Centre for Intelligent Systems

University of Wales Aberystwyth

Objectives

The mission of the Centre for Intelligent Systems is the development of artificial intelligence and sensing techniques for application in science and engineering, with particular reference to manufacturing industries.

The Centre was established formally with the aid of substantial financial support from the Research Quality Initiative of the Higher Education Funding Council for Wales. Our work on intelligent systems for industry includes:

- Intelligent software for failure analysis
- Model-based reasoning for design and diagnosis
- Intelligent instrumentation and data analysis
- Intelligent automation and robotics
- Advanced integration of manufacturing information.

The emphasis of the work of the Centre is on the development of innovative software for the solution of problems in science and engineering. Almost all of the research in the Centre is carried out in close collaboration with industry, ensuring that the work of the Centre is relevant to industrial needs.

The Centre embodies the research work of over thirty members of staff and research students, providing a wide range of interests and experience.
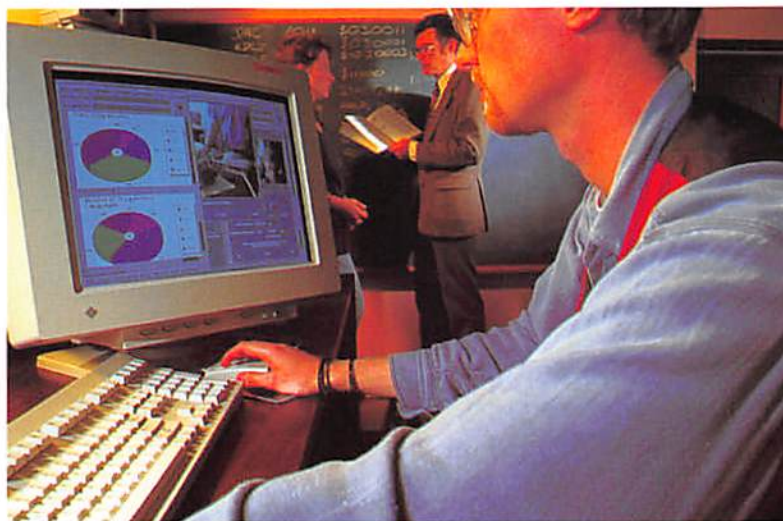
Aluminium diecasting programme at Kaye (Presteigne) Ltd.

Facilities

The Centre is equipped with high-performance computer workstations, CAD packages, vision processors and specialised artificial intelligence software, including ART, CBR Express, Poplog and Lisp. Three industrial robots, a Unimation Puma 560 and two Adepts are fitted with versatile sensors, parts feeders, specialised grippers and assembly jigs. Most of the equipment has been provided by the Engineering and Physical Sciences Research Council (EPSRC) and by industrial collaborators.

Robotic research applied to food processing.

Contact

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centre of expertise

Areas of Research

1. Failure mode effects analysis. The Centre is building systems to automate FMEA, both for electrical design in the automotive industry and for process FMEA in the foundry industry.

2. Intelligent robotics. The Centre has been working in advanced robotics for more than ten years, specialising in novel methods for robot control and learning.

3. Industrial applications of knowledge-based systems. Through use of the Teaching Company Scheme, the department has linked with industry to transfer advanced IT to industry.

4. The Centre co-operates closely with Aberystwyth's Institute of Biological Sciences in the development of intelligent software and novel instrumentation methods for rapid pharmaceutical screening and for online monitoring of industrial fermentations.

Industrial Clients

- Jaguar Cars Ltd
- Unilever Research
- GenRad Ltd
- Oswestry Hospital (Orlau)
- Cray Communications
- Ford Motor Company
- Ordnance Survey
- Integral Solutions Ltd
- Bruker Spectrospin Ltd
- Glaxo Research and Development Ltd
- Optokem Instruments Ltd
- Renishaw plc.
- Viewlogic Software Ltd

Major Grants

- An Automated FMEA Assistant: £208,437 from EPSRC plus £98,400 from project collaborators.
- Integrated Flexible Assembly Cell Technology: £327,527 from EUREKA FAMOS.
- Intelligent Behaviour-Based Control Systems: £151,265 from EPSRC plus £24,300 from project collaborators.
- Vehicle Model Based Diagnosis. 160,000 ECU from Framework IV, as part of a 4 million ECU project.
- Rapid Analysis of Multiple Deteminands using Ultrasensitive, Dispersive, Raman Spectroscopy and Supervised Learning: (with Inst. Biol. Sci.) £474,536 from BBSRC.
- An FT-IR Based Metabolic Microscope for Biotechnology: (with Inst. Biol. Sci.) £284,720, from BBSRC plus £122,145 from project collaborator.
- Quantification of Microbial Productivity via Multi-angle Light Scattering and Supervised Learning: (with Inst. Biol. Sci.) £159,772 from BBSRC.

Conferences/Courses

The Centre welcomes the opportunity to discuss with industry the running of focused courses on various aspects of industrial applications of intelligent systems. We also run Postgraduate courses and study programmes for students from the UK and elsewhere.

Publications:

1. J.E. Hunt and M.H. Lee, 'Towards a Knowledge-based Design Assistant', *Engineering Applications of Artificial Intelligence*, vol 5(4), pp275–88, (1993).

2. C.J. Price, Knowledge engineering toolkits, 250pp, Ellis Horwood, (1990).

3. J.E. Hunt, D.R. Pugh and C.J. Price, 'Failure Mode Effects Analysis: A Practical Application of Functional Modelling', *Applied Artificial Intelligence*, vol 9(1), pp33–44, (1995).

4. M.H. Lee and J.J. Rowland (eds), 'Intelligent Assembly Systems' *World Scientific*, (1995). ISBN 981 02 2494 X.

5. A.M. Woodward, A. Jones, X.-Z. Zhang, J.J. Rowland and D.B. Kell, 'Rapid and non-invasive quantification of metabolic substrates in biological cell suspensions using non-linear dielectric spectroscopy with multivariate calibration and artificial neural networks: Principles and Applications', *Bioelectrochem, Bioenerg,* (1996).

6. J.J. Rowland and H.R. Nicholls, 'A virtual sensor implementation for a flexible assembly machine.' *Robotica*, vol 13(2), pp195–99, (1995).

7. Y.F. Li, M.H. Lee, M.A. Rodrigues and J.J. Rowland. 'A visually guided robot system for food handling applications'. *In Proc. Intl. Conf. on Robotics & Automation*, San Diego pp2591–597. IEEE, May (1994).

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