School of Maritime, Science and Engineering

IAMPAR: Integrating Additive Manufacturing into Product Design: An Aid to Assembly and Recyclability

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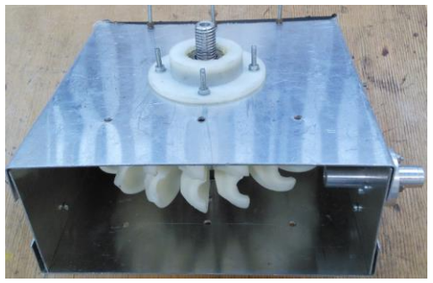
INTRODUCTION

Additive Manufacturing (AM) is the process of joining materials to make parts directly from 3D model data, usually layer upon layer, as opposite to subtractive manufacturing methods. Integrating AM into product design provides a new approach that can remove many limitations imposed by current design for manufacturing and design for assembly activities. If a sub-system/part of a complex product can be manufactured completely in one process and one material without using additional tooling/fixturing/process, this will lead to elimination of assembly operations so large costs (labours, toolings, logistics, etc.) will be reduced (examples illustrated in Fig. 1). Furthermore, because the whole sub-system/product is made of one material, it is straightaway to recycle fully without partial or complete disassembly once the product reaches its end of life.

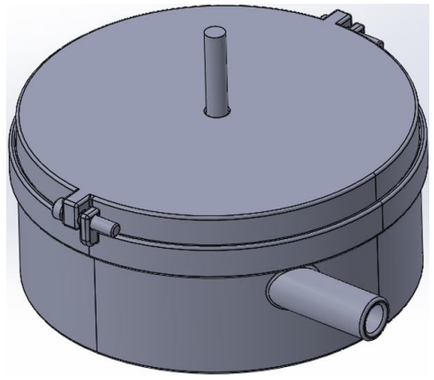
The 3D printed GE fuel nozzles

AIM

The aim of this research is to construct a feasibility study on integrating AM into product design to determine what possibilities/extents AM can offer to product designers wishing simplify assembly operations (times/costs) and improve recyclability (minimising waste/costs) of the product.



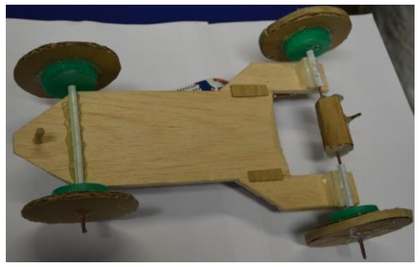
A water turbine made manually



A water turbine CAD design

METHODS

- Comprehensive literature survey/evaluation on design for manufacturing, assembly and recyclability (demonstration examples see in Fig. 2 and 4)
- 3D computer modelling of test case parts in a 3D solid modelling package (examples see Fig. 3 and 5)
- Analysing test case parts in a process simulation environment to determine the assembly and shape structure of the test case parts which will be featured with simple-assembly and high waste effective
- Producing suggested design guidelines and/or regulations to improve recyclability (minimising waste/costs) and reduce assembly operations (times/costs)
- Disseminating research results via academic publication.



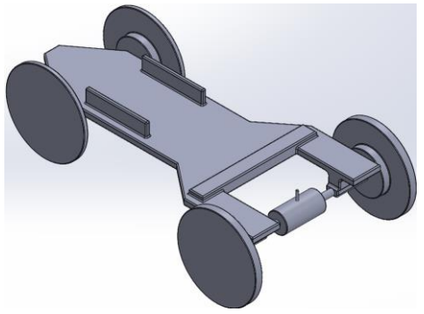
A student mini project: A racing car design and building

RESULTS

The research will present a good scenario for the expansion of novel application area of AM as it will be the technology of future to use in the production of full mass customised complex parts (see Fig. 6).

IAMPAR will lead to the generation of further knowledge in this area of design for manufacturing, assembly and recyclability, thus make a significant contribution in the optimal use and advancement of AM technologies.

IAMPAR will generate effective design and manufacturing guidelines and/or regulations for complex products, leading to deliver extra value (e.g. reduce piece parts to simplify product assembly and maximise recyclability), less wastes and low production cost.



A racing car design using CAD and building via AM

A water turbine printed by AM

Jilin Ye

Currently I am a Lecturer at SSU. I was involved in several research funding applications from ESRC, EPSRC and EU-FP6&7. I hold a PhD in Computer Aided Product Design and a BEng degree in Engineering. My industry experience was involved in RP&M, CIM, CE, SCADA and CNC applications. My research interests include high-value manufacturing technologies (Additive Manufacturing and 3D Printing), sustainable CAD/CAM, ICTs for resource efficiency integration, visualisation & virtual reality applications in engineering.