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SCIENCE AND ENGINEERING RESEARCH COUNCIL
RUTHERFORD APPLETON LABORATORY

COMPUTING DIVISION

DISTRIBUTED INTERACTIVE COMPUTING NOTE 791

VISITS

issued by
Dr D A Duce

Note on a visit to Dr Kaliszer,
Dept of Mechanical Engineering,
University of Birmingham, 18 January 1983

31 January 1983

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DISTRIBUTION: Dr R W Witty
Miss G P Jones
Dr P Smith (Robotics)
Investigators/Kaliszer

The visit took place following a request from Dr Sharma for a comment on the Distributed Computing content of a grant application from Dr Kaliszer entitled 'Modular Multi-Processor System for Controlling Machining Processes'.

Dr Kaliszer's research is concerned with grinding technology and in particular with the control of cylindrical grinding machines. Such machines are conventionally controlled by either stand-alone mini computer systems or programmable controllers of the Alan Bradley type. Dr Kaliszer's team are investigating more flexible control systems based on a modular multi-microprocessor unit.

Dr Kaliszer is seeking continued SERC support for Dr Spiewak, a visitor from the Technical University of Walsall, Poland, currently supported by an SERC visiting fellowship. The visiting fellowship expires in April. Support is also sought for Henry Fletcher, a project officer employed on an existing SERC contract ('in-process assessment of the actual error qualities generated during grinding'). Also working on the project is John Webster, formerly a PhD student and now a lecturer in the department.

John Webster gave an introduction to cylindrical grinding. There are three phases in the grinding process. First a rapid in-feed in which the grinding wheel makes contact with the work piece, this is followed by coarse and fine in-feeds during which material is removed. The grinding wheel is withdrawn from the workpiece in a final phase known as sparkout. Control of the grinding machine is complicated by the fact that the system does not have infinite rigidity. When the grinding wheel touches the workpiece, a force develops between the two, deflecting the workpiece and wheel systems. The deflection

depends on wheel condition and work hardness. Measurement of deflection is important for the decision of when to start the sparkout stage to ensure that the roughness and size of the finished piece are acceptable, at the same time.

The machine is equiped with roughness, roundedness/size and false senses, which provide imputs to the control system. The controller drives a stepping motor which controls the grinding wheel infeed. The Birmingham group have done extensive research in adaptive control algorithms, and transducer design. They are presently investigating whether lasers designed for video disc machines can be used to measure surface roughness. Initial experiments are producing promising results.

The first computer used to control the grinding machine in the department was a Nova 1220 mini computer, very out of date. A micro Nova MP200 was purchased on the existing SERC grant and the software system moved to this. The majority of the software was written in assembler, but some is in Basic. A 16-channel 12-bit A/D converter has also been purchased to replace a single channel 8 bit unit.

The new project proposal envisages replacing the micro Nova control system by a set of micros, each handling a particular sensor and communicating through a bus. Modules are likely to be Z80 based. The bus design proposed is home grown, but is sufficiently simple and general that commonly available buses can be interfaced to it with ease.

I was then shown a demonstration of the system, one of the few demonstrations the DCS Coordinator has not broken! The group make extensive use of Graphics in presenting reports, but their sole graphics output device is a single pen plotter located in a different room to the grinding machine. Displaying results is an hilarious exercise, as the system console is in the same room as the grinding machine, and the exercise entails running between the machine room and the console changing the pen in the plotter to display different curves in different colours.

I suggested to the group that they should make contact with Sloman and Kramer at Imperial College whose DCS project offers a rather more general approach to multi-processor control systems.

I was generally impressed with the quality of the team and their enthusiasm. They work well together and their talents are complimentary. Dr Spiewak clearly has much experience in constructing small hardware systems, and will doubtless make something work. However they need to be exposed to more modern methods of software construction! Additionally they would benefit from more sophisticated computing support. They recognise the benefits of a single user system (which their micro Nova is), and I told them briefly about Perq. They would probably be able to make a case for a Perq in one to two years time, as providing general interactive support for the project.

GENERAL

I spoke briefly to Professor Tobias, who is head of the Mechanical Engineering Department. He is concerned about the difficulties of technology transfer of specialist software into industry. He feels that technology transfer could be encouraged in the following way. First, workshops could be organised to which industries are invited and new ideas are presented. This could be followed up by hands-on experience under the guidance of a university group, followed by allowing industry access to the software on a university machine, to evaluate in-house. Thereafter if industry is seriously interested, money etc can be discussed. He feels such a scheme could operate in his department with a low level of manpower to provide manpower support. I indicated to him that there was general concern in SERC about technology transfer and that a similar mechanism to the one he proposed has actually been used in computing.



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