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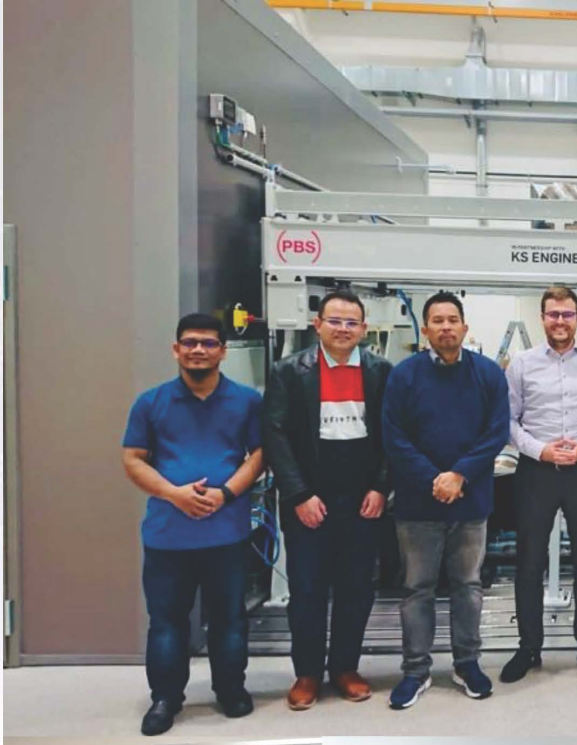
A Decade of Global Partnerships in Advanced Manufacturing Technology Research at Universiti Teknologi MARA (2014–2024)



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Universiti Teknologi MARA (UiTM) has emerged as a powerhouse in international collaborations, particularly in the realm of manufacturing technology over the past decade. Notably, its partnership with the Technical University of Chemnitz in 2014, backed by the esteemed German Research Foundation (DFG) and German Academic Exchange Service (DAAD), set the stage for a series of impactful ventures with renowned institutions worldwide.

Partnerships with universities like Montanuniversität Leoben, Technical University of Graz in Austria, Osaka University, National Institute of Technology Ube in Japan, Technical University of Liberec in the Czech Republic, and the revered ETH Zurich in Switzerland have broadened the reach. These collaborations owe their success to grant programs including Erasmus, ASEA-UNINET, Japan Student Services Organization, and the Swiss National Science Foundation.

The collaborative spirit at UiTM found its inception with the establishment of the Advanced Manufacturing Excellence Centre (AMTEx), evolving seamlessly into the Advanced Manufacturing Technology Research Interest Group (AMT-RIG). Recognized for its stellar performance, it ascended to official designation as one of UiTM centres of excellence, named as the Smart Manufacturing Research Institute (SMRI).

The first phase laid the groundwork by delving into the realm of virtual manufacturing, specifically focusing on wire arc additive manufacturing (WAAM). Utilizing cutting-edge software such as Simufact.Welding and JMATPRO, researchers embarked on a journey to predict critical factors including temperature distribution, cooling rate, phase transformation, and mechanical properties. This foundational phase set the stage for what was to come.
Moving forward, phase two saw the implementation and validation of theoretical findings through experimentation. Advanced robotic welding techniques, particularly cold metal transfer welding (CMT), were employed to bring theoretical simulations into the real-world realm. This hands-on approach ensured that theoretical models aligned with practical outcomes.

Phase three introduced a cost-efficient experimental design approach, emphasizing the development of Time-Temperature-Transformation (TTT) and Continuous Cooling Transformation (CCT) diagrams. By utilizing state-of-the-art equipment like the Gleeble machine, researchers sought to predict material expansion and grain size evolution, refining their understanding of material behaviour under varying conditions.

With a solid foundation in place, phase four focused on experimental validation of WAAM products, integrating insights from virtual manufacturing simulations to inform material properties determination. This iterative process ensured that theoretical predictions matched real-world observations, validating the efficacy of the developed models.

The culmination of these efforts led to the final phase: developing algorithms to further refine simulation accuracy. Using Simufact.Welding, researchers crafted algorithms capable of adjusting material properties based on multi-cycle temperature effects and grain size variations. This innovative approach allowed for locally defined material properties, enhancing the fidelity of simulations to real-world scenarios.

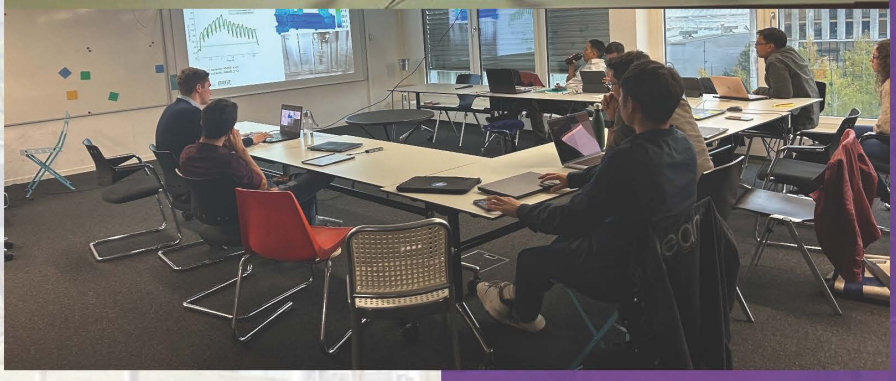
As UiTM continues its journey towards innovation and leadership in advanced manufacturing, its sights are set on a future defined by digital repair. Coined by UiTM researchers as Wire Arc Additive Remanufacturing (WAAR), this groundbreaking initiative represents a paradigm shift in the aerospace industry.

Aligned with the Malaysian Aerospace Industry Blueprint 2030, the goal is clear - to emerge as the foremost leader and technological provider in advanced digital repair for aerospace maintenance, repair and overhaul (MRO) programs. This strategic direction underscores the commitment to pushing the boundaries of possibility and driving transformative change within the aerospace sector. WAAR promises not only to streamline existing repair processes but also to

UiTM has successfully transferred manufacturing technologies and knowledge to industries within Malaysia. Noteworthy are UiTM collaborations with industry like ORS Technologies Sdn Bhd, Flexkey Sdn Bhd, and 3D Gens Sdn Bhd, which have facilitated access to cutting-edge advancements. These partnerships address industry-specific challenges, driving mutual learning and growth, and propelling global advancements.

UiTM has carved a niche as a leader in manufacturing simulation, focusing on metal additive manufacturing, metal forming, metal casting and welding processes. Its commitment to pushing boundaries is evident in integrating artificial intelligence with simulation processes, promising to revolutionize production optimization and product development.

UiTM aims to becoming a leader in advanced manufacturing simulation technology in Southeast Asia. It has been meticulously planned and executed over several distinct phases. Each phase represented a deliberate step forward in research and development, aimed at mastering the intricacies of manufacturing simulation.



The joint efforts between UiTM and its partners have yielded remarkable outcomes, showcasing the power of collaboration in driving research excellence. The projects have nurtured the talents of one postdoctoral researcher, three PhD students, and five master students, providing them with invaluable opportunities to contribute to cutting-edge research. Moreover, the collaborative research has led to the publication of more than 40 joint papers in high-impact journals, highlighting the significance and relevance of the research outcomes.

With strong support from its top management and a clear strategic goal to become a Globally Renowned University by 2025 (GRU2025), UiTM is committed to expanding its international collaborations in advanced manufacturing technology research and contribute significantly to on a global scale.

The success of international collaboration underscores its power in driving impactful results. The partnerships with prestigious institutions demonstrate the potential for transformative outcomes through cross-border cooperation in manufacturing technology.

introduce unprecedented levels of efficiency, reliability, and cost-effectiveness.

By leveraging advanced manufacturing techniques and cutting-edge digital technologies, UiTM aims to redefine the standards of excellence in aerospace MRO. The integration of WAAR into industry practices will not only enhance operational capabilities but also pave the way for new opportunities and advancements in aerospace engineering.

It is expected that in the coming years, WAAR will becomes synonymous with excellence, reliability, and innovation in aerospace digital repair. Through unwavering dedication and forward-thinking vision, UiTM is poised to shape the future of aerospace maintenance and repair on a global scale.

With leading institutions worldwide, the partnerships promise to drive innovation in aerospace technology, focusing on key areas of research. One such collaboration is with HES-SO Valais Wallis of Switzerland, exploring generative design for aerospace components. Another partnership, with Aalen University of Applied Sciences in Germany, delves into additive manufacturing in space. Lastly, UiTM is working with West University from Sweden on additive manufacturing for high-strength steel.

These partnerships bring together expertise from different corners of the globe, aiming to tackle challenges and drive progress in aerospace technology. By joining forces, UiTM and its partners are poised to make significant advancements in the field, shaping the future of aerospace innovation.

Despite challenges such as knowledge transfer, cultural differences, and financial constraints, the team has effectively navigated these obstacles through robust communication channels and strategic management practices.

In overall, these collaborations have brought numerous benefits, including access to expertise, enhanced research capabilities, and a strengthened reputation. With the grants total exceeding RM 4 million, mobility programs with involvement of 13 staff members, and engagement of 11 postgraduate and undergraduate students, making commitment to global collaboration is evident.

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UiTM *di hatiku* | اوسها تقوى مولیا

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