, please contact at
marcus_chern@SIMTech.a-star.edu.sg

Rea -T e Da b a d

A real-time dashboard that is customised to suit the company's needs and to connect multiple sources for congregation and

SIMTec S a ab e Ma fac g Ce e A a C fe e ce 2018

2 November 2018 I 9.00am-5.30pm I Matrix, Biopolis Singapore, Breakthrough and Discovery Theatres, Level 4

This year's conference theme is **Resource E□ciency in Manufacturing.** Delivering the keynote presentation is Dr Martin Vogt, Managing Director of VDI Resource E□ciency Centre (Germany), a competence centre of the German Association of Engineers (VDI) focusing on promoting resource e□cient technologies and processes in small and medium sized businesses.

There will be a post-conference Master Class on Resource E□ciency in Manufacturing – Methodologies and Industry Practice by *Dr Martin Vogt.* **Both events are comlimentary. For registration,** ***please visit https://appsvc.a-star.edu.sg/ERP/EventRegistration.aspx?EventID=2018082915090427***

For enquiries, please contact *at hwlee@SIMTech.a-star.edu.sg*

PE WSQ A I eg a ed Ca b F A e e Me d g (-CARE)

8 October 2018 | 9.00am - 6.00pm, SIMTech, Fusionopolis 2

PE WSQ U de a d e M c d c Ma fac g P ce e

8 October 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

PE WSQ G ad a e D a Add e Ma fac g

Module 1: Smart Additive Manufacturing System

23 October 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

PE WSQ I e a f F da a Lea a W ace

24 October 2018 | 8.30am - 12.30pm, SIMTech, Fusionopolis 2

PE WSQ OMNI P g a

29 October 2018 | 8.30am - 12.30pm, SIMTech, Fusionopolis 2

Ma e Ca Ma e g Sa e a d O e a P a g (S&OP) P ce A g S a eg e f O e a a E ce e ce

29 - 30 October 2018 | 8.30am - 5.30pm, SIMTech, Fusionopolis 2

PE WSQ G ad a e D a Ad a ced We d g Tec g e

Module 1: Design Arc Welding

20 November 2018 | 6.30pm - 9.30pm, SIMTech, Fusionopolis 2

Ma e Ca S C a A a c De c e, P ed c e & P e c e A a c

21 - 22 November 2018 | 8.30am - 5.30pm, SIMTech, Fusionopolis 2

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