

Information Technology, Electronics, Communications

Newsletter

New Year 2005

10 January, 2005

ITEC Group Committee, 2003 - 2005

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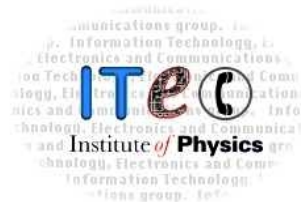
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The Chairman and Committee of



**send seasonal greetings to all Group
members and wish them a happy and
prosperous 2005 - *Einstein Year*.**

Editorial

This is the last ITEC Newsletter that will be generated by your present Editor. I believe this to be a role for someone who is more directly involved at the leading-edge in one or other of the very wide range of activities that our remit embraces. Perhaps it should also be someone who doesn't find it difficult to accept that physics includes software! My apologies for the long interval since the last Newsletter. The delay has been partly the result of the pressures and complications of retirement.

There will be several other changes to the ITEC Committee following the AGM. A formal notice to convene the meeting will be circulated shortly and will give details of the Committee places to be filled. So, members who feel that their particular facet of electronics is not properly represented - now is the time to put yourselves forward. At the AGM, we will be able to embrace the revised constitution for Groups that the Institute has adopted.

Since the last AGM, your Committee has been quite active in promoting several different types of event. There have been meetings and visits, and support for activities that engage children, such as LegoLeague. Reports on them are to be found elsewhere in this Newsletter. There is also a provisional schedule of planned events. With many of our interests overlapping with those of other specialist bodies, quite a few of our activities are best organised jointly and that is something your Committee is anxious to encourage. In fact the breadth of interests covered by the Group is one of its problems. To a greater or lesser extent, our subject overlaps with the remit of several other Groups and most of the Divisions.

Sifting through the accumulated material in my office recently, I came across the notes of a meeting of the Group held in 1973. At that time it was just called the Electronics Group. The subject was the teaching of Physics in Electronics Courses. I recall Professor D. A. Wright, from Durham, commenting that most of us would think we knew what "Physics" was, but that it was far more difficult to define the subject of "Electronics". Non-linear electrical phenomena and the handling of information were suggested. The current, longer name of the Group does no more than make some of this explicit.

If you are able to, do please log in to our web site from time to time. We try to keep it up to date with events and we welcome contributions from members. Please tell us about those things that have interested you recently and that you'd like to share with others in the Group. Ideally, your Committee would like to issue Newsletters twice a year. For this to be effective, my successor will really need a small team of feature writers to expound regularly on matters of immediate interest in the world of Electronics. So, all members who have views, please send them in. Surely there's a subject that you'd like to get off your chest in a few hundred well chosen words. Perhaps the appropriateness of Physics in Electronics courses and of Electronics in Physics courses would be a possible place to start. Or the importance of introducing some principles of good engineering design in both.

Happy New Year!

John Gowar

Meetings Planned for 2005

| | | |
|--|---|---|
| 23 February 2005 1.30pm – 7.00pm | New Trends in Nonlinear Optics A celebration of Willie Firth's 60 th Birthday Followed by (optional) dinner | Room JA 3.14 John Anderson Building, University of Strathclyde 107 Rottenrow, Glasgow, G4 ONG |
| 18 April 2005 (Provisional) | Members' Day and AGM | Aston University (Provisional) |
| Date to be arranged | Family visit to the National Archives | Kew |
| | | |

Meetings held in 2003/2004

Monday, June 30th, 2003 Group AGM and Talk 76 Portland Place

The AGM was attended by 20 members and was followed by an informal buffet and a talk by Professor Martin Smith of Imperial College: *Could an Electronic System be Intelligent?*

Saturday, August 30th, 2003 Family Day Out Jodrell Bank Visitor Centre

A number of children were among the 34 people who attended this visit. During the introduction we were fortunate to see the Telescope being re-positioned. The Visitor Centre included many hands-on Science experiments and a 3D theatre presentation on the Solar System, as well as a view of the night Sky over Cheshire in the Planetarium.

In the arboretum outside were plaques amongst the trees showing the relative position of the planets in the solar system. The telescope was repositioned again in the afternoon giving us a good view of the front of the dish. The weather was good and the visit thoroughly enjoyed.

Tim Scaife

Wednesday, September 17th, 2003 76 Portland Place

Workshop on *Wide Bandgap Semiconductor Technology*

Over 50 delegates from industry and academia attended this meeting. The five invited speakers came from UK, France and Germany and there were 8 contributed talks and 25 posters. Technical topics covered the latest results in: diamond devices, dramatic new results in diamond doping technology, GaN LED devices and SiC technology. It is hoped that this meeting will become a regular event.

Saturday, November 15th, 2003 Family Day Out *explore@Bristol*

Twenty members joined the visit to this impressive centre exhibiting hand-on science.

Wednesday, June 30th, 2004

76 Portland Place

Nonlinear Optics in Communications

About 30 people from the major UK academic groups and industrial laboratories attended this half-day meeting, which was organised by the ITEC group and co-sponsored by the IOP Quantum Electronics and Photonics group. Two invited lectures and ten contributed talks were presented.

The meeting opened with a session on Optical Switching and Processing led by an invited talk from Alistair Poustie from the newly formed Centre for Integrated Photonics. He discussed the potential applications of all-optical processing in communications and gave a brief review of the Centre.

The second half of the meeting was led by Jonathan Knight from the University of Bath who gave a review of developments in the world of Photonic Crystal Fibres. The day finished with a session on the applications of computational modelling to optical communications system design and research.

The afternoon was very successful in bringing together most of the major UK research groups in this field. It is intended that similar events should be held in future years.

Wednesday, July 13th, 2004

University of Liverpool

Pattern Recognition – Detection, Classification and Monitoring

Twenty-nine people, from academia and industry, attended this one-day seminar, which was held at the department of Electrical Engineering and Electronics at the University of Liverpool and was co-sponsored by ITEC, IMechE and IEE.

Overall the event was considered a great success. From the questionnaires returned by 80% of the attendees, all but one thought that the 'event addressed the relevant issues'. Well over 70% rated each of the specific assessment criteria either excellent or good. More attendees would have been welcome.

September 13th and 14th, 2004

University College, London

UCL Communications Symposium

ITEC sponsored a _ day sub meeting on sensor networks at this event.

End of 2004

76 Portland Place

A meeting on Dynamic Firmware and Reconfigurable Computers.

Sponsored School Physics Activities

LEGO LEAGUE REPORT

The start of a clear day in December saw two of the ITEC committee heading to the Space Centre in Leicester. This was the eminently suitable venue for the National Finals of the FIRST Lego League Competition, where we had been invited to act as judges for the Design Award.



18 teams from schools around the country had been selected in series of local heats. They came to the finals with their Lego robots. The timescales for designing, building and programming the robots to undertake a series of challenges was very short, just two months and all the teams produced excellent robots. They also had to give a presentation on the subject of Mars exploration, and a technical briefing to the judges.

The setting was ideal, with plenty of space for each team to make last minute adjustments to the robot or the program, judging rooms, stage and of course the tables for the trial itself. The challenge this

time was to go Mars, sending an autonomous robot out to carry out a series of set tasks in just 2 minutes. Each task carried a different number of points, so a clear strategy was required to design a robot, with tradeoffs between speed, control, ability to climb over obstacles and repeatability. Most teams opted for a variety of attachments, bringing the robot back to base for a quick change. Control mechanisms varied, from dead reckoning based on calibrated speed, to differential rotation measurements to calculate position, to sensing of terrain features. Dead reckoning varied with battery condition, rotation sensing was good, but only one sensor was given in the list of approved equipment, and terrain sensing was easily confused by changes in lighting conditions, and extra lines on the mat.

Each team was supplied with a mat at the start of the Challenge in September, in this case with a Martian landscape printed on it, and locations for each of the tasks marked out. Even this did not even out the variations: some teams had not stuck down the obstacles, some used sticky tape and some used Velcro. The changes on the day meant rapid redesigning to adapt to these differences.

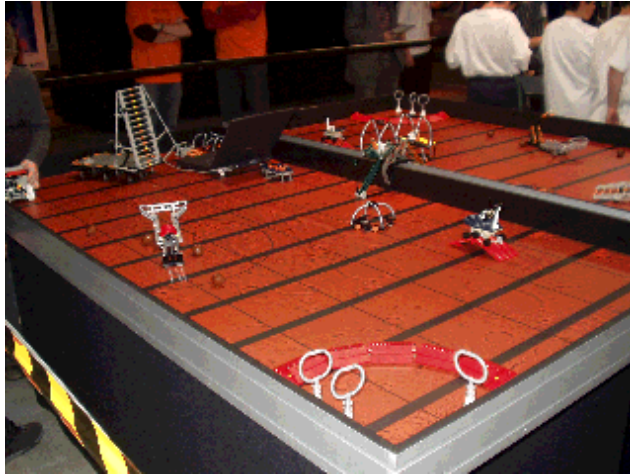


The challenges varied - for example: deploy the robot by pushing down a ramp and then drive down it, easy! But... small wheels could get stuck on the ramp grid, large wheels could climb over the edge of the ramp and then get stuck.... doh!

The teams were briefed by a Lego video, detailing the challenges. Two teams were still missing by then, and came in just in time for judging with their robots in pieces, but they all made it to the starting grid just in time.

The solar power array had to be swept clear of dust cubes that had become blown onto it, a variety of arms, sweeps, and jiggling mechanisms appeared here. The habitation modules had to be magnetically fixed together, but which shape for maximum points? The ice cores had to be retrieved from a crater, and boulders moved into the launch area for analysis. The launcher had to be loaded with a sample, then activated with gentle nudge - the referees got pretty good at catching the samples as the day

progressed. In a task of sheer prophecy, another Rover vehicle was stuck on a rock and the teams had to free this to reactivate it. The Lego teams had more luck with this than Prof Pillinghurst did on Christmas morning. The most complex task required the cooperation of the team on the table alongside: both teams had to lift up their side of the Joint Habitation module to join them together. Sadly I did not see anyone attempt this, but, according to the Danish experts from Lego Land, some teams had done it by philanthropically lifting their side and the other



team's at the same time, giving both teams the points! The final challenge was to get to the robot to climb into the crater; the tracked units found this easier.

Whilst each team went through the initial runs a couple of times to perfect their routes, the judges were busy testing each team on their design, choice of programming language, understanding of constraints, teamwork and research etc.

In another room, the research project presentation were being made, with high quality graphics, plays, laptops and various members presenting their view of life on Mars in the future.

The Judges then retired to compare notes, type the scores into the spreadsheet and select some of the category winners. These included The Design Award, Research Award and Teamwork Awards. The Robot Performance and Team Spirit Awards were judged out on the surface of Mars, with the knockout competition whittling the teams down to the two finalists. The scoring was so close by then that the referees had to add up the marks carefully before anyone knew who had won, not even the competitors could work it out. Whilst waiting for the results, an impromptu disco was held, with pupils, teachers and referees dancing to the Christmas favorites.

It was finally announced that **Spirit of Farlingaye** took the Performance prize, with **HCCS Techs** behind by a whisker. However, their performance in the other areas and all-round consistency gave the Techs the Champions Award, and a trip to compete in the European League in Italy in 2004.



About the ITEC Group Committee, 2003/2005

CVs for most of the Committee members have been given in previous Newsletters and more information can be found on the ITEC web site, together with photographs. Here, Keith Blow, who is a Professor at the University of Aston and leads the Photonics Research Group, has updated his current interests and Asoke Nandi, who is the David Jardine Professor of Signal Processing at the University of Liverpool and joined the ITEC Committee last year, gives his career background.

Keith Blow's research in communications falls into two main areas: optics and mobile. He writes:

Optical communications has come a long way since I joined the community in the early seventies but there are still some grand challenges ahead. Today's laboratory systems exceed 1 THz in bandwidth but are still some way below the potential capacity of optical fibre, which is about 50 THz. When these systems send information over more than a few km they become nonlinear, because the refractive index of the fibre depends on the optical intensity. Optical solitons are one approach to this problem where the effects due to the nonlinear refractive index are balanced against the fibre dispersion (the frequency dependence of the refractive index). This allows us to overcome some of the limitations due to distortions in the pulse shapes of a single channel. However, the ultrahigh bandwidth systems use many channels, each one occupying a different wavelength in the infrared spectrum. The same nonlinear effect causes interactions between the channels that limit the achievable bit rate. One solution is to use a combination of linear filtering and nonlinear pulse shaping processes along the transmission path. This leads to an all-optical regenerator which performs the same function as an electrical regenerator but in a very different way.

My interest in mobile communications was sparked by our Chairman, Ian Marshall, some years ago when we started working on applications of dynamic hardware in communications. We are currently working on ad-hoc networks which are formed when devices come together and start communicating with each other. In a dynamic network, topology and membership can change with time. One potential application is the creation of sensor networks from a large number of small simple devices. A critical consideration is lifetime, which is largely determined by the energy consumption and battery capacity of the nodes. We have been working on analysing the performance of these networks to assess the effects of routing topology and schemes that involve sending some of the nodes to sleep. In some cases energy consumption can be halved or the system lifetime doubled.

Asoke Nandi

Professor Nandi received the degree of Ph.D from the University of Cambridge (Trinity College), in 1979. He then held several research positions: at the Rutherford Appleton Laboratory; at the European Organisation for Nuclear Research (Switzerland); at the Department of Physics, Queen Mary College, London; and at the Department of Nuclear Physics, University of Oxford. In 1987, he joined the Imperial College, London, as the Solartron Lecturer in the Signal Processing Section of the Electrical Engineering Department. In 1991, he joined the Signal Processing Division of the Electronic and Electrical Engineering Department in the University of Strathclyde, Glasgow, as a Senior Lecturer. He was appointed Reader in 1995 and Professor in 1998. In March 1999 he moved to the University of Liverpool as David Jardine Professor in the Department of Electrical Engineering and Electronics.

While at CERN in 1983, he was part of the UA1 team that discovered the three fundamental particles known as W^+ , W^- and Z^0 . This provided the evidence for the unification of the electromagnetic and weak forces and was recognized by the Nobel Committee for Physics in 1984. Currently, he is the Head of the Signal Processing and Communications Research Group with interests in the areas of nonlinear systems, non-Gaussian signal processing, and communications research. With his group he has been carrying out research in machine condition monitoring, signal modelling, system identification, communication signal processing, time-delay estimation, biomedical signals, underwater sonar, application of artificial neural networks, ultrasonics, blind source separation, and blind deconvolution. He has authored or co-authored over 200 technical publications including two books "Automatic Modulation Recognition of Communications Signals (Boston, MA: Kluwer Academic, 1996) and "Blind Estimation Using Higher-Order Statistics (Boston, MA: Kluwer Academic, 1999).

Asoke was awarded the Mounbatten Premium Division Award of the Electronics and Communications Division, of the IEE in 1998 and the Water Arbitration Prize of the I.Mech.E. in 1999. He is a Fellow of the Cambridge Philosophical Society, the Institution of Electrical Engineers, the Institute of Mathematics and its Applications, the Institute of Physics, and the Royal Society of Arts.

HIGH SCHOOL PROJECT ON ASTROPHYSICS RESEARCH WITH COSMICS (HiSPARC)

HiSPARC is a joint experiment conducted by secondary school students, teachers and University scientists. The initial project is based in the Netherlands and aims to detect and measure high energy cosmic rays. The combination of hands-on experience and participation in genuine scientific collaboration opens the eyes of secondary school students to the scientific and technological world around us and helps students to make a more informed choice of scientific and technical studies and careers. The project embraces two fields of physics that enjoy good popularity among young people; particle physics and astronomy.

HiSPARC is based on clusters of secondary schools formed around a local university. In Holland, each cluster has a coordinator, who acts as the local manager and the first contact for the schools in the cluster. The universities and schools jointly provide the necessary technical and administrative support. On a national level the project is managed by the national project manager who is supported by an advisory board. At present, there are five clusters, all in the Netherlands: in Groningen, Utrecht, Nijmegen, Leiden and Amsterdam. Twenty-seven schools and over a hundred Dutch students are currently taking part in the initial phase of the project but it is hoped to extend the concept to universities and schools within the UK via ITEC support.

Initially we are looking for university based coordinators who are interested in furthering physics collaboration between their university and local school physics departments. A .pdf file is available giving more detail of the project and if you or a colleague would like a copy, please e-mail the ITEC committee schools' member, Richard Horton, via MrHorton@hlc.org.uk