

12 March 1979 No.5

Microprocessors

There has been such rapid progress in electronics technology over the past 20 years that it is often referred to as the "Age of Electronics Revolution". It all started in earnest in the late 1940's with the production of the first transistor. This discovery coincided with the development of the stored-program digital computer - and an industrial explosion took place.

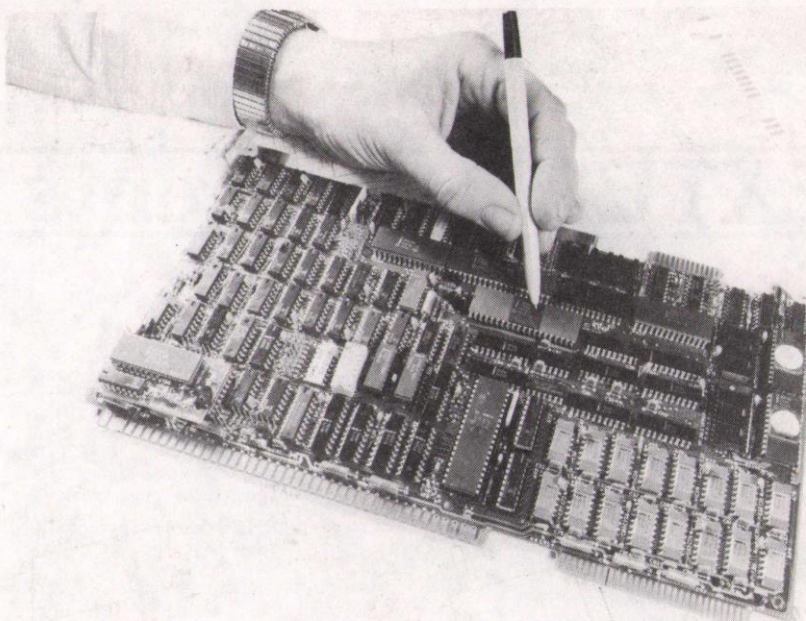
Transistors & Integrated Circuits

A major breakthrough was the realisation that the semi-conductors (such as silicon and germanium) used in making transistors also had a bulk resistance and a capacitance. Thus it appeared feasible to make up a complete circuit on a single semi-conductor chip. Photo-lithography developed in the mid 1950's allowed the batch-processing of many hundreds of transistors precisely located on a single wafer sliced from a large crystal of germanium or silicon. By 1959 the integrated circuit was perfected using silicon dioxide to electrically separate the circuit elements and act as a support surface for the interconnections.

Rapid advances

Since 1960 the number of elements in advanced integrated circuits has been doubling yearly. The techniques for producing circuits have reached the limit of ordinary optics and in the future it will be necessary to gain improvements in the precision of the pattern using electron beam lithography (see Bulletins 5 & 6 1978). Micro-electronics have proved to be low-cost and extremely reliable.

A microprocessor provides the central processing unit of a computer and can consist of thousands of transistors, resistors, capacitors etc in a single chip. By adding extra chips to provide programmable read only memory, random access memory and input/output signals it is possible to assemble a complete computer system. A recent trend is towards the provision of an entire microcomputer on a single chip.



Close-up view of an Intel 8086 microprocessor central processor unit. The device, which contains about 29,000 transistors fabricated on a 5mm by 5mm silicon chip, is being studied for an application in basic communications.



Paul Sellar and Roy Bairstow are busy on microprocessor development work for controlling bubble chamber scanning tables.

(continued on Page 2)

INTERNAL Events

RUTHERFORD LABORATORY
LECTURE - LECTURE THEATRE - 1515 hrs
15 March: Prof F Graham Smith FRS/
Director RGO
'The Royal Greenwich
Observatory and the
Building of the Northern
Hemisphere Observatory'.

HEP SEMINARS
CONF RM 61 - 1100 hrs
14 March: Ash Carter/Oxford
'Leading Log Contributions
to all Orders in QCD'

21 March: Dr S Aronson/Brookhaven
'The "ISABELLE" Project'

NIMROD LECTURE SERIES
LECTURE THEATRE - 1130 hrs
20 March: Dr R Palmer/Brookhaven
'Evidence for Prompt Single
Photon Production at the
ISR'

Note: This lecture is at 1000 hrs
in R12

26 March: Prof J Steinberger/CERN
'Neutrino Experiments'

COMPUTING SEMINARS
LECTURE THEATRE - 0930 hrs
16 March: John Burren/C & A Div
'Plans for the IBM 3032
Computer'

Please note that this is a SPECIAL
SEMINAR, being held in a new venue
at a different time from usual.

COLLOQUIUM R27 - 1400 hrs
20 March: M Newman/Tech Div
'Integrated Circuit Design
Software for the EBL
Facility'.

EXTERNAL Events

NPD COLLOQUIUM
H8 AERE HARWELL - 1530 hrs
22 March: Dr C G Windsor/AERE
'Why are We Doing Neutron
Scattering on the Harwell
Linac?'

HEP SEMINARS
CAVENDISH LAB - CAMBRIDGE - 1500 hrs
14 March: Dr K Green/RL
'Particle Physics with
Cold Neutrons'

HEP SEMINARS
DAMTP -CAMBRIDGE - 1500 hrs
16 March: Dr G Shaw/Manchester
'Two-dimensional QCD
and Decays of Heavy States'

THEO PHYS SEMINARS
QMC - 1615 hrs
12 March: Prof J R S Chisholm/
Canterbury
'A Gauge Theory of
Electrons and Monopoles'

THEO PHYS SEMINARS
SCHUSTER LAB - MANCHESTER - 1430 hrs
14 March: Dr G Shaw/Manchester
'Two-Dimensional QCD'

21 March: Dr C Michael/Liverpool
'Some Tests of QCD'

THEO PHYS SEMINAR
CLARENDON LAB - OXFORD - 1615 hrs
15 March: Prof S Katsura/Tohoku
'Spin Glass Theories'

PHYS DEPT COLLOQUIA
J J THOMSON LAB - READING - 1700 hrs
19 March: C R A Sutton/Reading
'Internal Friction in
Molybdenum'

THEO & HEP SEMINARS
L.TH.C - SOUTHAMPTON - 1430 hrs
16 March: Dr M Berry/Bristol
'Diffractionals'

NUCLEAR PHYSICS SEMINARS
SURREY - 1400 hrs
14 March: G C Morrison/Birmingham
'Aspects of Heavy Ion
Reactions around
10 MeV/Nucleon'

Microcomputers for Bubble Chamber Research

The Bubble Chamber Research Group has taken advantage of this new technology and has used microprocessors as the basis of a new real-time computer system to control and collect data from its fifteen film digitising tables.

Its original computer system used conventional 'hard wired' electronics to interface the tables together with their associated typewriters and data boxes to an IBM 1130 computer. This old computer system whilst satisfying its original design concept was inflexible and totally saturated with the I/O (Input/Output) problem of passing data to and from the tables.

New methods

In the new system, the previous interfaces are replaced by microcomputers, each table having its own dedicated computer. These microcomputers have been constructed around an INTEL 8080A microprocessor chip, probably the most widely used microprocessor on the market today.

It costs around £20 and contains the equivalent of some 5000 transistors. This microprocessor has been transformed into a full computer by the addition of memory modules, interrupt driven I/O modules and peripheral slave microprocessors providing specialised high speed arithmetic capabilities. The ability of each one of these microcomputers to handle and process data exceeds that of the IBM 1130 computer in the old system.

Distributed system

All the microcomputers (and therefore digitising tables) in the system are linked by a packet switched communication network together with a GEC 4080 minicomputer. The microcomputers allow many computational tasks and almost the entire I/O problem, to be handled directly at the tables, leaving the GEC 4080 computer free to concentrate on "number crunching" problems.

It was the advent of microprocessors that allowed a relatively economical transition to be made from a highly inflexible centralised computing system to an extremely flexible and far more powerful distributed system.

The Group is also involved in the development of a microcomputer system to control and monitor drift chamber conditions in the ISIS detector for use at the CERN SPS. It is based on the Intel 8085 chip, which is also used in the computer interfaces for the Group's newly acquired VAX 11/780 computer.

Other applications

Other groups at the Laboratory are exploring the possibilities of using microcomputers and we look forward to bringing you details of further applications in the future. We are grateful to Peter Wilde, John Barlow and Chris Adams for interesting discussions on this topic.

Rutherford Laboratory Lecture

This month's Lecture will be given by Professor F Graham Smith FRS, Director of the Royal Greenwich Observatory. In it he will detail the current work and aims of the Royal Greenwich Observatory and the Northern Hemisphere Observatory and outline the proposals for their future role in Astronomical Research.

The two Royal Observatories are responsible for the provision of the telescopes, instruments and measuring machines which are required for university research. The Royal Greenwich Observatory in particular is responsible for the provision of the Northern Hemisphere Observatory, which is part of a Spanish International observatory in the Canary Islands. Three telescopes, with diameters 4.2 metres, 2.5 metres and 1.0 metre are proposed for the Northern Hemisphere Observatory.

The Royal Greenwich Observatory also continues its traditional role in providing a national and international time service, which involves monitoring the rotation rate of the Earth, and an international service for astronomers, surveyors and navigators through the Astronomical Ephemeris, the Star Almanac for Land Surveyors, and the Nautical Almanac.

The Lecture will be held in the Lecture Theatre on Thursday 15 March at 1515 hrs, and should appeal to a wide cross-section of Rutherford Laboratory staff.

Silver for Science



Obverse of Glazebrook Medal in silver-gilt

The Institute of Physics has announced the award of the Glazebrook Medal & Prize for 1979 to Dr T G Pickavance FRS "for his contributions to the construction and utilization of large particle accelerators both in the UK and the rest of Europe".

The Award was instituted in 1965 and named in honour of Sir Richard Tetley Glazebrook FRS, the eminent Victorian mathematician and scientist, first President of the Institute of Physics 1920-21, and one time Director of the National Physical Laboratory. It is awarded annually for outstanding contributions in the organisation, utilization or application of Science.

We offer our congratulations to Dr Pickavance.

Christian Fellowship

22 March: All are welcome to attend a Bible Study class led by Dennis Williams. Is the Christian faith and belief in an unseen God relevant for today? Why not come along to listen, discuss and put your point of view.

29 March: One of the current successes in the West End Theatre is a continuous reading of St Mark's gospel. We will not cover the whole of this fascinating account of the life of Christ in half an hour, but why not come and enjoy a selected portion.

Both meetings will be held in the R2 conference room at 12.30 p.m.

Library Notice

ASPINALL D - "The Microprocessor and its Applications - an Advanced Course", has joined its predecessor ASPINALL D - "Introduction to Microprocessors", as missing from display!

We are replacing both books. If you had added your name to the waiting lists; could you contact the Library R61, Ext 384, and we will put your name on the lists again.

Film Badge Notice

It is Period 3, colour strip GREEN for beta-gamma films. Please check that you are wearing the correct film and all old ones are returned.

Training

UNIVERSITY COLLEGE OF SWANSEA
26-28 March: Introduction to Microprocessors

UNIV OF WALES INSTITUTE OF SCIENCE AND TECHNOLOGY
13-18 May: Effective Scientific & Technical Communication

UNIVERSITY OF SOUTHAMPTON
28-30 March: Theory & Practice of Microprocessors (extended course)

2-3 April: Theory & Practice of Microprocessors (intensive course)

NATIONAL CENTRE OF TRIBOLOGY
10 April: Fluid Lubricants
26 April: Maintenance Fitting of Rolling Element Bearings

UNIVERSITY OF SHEFFIELD
14-25 May: Measurement, Analysis & Control of Noise
4-8 June: Hydraulic Servos & Systems Analysis
11-13 June: Gas Turbine Engine Performance

THE INSTITUTION OF ELECTRICAL ENGINEERS

Vacation Schools
at Balliol College Oxford
25-30 March: Industrial Digital & Microprocessor Based Control Systems

at University of Lancaster
8-14 July: RF Electrical Measurements

Conference
3-5 April: Low Light and Thermal Imaging

Further details may be obtained from Training section, Ext 6285/266

WELCH FOUNDATION SCHOLARSHIP 1980

A scholarship is offered to a young scientist who wishes to contribute to the study of vacuum science, technique or their application in any field.

Further information from Training section, Bldg R20, Ext 266

National Savings

Monthly cycle No 21 Certificates are available now for collection at the Cash Office, Building R20.

OVERSEAS Visits

R P Mannix to ILL Grenoble from 12-23 March to work on EDM Experiment.
S Jaraslawski to DESY from 14-23 March for commissioning of PC Processor.
F E Close to Bourg St Maurice from 17-23 March to attend conference on high energy lepton interactions.
D W Duke to Les Arcs from 17-23 March to attend conference.
B T Payne & J A Blisset to DESY from 18-23 March to work on TASSO.
H Wroe & P L Davidson to Argonne from 11-16 March to test neutron detector.
P Sharp to CERN from 12-15 March to work on Prop.202.
P J Litchfield to CERN from 12-13 March to give progress report.
R P Hand to CERN from 12-23 March to work on software for WA42.
A D Taylor to USA 14 March-14 April to attend ICANS III conf. and visit various labs for discussions.
F R A Hopgood to Paris 15-17 March to attend meeting of SEILLAC II. Organising Committee.
C J S Damerell to CERN 23-30 March to work on experiment NAIL.

Rec Soc News

Indoor Sports Day

Friday 20 April at Norton Recreational Centre, Runcorn.

After last year's successful event, we are hoping for an even bigger turn out this year. Anyone interested in taking part, please contact the organisers listed below.

EVENT	TYPE OF EVENT	ORGANISER
Table Tennis	Team of 3	R E Thomas Ext 6219, R27
Chess	Individual	P Craske
Bridge	Pairs	Ext 232, R2
Dominoes	Pairs	I Forster
	(9 spot)	Ext 6300, R6
Darts	Team of 5	
Badminton	Mixed & Mens	Mrs L Claringbold Ext 214, R27
	Doubles	
Squash	Team of 5	J N Rice
	(3 male, 2 female)	Ext 6681/6363, R51
Volleyball	Team of 6	J Ellis
	(at least 2 females)	Ext 6689, R2

If anyone has played Volleyball, we need you - or your advice.

Chess

After five rounds of this years tournament, it has developed into a battle for top spot between Roy Culliford and Peter Hemmings. Both have 5 points, and as they are not to meet until the last round, it could become a cliff-hanger.

A group of players are chasing the leaders, Dick Apsey, Peter Craske, Rob Hambleton and Fred Gilbert, all with 3 points.

Rutherford Wives

We shall be having our March coffee morning at Coseners House, Abingdon, on Wednesday 14 March from 10.30 - 12 noon.

This will be Suzanne Litchfield's last coffee morning with us for a while, as she will soon be leaving for Geneva - a chance to say "au revoir".

Gillian Litt
Tel. Abingdon 26009

Folk Club



The club has been recently re-formed after a prolonged absence and has had three meetings so far. The photograph shows the main guests, "Waterfall", at our last meeting. The initial response to the club has been excellent with the last two meetings very well attended. If this support continues then the chances of the club meeting regularly after the summer break are very high.

The club meets on the first Friday of the month in the R22 Coffee Lounge with the doors opening at 7.30 pm for a prompt 8.00 pm start. We have a licensed bar with real ale and food available.

The next two meetings are on 6 April and 4 May. The 6 April will be a special meeting with not one main guest but three. These will be "Gaylebrook

Cottage", "Wayland Smithy" and "The Great Western Band". This evening promises to be one to remember, however there will be no floor singers on this evening so if you were thinking of coming along to give us a tune or a song then you will have to wait until the following month. (Don't forget to come along on 6 April though).

On 4 May the main guest will be "Therapy" who have to be one of the best duos on the folk circuit.

We are always looking for people to help run the club so if you are interested or if you want tickets for the next two meetings then don't hesitate to contact me or one of the other committee members.

Steve Halliday
Room 1.23, R25, Ext 492

Lunchtime Music

Wednesday 14 March - 12.30
DEBUSSY - Selected pieces/New
Philharmonia Orchestra/Pierre Boulez

The response to our last music session 'The Moody Blues' was most encouraging - Thank You to all who came along. This week, pursuing our policy of attempting to cater for a variety of musical tastes, we return to the classics with a selection of music by Debussy.

Claude Achille Debussy was born in 1862 and from the age of 12 was a student at the Paris Conservatoire. At 32 he produced his tone-poem 'Prelude a l'Après-Midi d'un Faune' based on a poem by the symbolist poet Mallarme, which won him much admiration while at the same time provoking considerable discussion.

Lecture Theatre

The characteristic of his music which made it appear so novel in style is a delicate suggestiveness in harmonic and orchestral expression rather than plain and blunt statement, linking him to the French Impressionist painters and Symbolist poets with whom he was contemporary and by whom he was much influenced.

Two pieces we hope to include in the programme are La Mer and Prelude a l'Après-Midi... so, come along all you classical music buffs, lets have a response as good as that for the Moody Blues, otherwise we shall have to plan our programme for those who actually turn up! If you have any suggestions to make for future inclusion in the programme - any style of music - please contact Joan Homer, ext.6163.



RUTHERFORD LABORATORY

BULLETIN

Deadline for Insertions

1000 hrs - Tuesday 20 March 1979.

Editor: Jean Banford

Room 23, Building R20
Rutherford Laboratory
Chilton Didcot Oxon OX11 0QX
Abingdon (0235) 21900 Ext 484

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