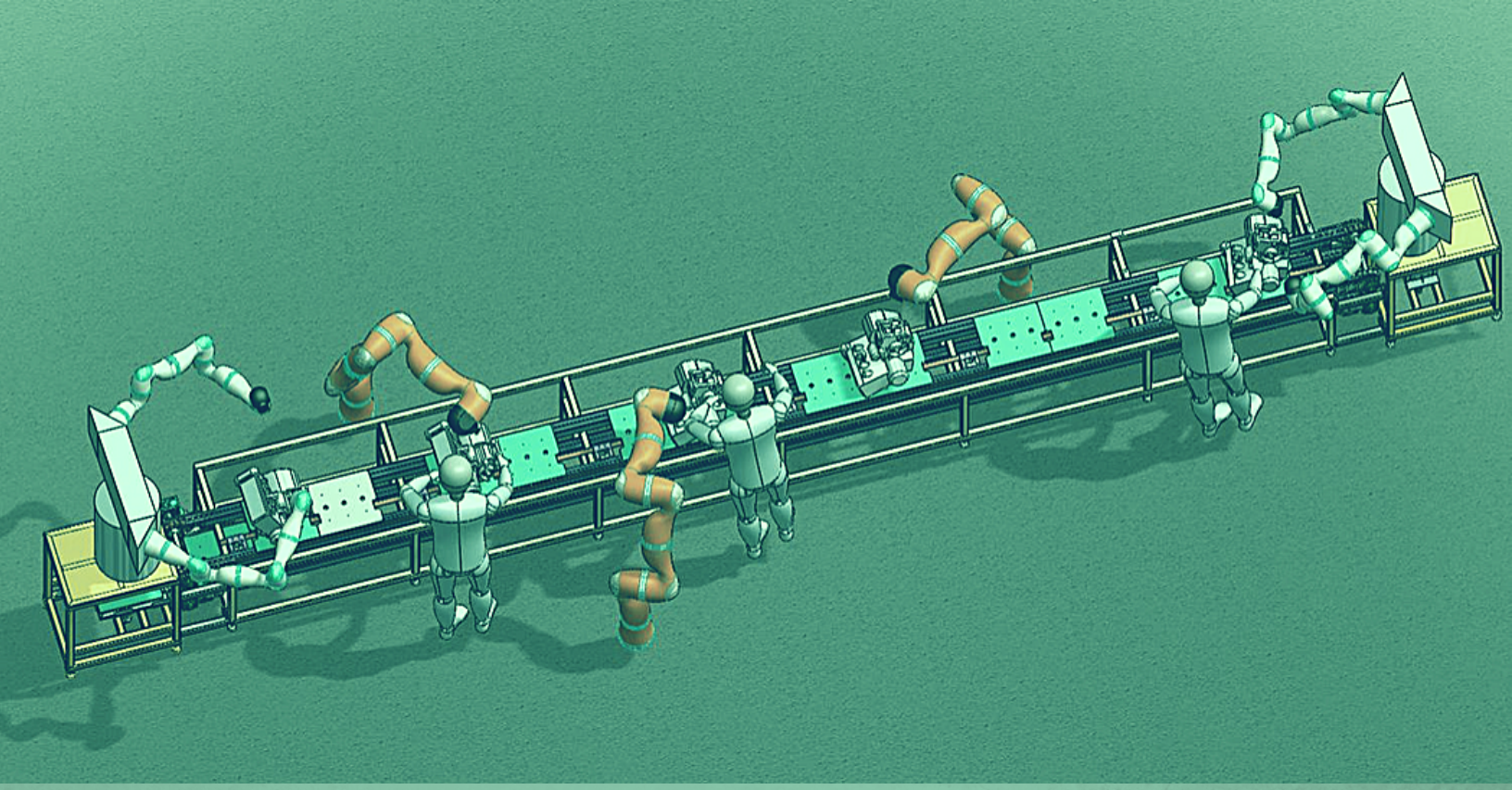


2017 international workshop on

Autonomous Remanufacturing

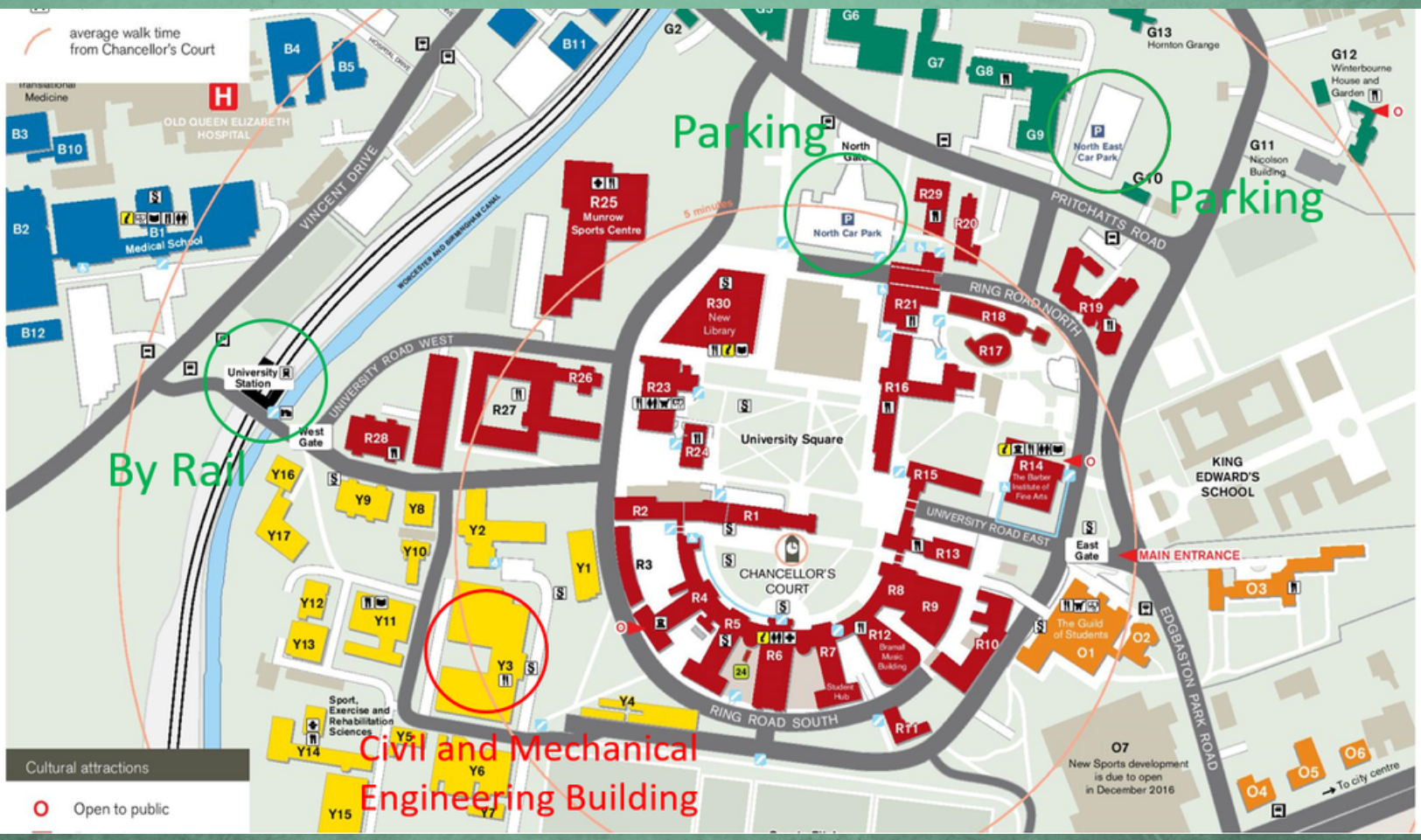
Location and Agenda

04 July 2017

G26, G28, G29, Civil and Mechanical Engineering Building, University of Birmingham, UK

University Map

- Travelling by rail - Most cross-country services to Birmingham arrive at New Street Station. Up to six trains an hour depart for the University on the cross-city line (ten minutes to University station, final destination Longbridge or Redditch). The centre of the main campus is a five-minute walk from University Station.
- Travelling by car - Visitors to campus are requested to park in our pay and display car parks.



Agenda

09.00 - 09.25 Registration (G26,G28)

09.25 - 09.30 Welcome and Introduction (G29)
Prof D. T. Pham, Chance Professor of Engineering, University of Birmingham

09.30 - 10.00 Keynote presentation - Symbiotic Human-Robot Collaborative Disassembly in Remanufacturing (G29)
Dr Wenjun Xu, Associate Professor at the School of Information Engineering, Wuhan University of Technology, China

10.00 - 10.20 Maintenance strategy development within the food and drink industry: A case study approach (G29)
Dr David Baglee, Faculty of Engineering and Advanced Manufacturing, University of Sunderland, UK

10.20 - 10.40 Remanufacturing at Caterpillar (G29)
Mr Chris Smith, Caterpillar Shrewsbury Ltd.

10.40 - 11.10 Coffee & Break (G26,G28)

11.10 - 11.40 Keynote Presentation - Economic modelling of robotic disassembly processes for remanufacturing (G29)
Dr F. Javier Ramírez, School of Industrial Engineering, Department of Business Administration, University of Castilla-La Mancha, Albacete, Spain

11.40 - 12.00 Robot Versatility and Autonomy as a Key enabler for the High Mix-Low Volume context in Remanufacturing? (G29)
Dr. Damien SALLÉ, Division Industry and Transports , Head of the Robotics Group for Advanced Manufacturing, TECNALIA, Spain

Agenda

12.00 - 12.20 New solutions for the optimal recovery of Hydrogen fuel cells in Electric Vehicles (G29)
Dr David Stewart, High Speed Sustainable Manufacturing Institute(HSSMI), UK

12.20 - 13.30 Lunch & networking (G26,G28)

13.30 - 14.00 Keynote Presentation - Futuring European Industry (G29)
Dr Konstantinos Georgoulias, Laboratory for Manufacturing Systems & Automation, Department of Mechanical Engineering and Aeronautics, University of Patras, Greece

14.00 - 14.20 Developing and applying Automated Remanufacturing technology (G29)
Prof David Wimpenny, Manufacturing Technology Centre, UK

14.20 - 14.40 Remanufacturing at BMW (G29)
Dr Dieter Geus and Mr Benjamin Haselbacher, BMW

14.40 - 15.10 Coffee & Break (G26,G28)

15.10 - 15.30 Disassembly and processing of waste electrical and electronic equipment (G29)
Prof Weidong Li, Institute of Manufacturing and Materials Engineering, Coventry University, UK

15.30 - 15.50 Knowledge Engineering on Big Data towards achieving zero defects for Sustainable ManufacturingG29)
Dr Michael Packianather, School of Engineering, Cardiff University, UK

15.50 - 16.00 Event closing

Abstract

Time: 0930 - 1000 Location: G29

Keynote - Symbiotic Human-Robot Collaborative Disassembly in Remanufacturing

Dr Wenjun Xu, School of Information Engineering, Wuhan University of Technology, China

This talk describes the mechanisms and methods for operation control and optimization of symbiotic human-robot collaborative disassembly in remanufacturing, as well as the principles and methods of such system integration, which including: i) the mechanism and system architecture of symbiotic human-robot collaborative disassembly in remanufacturing, ii) the multi-modal intelligent perception for symbiotic human-robot collaborative disassembly, iii) the information model and dynamic process planning for disassembly by symbiotic human-robot collaboration, iv) the model and dynamic optimization of robotic autonomous control in disassembly by symbiotic human-robot collaboration, and v) the integration of prototype system and the demonstrations. The experimental results and the case studies validate the feasibility and effectiveness of the works presented in this talk, which can improve the disassembly efficiency of waste products in remanufacturing, reduce the cost of labor in production, enhance the competitive advantages of manufacturing equipments used by factories, and furthermore provide theoretical and technical basis for the sustainable development of enterprises in manufacturing industry.

Abstract

Time: 1000 - 1020 Location: G29

Maintenance strategy development within the food and drink industry: A case study approach

Dr David Baglee, Faculty of Engineering and Advanced Manufacturing, University of Sunderland, UK

The presentation will describe the development and implementation, through case study analysis, of a new maintenance strategy using predictive maintenance strategies and an information system designed to support staff training. This project has resulted in the transfer of modern maintenance technologies, already successfully implemented in other industry sectors to the food processing sector. This has been achieved through the transfer and implementation of structured maintenance methods and the introduction of monitoring tools for processing equipment. Significant benefits include the ability to predict equipment failure, the development of best practice and a significant increase in productivity will be highlighted. The presentation will conclude with an overview of the new an innovative tools and techniques available to support maintenance strategy development.

Abstract

Time: 1020 - 1040 Location: G29

Remanufacturing at Caterpillar

Mr Chris Smith, Caterpillar Shrewsbury Ltd., UK

Caterpillar is a worldwide manufacturer of construction & mining equipment, diesel & natural gas engines, industrial turbines, and provides a wide range of related services.
CAT Reman, offers parts & components manufactured to “same-as-new” quality, at a fraction of the cost of new parts.
The Cat Reman business model operates on a one-for-one exchange basis. End-of-life products are replaced, through our dealer network, for a remanufactured alternative. One of the largest remanufacturers in the world, Caterpillar uses state-of-the-art technologies in a manufacturing environment to meet original performance specifications, and which also incorporates critical engineering changes.
The Caterpillar business model is cyclical as opposed to linear. Rather than being disposed of at the end of its life, the core is returned in order to recover and regenerate products and materials at the end of each service life.
The cost of Remanufacturing grows as more processes are required to recover the material. If we can reduce the amount of work required by managing the core cycle, we can reduce the overall cost of remanufacture in both monetary terms and its impact on the environment.

Abstract

Time: 1110 - 1140 Location: G29

Keynote -Economic modelling of robotic disassembly processes for remanufacturing

Dr F. Javier Ramírez, School of Industrial Engineering, Department of Business Administration, University of Castilla-La Mancha, Albacete, Spain

Prior research has considered the economic evaluation of design for disassembly based on the end-of-life approach. Such an evaluation is affected by a high degree of uncertainty due to the disparity of recycling processes adopted. The key to fully achieving the benefits of remanufacturing lies in the efficient and cost-effective reuse of components from end-of-life products. In addition, unlike material recycling and disposal, remanufacturing reduces environmental impacts due to the product or component retaining their geometrical forms. Maximising the economic value of remanufacturing options while meeting environmental regulations is a key problem to address.

This research considers a technical approach to cost metrics for robotic disassembly. We adopt a technical approach because, in robotic disassembly, the economic factors are determined by technical drivers that can be estimated with a high degree of precision. The research analyses, proposes and models economic rules that can help the robotic system in planning and re-planning the disassembly sequence and making decisions about basic disassembly operations. We also model the financial revenues and environmental benefits as the other fundamental drivers for end-of-life product disassembly.

Abstract

Time: 1140 - 1200 Location: G29

Robot Versatility and Autonomy as a Key enabler for the High Mix-Low Volume context in Remanufacturing?

Dr Damien SALLÉ, Head of the Robotics Group for Advanced Manufacturing, Division Industry and Transports, TECNALIA, Spain

Waste Electrical and Electronic Equipment (WEEE) contain hazardous materials posing considerable environmental and health risks, and valuable materials for recycle and recovery.

WEEE disassembly and processing can significantly facilitate the overhaul, repairing and re-use rate of valuable components, maximise hazardousness removal and improve material recovery rate from the disassembled components. However, effective disassembly and processing of WEEE to meet the legislative and economic considerations of different stakeholders is a challenging research issue. This talk presents a new disassembly and processing approach for WEEE based on the Analytic Hierarchy Process (AHP) and Particle Swarm Optimization (PSO) algorithms. The merits of the approach include the flexibility to handle WEEE to meet various requirements of stakeholders, and the capability to achieve selectively optimised WEEE processing. The feasibility of the approach has been verified through an industrial case of Liquid Crystal Display (LCD) television WEEE processing.

This research was carried out as a part of the GREENet and CASES projects which are supported by the European Commission FP7 programme.

Abstract

Time: 1200 - 1220 Location: G29

New solutions for the optimal recovery of Hydrogen fuel cells in Electric Vehicles

Dr David Stewart, High Speed Sustainable Manufacturing Institute(HSSMI), UK

Due to European and National policies regarding the reduction of CO2 and NOx emissions, vehicle propulsion systems are moving away from traditional petrol and diesel combustion engines, and towards low carbon hybrid and electric powertrains. As a result, many automotive manufacturers are focusing their development on new Hydrogen fuel cell vehicle technologies. With the increased production and consumption of these new technologies, comes new challenges around how to optimally recover the components and materials within them at the end of life. With the growing stringency of the End of Life Vehicle (ELV) directive, coupled with the potential commercial opportunities that can be exploited from it, it is absolutely critical that automotive manufacturers and the producers of these components understand how to do this from the very start.

This was the objective of a recent Innovate UK funded project which explored how, through smart product, process, supply chain and business design, the recovery process can be facilitated. The results prove that you can remanufacture and recycle Hydrogen fuel cells, although design changes to the fuel cells need to be made. This paper presents the results from this project and includes recommendations for how more automated remanufacturing processes can be achieved.

Abstract

Time: 1330 - 1400 Location: G29

Keynote - Futuring European Industry

Dr Konstantinos Georgoulias, Laboratory for Manufacturing Systems & Automation, Department of Mechanical Engineering and Aeronautics, University of Patras, Greece

Industry is the backbone of the European economy, producing 80% of Europe's exports; accounting for 2/3 of private research and innovation; providing high skilled jobs. Industrial activities are integrated in increasingly rich and complex value chains, linking flagship corporations and small or medium enterprises (SMEs) across sectors and countries. However, there has been a decline in manufacturing to 15.1% of GDP and approximately 3.5 million jobs have been lost in those sectors since 2008.
The FUTURING project aims at contributing to define a strategy for the re-industrialization of Europe, by focusing on the role of Research and Innovation within the framework of other dimensions – Economy, Society, Environment, Globalization, Geopolitics– and incoming paradigms such as Circular Economy. It explores future scenarios, concerning EU Industry, through the use of foresight and other policy intelligence tools, to identify critical factors on which action should be taken in order to overcome barriers and to foster opportunities for the EU re-industrialization process.

Abstract

Time: 1400 - 1420 Location: G29

Developing and applying Automated Remanufacturing technology

Prof David Wimpenny, Manufacturing Technology Centre, UK

Remanufacturing, the repair of object to recover, and in some cases even improve upon, the original condition is a particularly challenging area of manufacturing. Remanufacturing of high value engineering components usually involves a complex series of manual operations which can be difficult to control. Moreover, precise planning of the remanufacturing process is particularly challenging as it difficult to predict when a component will arrive for repair and also the level of damage as this varies significantly, depending on the particular condition of service.

The development of an automated repair method for engineering parts, where several key repair steps are integrated into a single seamless process, was the goal of the Innovate UK funded RECLAIM project. This project, which concluded in 2012, has led to the successful commercialisation of this hybrid AM repair approach.

The work undertaken at the Manufacturing Technology Centre over the last 5 years, together with academic and industry partners, will be presented and illustrated with case studies from several key sectors, including the aerospace, rail and power generation equipment.

Abstract

Time: 1420 - 1440 Location: G29

Remanufacturing at BMW

Dr. Dieter Geus and Mr Benjamin Haselbacher, BMW

Remanufacturing is an important field in the automotive industry. Many engine components are large and expensive. The identification of degradation and the repair or replacement of worn out or obsolete parts is resulting in cost savings and eventually in a greener environment. Dr. Dieter Geus will give a brief overview of the importance of re-manufacturing in the BMW Group's powertrain division. As a manager in the field of remanufacturing at the BMW factory in Landshut, he was responsible for the disassembly of old engines in their individual parts, the testing of the parts and the reinsertion of the engine for aftersales. He will provide a perspectives of important criteria for decision making in this field and what led to the conclusion to outsource this area.
On this basis, and following the cooperation of BMW Plant Hams Hall and the University of Birmingham, Mr Haselbacher will give an insight of the meaning of Big Data and Industry 4.0 for future decision making. New innovations as cyber physical system or internet of things have the potential to reinvent re-manufacturing approaches in this field of study

Abstract

Time: 1510 - 1530 Location: G29

Disassembly and processing of waste electrical and electronic equipment

Prof Weidong Li, Institute of Manufacturing and Materials Engineering, Coventry University, UK

Waste Electrical and Electronic Equipment (WEEE) contain hazardous materials posing considerable environmental and health risks, and valuable materials for recycle and recovery.

WEEE disassembly and processing can significantly facilitate the overhaul, repairing and re-use rate of valuable components, maximise hazardousness removal and improve material recovery rate from the disassembled components. However, effective disassembly and processing of WEEE to meet the legislative and economic considerations of different stakeholders is a challenging research issue. This talk presents a new disassembly and processing approach for WEEE based on the Analytic Hierarchy Process (AHP) and Particle Swarm Optimization (PSO) algorithms. The merits of the approach include the flexibility to handle WEEE to meet various requirements of stakeholders, and the capability to achieve selectively optimised WEEE processing. The feasibility of the approach has been verified through an industrial case of Liquid Crystal Display (LCD) television WEEE processing.

This research was carried out as a part of the GREENet and CASES projects which are supported by the European Commission FP7 programme.

Abstract

Time: 1530 - 1550 Location: G29

Knowledge Engineering on Big Data towards achieving zero defects for Sustainable Manufacturing

Dr Michael Packianather, School of Engineering, Cardiff University, UK

This presentation deals with the problem of defects appearing in manufactured products and how they could be prevented in order to achieve zero defects. This is obtained through the introduction of a Monitoring and Data Analysis System (MDAS), a software that combines knowledge engineering, data mining, neural network modelling and graphical data analysis in identifying patterns and trends which increases the risk of products being rejected. A pilot version of the proposed system has been tested on two production lines of a highly regulated industry. The proposed system could be adapted to suit other manufacturing industries.