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1. AG Vasuthaven, ZK Wani, AB Abdullah, Z Hussain, Post-processing Techniques for Additive Manufacturing, 155-173. 2023

Active Grants

STG - Matching
Title: Tribological Performance of Additive Manufactured Aluminum Alloys, 2021-2023

FRGS Grant
Title: Investigation on the effect of hot forging on the deformation behavior and microstructural response of Wire Arc Additive Manufacturing (WAAM) of high strength low alloy (HSLA) steel components, 2022-2025

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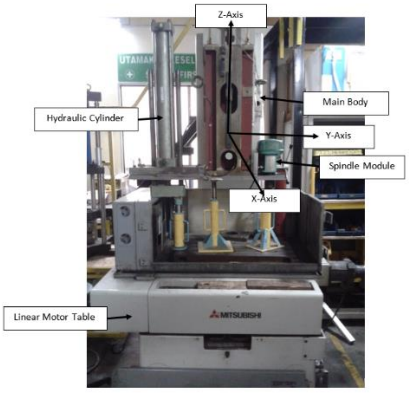
Preface

Financial sustainability is now becoming an important and critical issue at most of the public universities in Malaysia. Relying on government funding puts pressure on the government. Therefore, every year there is a complaint from university management about the allocation shortage. For the last 10 years, the government has been challenging the universities to raise income and cut expenses. One of the major expenditures for most universities is funding research projects. There are various sources of research funding, which mostly come from the government through various agencies like MOHE, MOSTI, and many more. However, they are also from industry and international funders. The most common and well-known approach in financial sustainability is by bringing funding to the universities via research grant, contract research and consultancies work. However, there is another way but not many choose to implement it, which is by utilizing the available facilities. Metal Forming Research Lab opts to contribute via the later approach. We collect disposed or abandoned machines or rigs and transform them into a functional and reliable experimental apparatus, and it has been practiced for a few years. To date, at least five machines and rigs have been retrofitted or reconditioned and used in several courses including EPL212 (Manufacturing Lab 1), EPL 331 (Manufacturing Lab 2), and EPD342 (Design for Manufacture and Tooling). Furthermore, for the last five years, at least five final-year projects utilized these facilities in their experiment. In addition, a few more postgraduate students also get benefited from machine like twist forming machine. One major project is where a body of a hybrid machine for composite hole making was took from a body of a disposed and abandoned heat sink EDM machine.

Refurbished Machines/Rigs at MFRL

Hydraulic press machine structure (red color) back in service after abandoned in scrap yard.

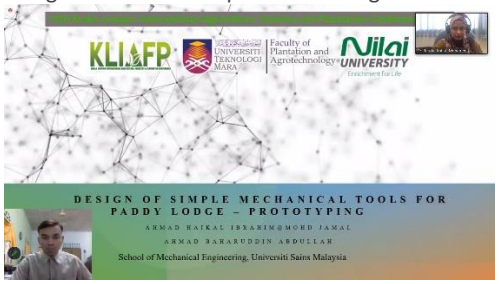
Twist forming machine utilized by FYP and Master students after minor repair and add load a cell.



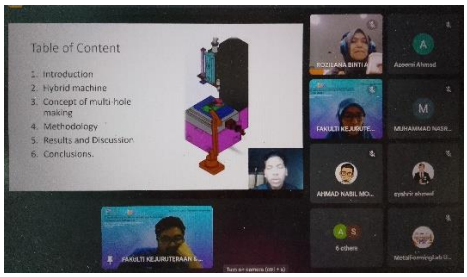
Disposed heat sink EDM machine reuse as main body for a PRGS project.

Final Year Project at International Conference.

This year, two final year students participated in an international conference. Azeemi Ahmad Tamizi presented part of his project at 5th International Symposium on Intelligent Manufacturing and Mechatronics (SIMM2023). His paper is about multi-hole making on composite panel, a feasibility study. While Ahmad Haikal Ibrahim@Jamal shared his invention at the 12th Kuala Lumpur International Agriculture, Forestry & Plantation Conference 2023. Both conferences are run virtually. His project is about the design of a mechanical tool for lodged paddy rice. It is a good exposure to them and hopefully both gained valuable experience during the conference.



(a) Haikal



(b) Azeemi

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Circular Economy and Features Reconstruction Via Additive Manufacturing – A Brief Review

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Circular Manufacturing, also known as circular economy, is a production and consumption approach that promotes businesses that recycle resources rather than wasting them (https://www.plataine.com/glossary/what-is-circular-manufacturing/). Pigosso and McAloone (2021) defined circular economy as an economy that provides multiple value creation mechanisms, which are separated from the consumption of limited resources especially in the case of manufacturing industries. They perceived it as an essential plan for assisting a transition to sustainable growth. Bjørnbet et al. (2021) said that since it keeps resources in a cycle, the circular economy concept has gained popularity. The adoption of circular economy practices may be better understood in terms of economic motivations. It is based on the idea of resource efficiency or "produce more with less", this idea has an inseparable connection to resources that result in cost reductions. This link is caused by the repair, redistribution, or recycling of industrial inputs, the greater utilisation of by-products, the creation of products from waste, and lower waste disposal costs. Resource efficiency also depends on using operational optimisation techniques, including minimising waste, maximising the use of energy, water, and resources, implementing efficient production practices etc. (Gusmerotti et al. 2019) With an impact on innovation, business models, waste reduction, improved repairs, and remanufacturing processes, additive manufacturing (AM) is an essential instrument for the circular economy. By providing an innovative basis for business models, design, and production, this area of study has the potential to provide numerous benefits for sustainable development. The resources and economically viable production are therefore possible as observed by Cecimo (2022). Jahromi et al. (2022) added that other functions including quick tooling and direct manufacture of operating end products, are now made available by AM techniques due to the development of innovative materials, processes, tools, and software. Hendrixson (2020) in her article listed elements that the AM can support the CE as shown in Figure 1.

Fig. 1 Elements that AM contributes to CE (Hendrixson, 2020).

Many industries, such as automotive, aerospace, healthcare, biomedical engineering, water treatment, and energy generating sectors, presently profit from sophisticated AM processes. Despite the advancement of contemporary features, such as three-dimensional (3D) printing, geometric design has developed greatly, defining it from other academic disciplines. Manufacturing industries are vital for the industrial level of circular economy (CE) implementation due to the fact that they have a role in how the product life cycle operates and have the opportunity to generate profit that is not dependent on resource use. Therefore, computer-aided design (CAD) and computer-aided 22 manufacturing (CAM) technology are crucial for the implementation of feature reconstructions. When traditional methods of production are paired with contemporary technology, the designs become more desirable (Lin et al., 2019). The addition of material in layers has been viewed as a new option to address environmental impact, material and process economy, and the possibility to produce new, complicated geometries that are limited by traditional manufacturing technologies (Anguilar-Duque et al. 2018). However, Cecimo (2022) stated that employing recycled materials alone does not result in an increase in overall sustainability of manufacturing. It is upsetting to believe that the issue is limited to the specific type of material and its recyclability. The most important issues are to the quantity of materials that the producer uses for making the final product, as well as the use of water, lubricants, and tools. As a result, the sustainability of the additive manufacturing process largely depends on the fact that manufacturers simply utilise the resources required for manufacturing a certain product and recycle the rest of the materials. As CE works principle aimed at optimizing resources, minimising waste generation and the use of limited natural resources. This enables the manufacturers to:

a) maintaining and restoring value from current produced goods.
b) reducing the need for resources that are limited.
c) Reduce the amount of energy used in new production.

In the past, linear economies employed a "take-make-dispose" strategy, collecting and manufacturing objects using natural resources after use discarding them away as waste material. Consumers now value items that use sustainable practices because they are becoming more aware of the impact they have on the environment. Manufacturers are being driven to move away from the traditional economic structure by today's movement towards a system of circular economy. With this transformation, a business will become less dependent on resources, reduce its environmental impact, and have more 23 designs and material versatility (https://www.plataine.com/glossary/what-is-circularmanufacturing/).

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