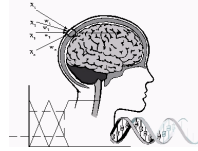




# International

*Innovation in Knowledge Based and Intelligent Engineering Systems*



## INVITED SESSION SUMMARY

### Title of Session:

**Advanced Sustainable Manufacturing Technologies (ASTUTE)**

### Name, Title and Affiliation of Chair:

Mohamed Naim, Professor, Cardiff University  
Johann Sienz, Professor, Swansea University  
Rossi Setchi, Professor, Cardiff University

### Details of Session (including aim and scope):

ASTUTE is a part-funded Welsh Government programme designed to stimulate growth in the manufacturing industry across Wales by applying advanced engineering technologies and techniques to manufacturing challenges, driving cutting edge research, development and innovation (RD&I). RD&I projects are cocreated and co-delivered by industry and academe, taking an intervention-based design science approach to developing solutions for specific manufacturing problems but which have generic implications. We are looking for contributions that have similar RD&I features and may cover a range of topics related to

Manufacturing Systems Engineering - utilising multi-disciplinary approaches that encompass a product's whole life cycle allows companies to develop sustainable products and services through integrated application of technologies, knowledge, information, materials, energy, transport and people. The goal is to delivering products, processes and/or services, and their supporting supply chains and logistics. Improving complex processes and systems eliminates steps that do not add value and improves manufacturing resilience, productivity and sustainability. Frequently, there will also be aspects from more than one expertise needed to move a manufacturing process or manufactured product forward.

Computational Engineering Modelling - Computational Engineering Modelling is one essential tool to increase understanding of complex processes and products. Improving manufacturing processes and manufactured products often requires experimentation along a "trial and error approach". This can be costly in terms of staff time and materials and is often a lengthy process sometimes with an uncertain outcome. The predictive capabilities offered by computational modelling can reduce or eliminate the "trial and error" approach so that new products can have shorter lead times to market and new processes and products can be optimised with low risk and faster implementation times.

Advanced Materials Technology – This may include sophisticated multi-component metallic alloys, polymeric materials and elastomers, composites, semiconductors and digital materials. Often there is a need for expertise to interpret microscopic behaviour of these materials in terms of the underlying structures and phase transformations at the atomic scale. Advanced techniques available include studying microstructures of materials. These include high resolution electron and optical microscopes, Atomic Force Microscopes (AFM), Energy Dispersive X-ray Analysis and X-ray Photoelectron Spectroscopy (XPS). There is also a need for capabilities for studying bulk degradation mechanisms, such as fatigue, high temperature creep, embrittlement etc. and surface degradation mechanisms such as oxidation, corrosion and susceptibility to Ultraviolet light. These phenomena have a critical effect on component durability.

### Main Contributing Researchers / Research Centres (tentative, if known at this stage):

ASTUTE Aberystwyth University

ASTUTE Cardiff University  
ASTUTE Swansea University  
ASTUTE University of South Wales  
ASTUTE University of Wales Trinity St. David

**Website URL of Call for Papers (if any):**

**Email & Contact Details:**

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Professor Johann Sienz (j.sienz@swansea.ac.uk)  
Professor Rossi Setchi (setchi@cardiff.ac.uk)

Professor Mohamed Naim (CEng, FIET, FCILT) holds a Chair in Logistics and Operations Management at Cardiff Business School where he was a former Deputy Dean. He is currently a co-director of the Centre for Advanced Manufacturing Systems at Cardiff (CAMSAC) formerly the EPSRC funded Cardiff University Innovative Manufacturing Research Centre (IMRC). He was the Cardiff lead on the Welsh European Funding Office (WEFO) sponsored project Advanced Sustainable Manufacturing Technologies (ASTUTE), and is a co-director on the current ASTUTE2020 and ASTUTE East programmes. He is a founding member of the Logistics Systems Dynamics Group (LSDG). Mohamed's current research interests may be summarised as the development of novel business systems engineering approaches to the establishment of resilient supply chains. This encompasses sustainable supply chains and the role of flexibility in lean, agile and leagile systems. He is currently a co-investigator on the Department for Digital, Culture, Media & Sport funded programme on 5G Logistics.

Professor Johann Sienz (CEng, CMath, FIMechE, FRAeS, MIMA) holds a Personal Chair in the Faculty of Science and Engineering, Swansea University, where he is the Deputy Pro-Vice Chancellor and Deputy Executive Dean. At Swansea, he founded the Future Manufacturing Research Institute, he is a co-investigator of the EPSRC funded doctoral training centre "Enhancing Collaborations and Interactions With Data And Intelligence Driven Systems", and he directs the ASTUTE, part-funded Welsh Government, four university partnership operation and IMPACT, the Institute for Materials, Processing and Numerical Technologies. His research covers computational modelling and optimization of structures, systems and processes, additive manufacture, smart manufacturing, digital twins, AI, data sciences, and digitally enhanced marketplaces. His projects involve extensive collaboration with industry in the face of a rapidly changing technology base. He is the Editor in Chief of the highly regarded international Q1 journal "Applied Mathematical Modelling".

Professor Rossi Setchi (CEng, CIP, FIET, FIMechE, FBCS, SMIEEE) is Professor in High-Value Manufacturing and the Founding Director and Principal Investigator of the Research Centre in AI, Robotics and Human-Machine Systems (IROHMS) at Cardiff, which is a collaboration of the Schools of Engineering, Psychology and Computer-Science and Informatics. IROHMS currently involves over 55 academics and postgraduate researchers and 20 PhD students. She also leads ASTUTE Cardiff, a team of 20+ academics and researchers helping Welsh manufacturing companies to develop more advanced and sustainable engineering solutions. Rossi has a distinguished track record of research in a range of areas including AI, robotics, systems engineering, additive manufacturing, industrial sustainability, Cyber-Physical Systems and Industry 4.0, and, in particular, has built an international reputation for excellence in knowledge-driven symbolic AI, computational semantics and human-machine systems. Her edited books on Sustainable Design and Manufacturing are among the top Springer publications in 2019 and 2018 that address important United Nations Sustainable Development Goals (SDGs).