

# EEUG News

The newsletter for the Educational Electronic Computer Aided Design users

Volume 16 N<sup>o</sup> 2 June 2003 Editor: Geoff Lawday [geoff.lawday@bcuc.ac.uk](mailto:geoff.lawday@bcuc.ac.uk)

## News from the ECAD Educational User Group Committee

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### Chairman's Welcome

Welcome to this issue of the EEUG Newsletter. The main work at the moment is in the preparation for the September 2003 workshop at Lancaster University. We hope to see everyone there. Please make the effort to attend and to register as soon as possible. The workshop programme is developing and is being updated as the organisation continues.

We have included a number of items this time, including articles from the community relating to the September workshop. We would hope to include articles of potential interest in each issue. If you do have any articles for future newsletters, you can send them to us at any time.

### Workshop 2003 – additional call for contributions and registration

Thanks to those who have sent articles for the Workshop in September, but we are still looking for a number of additional oral presentations and demonstrations.

We set the deadline this year for the 30<sup>th</sup> June, but will still be able to include submissions after this date. As usual, we do look for good support from the EEUG Community. This year, a good mixture of both teaching and research activities would be of interest.

If you are intending to attend the workshop, we do need to know as soon as possible the number of attendees. The registration form is attached to the end of the newsletter and is also available on the EEUG Website. Can you either register with Richard Walters, or email him your intention to register as soon as possible. We need to know the approximate overnight numbers to book the on-campus rooms **by the 10<sup>th</sup> July**.

This year, the best paper submissions to the workshop will be considered for inclusion in the International Journal of Electrical Engineering Education (<http://www.ee.umist.ac.uk/jjee/>). Full details are available on the EEUG website <http://www.eeug.org.uk>

*“Mechatronics, Multidisciplinary teaching and research”*

**10<sup>th</sup> and 11<sup>th</sup> September 2003  
Lancaster University, Lancaster, UK**

Increasingly, the role of the engineer is diversifying and becoming multidisciplinary in nature. In electronic engineering, this is noticeable with the breaking down of the traditional barriers in communication and work practices between the hardware and software engineer. Taking this to the next level, traditional barriers between electronic hardware, software, mechanical engineering and IT are now being removed. Mechatronics, with its multidisciplinary approach to the design and development of engineering solutions, provides an important direction to follow in teaching and research. The importance of inclusion, rather than exclusion, along with team building is a key to future success.

The EEUG Autumn Workshop 2003 is to be held on the 10<sup>th</sup> - 11<sup>th</sup> September 2003 at Lancaster University. Contributions are sought from those involved in (or have planned involvement in) Mechatronics teaching and research activities, in particular (but not exclusively):

- Multidisciplinary teaching and learning instruments.
- Mechatronics teaching and learning
- Teaching and learning experiences.
- CAD tool design, use and application.
- Teaching of product design and development in team environments: competition based student project work and assessment.

Three types of contribution are sought:

- Oral presentations, which are informal in nature, and should be around 20 minutes long.
- Demonstrations of teaching and research material.
- Poster presentations detailing current projects. In particular, we would encourage the presentation of postgraduate student research project work.

Offers of contribution (title and brief synopsis (maximum 1 page) should be sent to Ian Grout ([Ian.Grout@ul.ie](mailto:Ian.Grout@ul.ie)).

### **Committee Membership**

This year we have a number of departures from the committee and are looking for nominations for these vacant positions. Both Geoff Lawday (Information Officer) and Jonathan Dell (RAL Liaison Officer) finish their 3-year positions and will be stepping down at the September 2003 workshop. On behalf of the EEUG Community, many thanks to Geoff and Jonathan for their great support. Additionally, Alla Cordery (Secretary) will be stepping down from the committee. Robert Self (University of Essex) will be taking over the RAL Liaison Officer duties in September.

We therefore require the positions of **Secretary** and **Information Officer**. If there are any nominations for these positions, they can be sent to Ian Grout ([Ian.Grout@ul.ie](mailto:Ian.Grout@ul.ie)).

## RAL/EEUG Advisory Committee

The RAL/EEUG meeting was held this year at the Cosener's House, Abingdon on the 30<sup>th</sup> April, immediately prior to the planned committee meeting. Jonathan Dell and Robert Self attended the meeting on behalf of the EEUG. John McLean of RAL provided an informative presentation on the current state and future aspirations of the microelectronics support centre. The situation that automatic government funding is no longer available and that RAL has to submit bids for funding was again highlighted.

The tools and services provided by RAL were highlighted, in particular updates to **Xilinx** and **Altera** software suites and the **Synchronicity** suite of tools (This is a suite of software tools for design collaboration and revision control for managing projects involving a team of designers).

Feedback from the Universities on their uses and issues relating to ECAD tools was discussed. The discussion concluded that the EEUG could provide a means to highlight the needs via a membership questionnaire. This would be taken for discussion at the EEUG committee meeting [*note – this was subsequently discussed and agreed at the committee meeting on the 30<sup>th</sup> April – the questionnaire has been circulated to the EEUG community*].

RAL have suggested that they may be able to identify a speaker for EEUG workshop in the area of MEMS, possibly as a morning paper presentation. John McLean would like to hear of more details on the EEUG workshop when we have them near the time in order to assist with this.

## Treasurer's Report

June 2002 – June 2003

We are currently fully up to date financially, with all money from the 2002 workshop paid in promptly-many thanks to all. Unfortunately, the overall situation for the last year does not look very healthy. Our annual figures are detailed below:

Income:

£2,202.35 of which £2.35 was interest and the rest from the workshop.

Expenses:

£2,672.53 of which £1,874.46 are workshop expenses and about £600 is travel to committee meetings.

Overall we are about £470 overspent on the last year. It is, however, worth highlighting that £330 of that is an advanced payment for the next workshop. This is an extra outgoing in this year caused by the differing payment requirements of the universities at which we hold the workshop. The full payment for last year's workshop was made after the workshop, and so was in this period, as is the initial payment for next year's workshop. We have reserve funds to cover this, and this payment will be offset by income from the workshop in September.

There is still a need to generate a moderate increase in income to offset the every-increasing cost of travel to the committee meetings which is the major cause of the remaining deficit this year, and to ensure that the committee can fully meet the needs of the community.

## Workshop keynote talk **Prodrive**

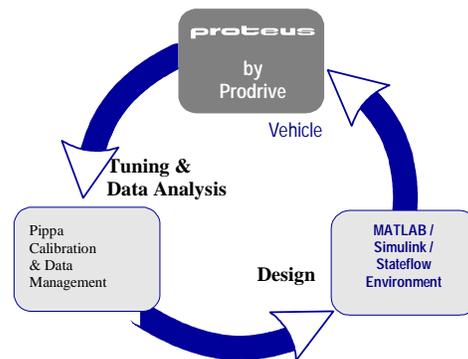
Prodrive is well known for its work in motorsport, running the Subaru World Rally Team and the Ferrari 550 Maranellos. In addition to motorsport Prodrive has a versatile automotive consultancy working on new technologies for mainstream road vehicles.



This division of Prodrive consists of many skills, one of which is the electronics and controls group. This group of engineers develop advanced control systems for mechanical systems on the vehicle. The control systems use all aspects of mechatronic design with the added complexity of vehicle dynamics influencing the control system with real time, real world signals. For example the Active Torque Dynamics (ATD) system that Prodrive have developed controls the handling of the vehicle by altering the distribution of torque to each road wheel. The control system receives inputs from many sensors including steering wheel position, wheel speeds, and yaw rate, and controls the torque distribution using active differentials. These have electronically controlled clutches enabling the control system to control the torque being transmitted across the differential. The control algorithms not only have to deal with the mechanical elements of the control problem but also have to provide

smooth and acceptable results in the vehicle's handling dynamics.

To increase the speed in which these control systems are designed, Prodrive has developed a rapid prototyping environment. In this environment the control model is designed and simulated using MATLAB, Simulink and Stateflow.



The Real Time Workshop is then used to autocode the control software and this is downloaded to the Prodrive uProteus Electronic Control Unit (ECU). This is connected to the mechanical system and tested. A real time software monitoring program called PIPPA completes the rapid prototyping environment and enables the control system to be calibrated, monitored and debugged. This method of control system development provides very fast algorithm design and enables changes to the control strategy to be performed even on the test track, this results in more and more complex control systems being used to provide higher performance, better handling, and safer vehicles.

Peter James

<http://www.prodrive.com/electronics>

## **SCHEMEBUILDER EDUCATION**

### **A Mechatronic System Design Tool**

Schemebuilder is a knowledge based, computer aided conceptual design (CACD) tool developed at Lancaster University. It uses Microsoft Visio to visualise the design, and can communicate with any engineering design packages, which are prepared to use Microsoft COM interface. Currently it is associated with MATLAB, as one of the most widely used and well supported mathematical modelling packages used both in academia and in industry.

Visio uses identities called “shapes”, which are organised on screen windows called “stencils”. These shapes are thus made accessible from the stencils so that they are re-usable. The shapes can be either specific models (associated to a specific mathematical model) or generic models (without an associated mathematical model) or system models (design concepts). System models can contain either specific or generic models, or sub systems and they represent a common solution for a frequently occurring problem. These design concepts can be used in industry in order to cut development time, or in academia to teach students common solutions to a problem and good engineering practice.

For a specific purpose or application, a user can define a Visio template that includes the necessary stencils. Figure 1 shows a typical screenshot. The large window shows the system model that is being constructed. The existing template shown in the left hand window in Figure 1, was created for an industrial application. The stencils that have already been created are listed

and one of the stencils has been opened to show its shapes. New templates are under development for educational use. The template shown has stencils for each main physical domain (mechanical, electrical and hydraulic) and also one for generic Bond graph components. The stencils contain shapes that represent the most common ideal components for each domain (flow and effort sources, potential and kinetic energy storages, dissipaters, transformers and common flow and effort junctions) and gyrators for crossing domains. New shapes can be added to the stencils easily.

The modelling technique is based on the concept of Bond graphs: the links between shapes are power connections, like force and velocity in the case of linear motion. These connections are characterised by “type”. Connection types are strictly controlled by the connection vocabulary. This strict definition of connection types ensures that, Schemebuilder will warn the user of an incompatible connection immediately. Shapes are characterised by the function vocabulary. Using the function vocabulary, Schemebuilder can perform a search for an alternative shape, based on the main function of any shape, and this search is domain independent, that is it is influenced only by the function of the shape, and its input and output requirements. For example if the function of the shape is actuation, its input is electrical power, and its output is translation motion, an alternative search finds a linear motor as well as a hydraulic cylinder with a servo valve. This alternative search is a unique feature of Schemebuilder.

The architecture of Schemebuilder is flexible and can be seen in Figure 2. This architecture allows its extension with extra modules, like those that were developed for it recently under a European joint research project (EU Shared-cost RTD, Contract Number GRD1-2000-25270). These new

modules help the user in choosing an appropriate controller for the designed system and in tuning the controller. This level of integration of conceptual design and mathematical modelling makes Schemebuilder an exceptional tool.

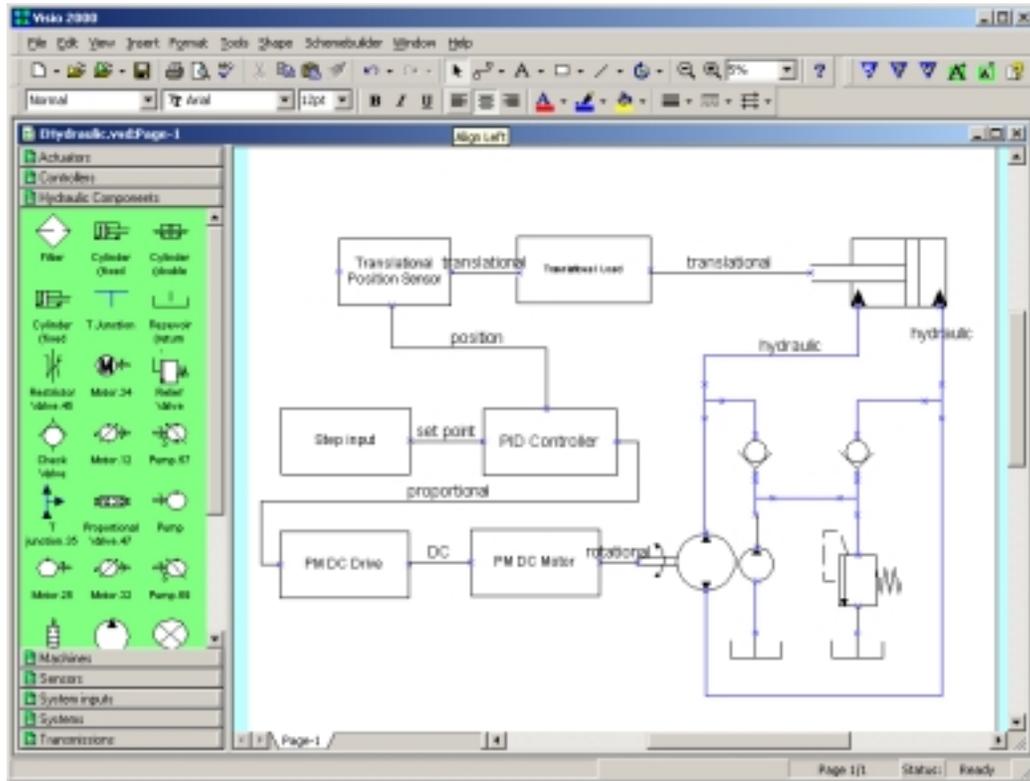


Figure 1

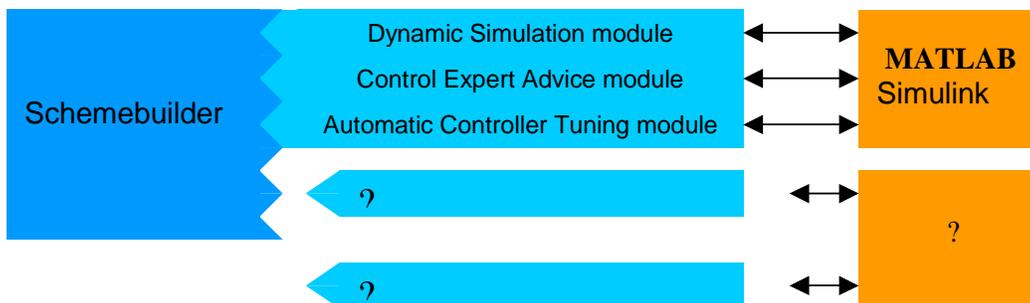


Figure 2

***LIST OF PUBLICATIONS  
ON SCHEMEBUILDER:***

1. **Porter, I., Counsell, J. and Shao, J.** (1998) Knowledge representation for mechatronic systems, *Proc. of CACD'98, International Workshop*, Lancaster University, pp. 181-196.
2. **Bradshaw, A. and Counsell, J. M.** (1998) A Knowledge Based Mechatronics Approach to Controller Design, *UKACC International Conference on Control '98*, Swansea, IEE Conf Publ Number 455, Vol II, pp 1510-1515.
3. **Porter, I.** (1998), Schemebuilder Mechatronics, *Engineering Design Conference '98: Design Reuse*, Brunel University, pp561-568, ISBN1860581323
4. **Porter, I., Bradshaw, A., Counsell, J. and Nagy, Z.** (2002) Integration of modelling and conceptual design, applied to mechatronics, *Proc. of Mechatronics 2002, 8th Mechatronics Forum International Conference*, University of Twente, the Netherlands, pp. 1275-1284.
5. **Nagy, Z., Porter, I., and Bradshaw, A.** (2003) Schemebuilder: From Conceptual Design To Control Of Mechatronic Systems, *Proc. of International Conference On Mechatronics 2003*, Loughborough University, UK

## EEUG Logo – 2<sup>nd</sup> Call

Currently, the Group does not have any unique and identifiable logo that we can use for publicity, etc. We are looking for suggestions from the EEUG community for a suitable and meaningful logo. If you have any suggestions, please forward them onto any member of the committee. We will bring suggestions for the logo to the next AGM in September 2003.

## EEUG Website

<http://www.eeug.org.uk>

## Membership Questionnaire

We recently sent out via email a questionnaire to those on the membership list. This questionnaire is aimed at enabling us to obtain an understanding of the EEUG Community ECAD use and requirements. Please make every effort to complete the form and send it back via email to the Chair. If we obtain sufficient response, we will present the findings at the next AGM in September.

## Workshop 2004

Looking forward to the workshop next year (September 2004), we would like suggestions as to a suitable **theme** and **location**. Please send suggestions to Ian Grout ([Ian.Grout@ul.ie](mailto:Ian.Grout@ul.ie)). The suggestions will be discussed at the AGM and the theme decided on. This

will enable us to start preparations immediately.

One theme that has been suggested to-date and would fit in well with the overall direction of the EEUG is:

### Applying ECAD – hardware choices for teaching exercises

- Looking at ways to deal with the widening gap between the silicon you can buy and the laboratory equipment and support services which have to handle it, problems of ever-lower voltages and ever-higher speeds, unsocketable parts, etc.
- Simulation (approaches and strategies for encouraging validation and their types of simulation, while ensuring that REAL operation isn't ignored; Experiences with Europractice (and any other systems or third-party production of ECAD designs, possibly including PCB production).
- Transferable ECAD skills (the need to turn out graduates with experience of commercial tools Vs the learning time and effort required to inculcate those skills with complex modern suites of software).

**EEUG Workshop 10<sup>th</sup> – 11<sup>th</sup> September 2003 LANCASTER UNIVERSITY  
REGISTRATION FORM**

Please complete all sections below and return to:

Dr. Richard Walters, EEUG Treasurer,  
CCTM, London Metropolitan University North Campus, 166-220 Holloway Road, London,  
N6 8DB, UK

Email: [r.walters@londonmet.ac.uk](mailto:r.walters@londonmet.ac.uk)

Surname: \_\_\_\_\_ Style: (Dr/Mr/Miss etc) \_\_\_\_\_

Forename: \_\_\_\_\_ Sex: Male / Female

Organisation: \_\_\_\_\_

Address: \_\_\_\_\_

\_\_\_\_\_

County: \_\_\_\_\_ Country: \_\_\_\_\_

Postcode: \_\_\_\_\_ Email: \_\_\_\_\_

**Attendance Details:** (Please tick as appropriate)

I will be attending on both 10 <sup>th</sup> and 11 <sup>th</sup> September and will require overnight accommodation (Total cost £90.00 : includes evening meal, accommodation, breakfast, lunch and refreshments).	
I will be attending only on 11 <sup>th</sup> September (Total cost £50.00: includes lunch and refreshments).	

**Payment Details:**

Enclosed Cheque (made payable to the "EEUG")		Company Invoice	
Invoice/ Cheque Number: _____			

Please indicate any special dietary or other requirements in the space below, e.g. Vegetarian meals, wheelchair access, etc.

**Cancellation Policy:**

The EEUG reserves the right to charge an administration fee of 25% for cancellation after 31<sup>st</sup> August, and 100% for un-notified non-attendance.