



THE RADIO AND ELECTRONIC ENGINEER

The Journal of the Institution of Electronic and Radio Engineers

Volume 43, 1973
January-December

Published by the INSTITUTION OF ELECTRONIC AND RADIO ENGINEERS
8-9 Bedford Square, London WC1B 3RG

Telephone: 01-637 2771 (10 lines)

Telegrams: Instrad London WC1

Bound Volumes of the Journal

Limited numbers of the following bound volumes are available:—

Volume 6 (1946)	£2.75	Volume 27 (January-June 1964) ..	£3.75
Volume 7 (1947)	£2.75	Volume 28 (July-December 1964) ..	£3.75
Volume 9 (1949)	£3.25	Volume 29 (January-June 1965) ..	£3.75
Volume 10 (1950)	£3.75	Volume 30 (July-December 1965) ..	£4.00
Volume 12 (1952)	£3.75	Volume 31 (January-June 1966) ..	£4.00
Volume 14 (1954)	£3.75	Volume 32 (July-December 1966) ..	£4.00
Volume 15 (1955)	£3.75	Volume 33 (January-June 1967) ..	£4.00
Volume 16 (1956)	£4.00	Volume 34 (July-December 1967) ..	£4.00
Volume 17 (1957)	£4.50	Volume 35 (January-June 1968) ..	£4.00
Volume 18 (1958)	£4.50	Volume 36 (July-December 1968) ..	£4.00
Volume 19 (1959)	£4.50	Volume 37 (January-June 1969) ..	£4.00
Volume 20 (1960)	£4.50	Volume 38 (July-December 1969) ..	£4.00
Volume 21 (January-June 1961) ..	£3.50	Volume 39 (January-June 1970) ..	£4.50
Volume 22 (July-December 1961) ..	£3.50	Volume 40 (July-December 1970) ..	£4.50
Volume 23 (January-June 1962) ..	£3.50	Volume 41 (January-December 1971)†	£6.25
Volume 24 (July-December 1962) ..	£3.50	Volume 42 (January-December 1972)†	£7.00
Volume 25 (January-June 1963)* ..	£3.50	Volume 43 (January-December 1973)	£8.50
Volume 26 (July-December 1963) ..	£3.50		

Volumes 1–5, 8, 11 and 13 are now out of print.

* In January 1963 the *Journal* was given the title *The Radio and Electronic Engineer*. Prior to this date it was entitled *The Journal of the British Institution of Radio Engineers*.

		<i>Postage and Packing extra</i>	
		<i>Great Britain</i>	<i>Overseas</i>
† Bound volumes of <i>Journal</i> and <i>Supplement</i> combined	£8.25	50p	60p
Bound volumes of <i>Supplement</i> only	£3.55	30p	40p

Members' own copies of the *Journal* can be bound into volumes at a cost of £3.00 per volume (postage and packing extra: Great Britain 50p, Overseas 60p).

The appropriate *Journals* should be sent to the Publications Department, IERE, 9 Bedford Square, London WC1B 3RG.

SUBSCRIPTION RATES FOR THE JOURNAL

Home and Overseas: 1 year	£11.00	2 year	£20.00	3 year	£28.00	Single copies	£1.00
U.S.A. and Canada: 1 year	\$30.00	2 year	\$54.00	3 year	£75.00	Single copies	\$2.75

INFORMATION FOR AUTHORS

Papers published in *The Radio and Electronic Engineer* are listed or abstracted as follows:

Title listings: 'British Technology Index'; 'Current Papers' (Electrical and Electronic Engineering, Physics, and Computers and Control); 'Current Contents'; 'Science Citation Index'; ASCA.

Abstracted fully: 'Science Abstracts' (Physics, Electrical and Electronics, and Computer and Control); 'Referativni Zhurnal'.

Abstracted selectively: 'Chemical Abstracts'; 'Computing Reviews'; 'Acoustics Abstracts'; 'Solid State Abstracts Journal'; 'Nuclear Science Abstracts'.

Offers of papers and short contributions for consideration for publication in *The Radio and Electronic Engineer* or for reading at meetings are welcomed and should be sent to the Institution. The general requirements for manuscripts, illustrations etc. are specified in the leaflet 'Guidance for Authors', a copy of which will be sent on request. Submission of a synopsis prior to completion of the full paper, though not essential, can save time and unnecessary effort on the part of an intending author.

COPYRIGHT

This publication is copyright under the Berne Convention and the International Copyright Convention. All rights reserved. Apart from any fair dealing under the UK Copyright Act 1956, part 1 section 7 whereby a single copy of an article may be supplied, under certain conditions, for the purpose of research or private study, by a library of a class prescribed by the UK Board of Trade Regulations (Statutory Instruments, 1957, No. 868), no part of this publication may be reproduced, stored in a retrieval system or transmitted in any form or by any means without the prior permission of the copyright owners. *Multiple copying of the contents of the publication without permission is always illegal.* Authority is however freely given to copy titles and abstracts of articles on condition that a full reference to the source is made.

The Institution is not, as a body, responsible for expressions of opinion appearing in its publications, unless otherwise stated.

Principal Contents of Volume 43, 1973

JANUARY/FEBRUARY 'Transistors — the first 25 years'

The first 25 years of the transistor. A. A. DYSON	1
The first decade of transistor development: a personal view. Professor J. J. SPARKES	3
The pre-history of the transistor. Professor W. GOSLING	10
Semiconductor device developments in the 1960s. A. A. SHEPHERD	11
The technology of semiconductor materials preparation. J. C. BRYCE and B. A. JOYCE	21
The technology of semiconductor manufacture. M. SMOLLETT	29
Integrated circuit development. J. S. BROTHERS	39
The struggle for power, frequency and bandwidth. CARL S. DEN BRINKER	49
Integrated circuits for analogue systems. Professor W. GOSLING	58
Trends in semiconductor digital circuits. K. J. DEAN	67
Semiconductors for microwave frequencies. Professor H. HARTNAGEL	75
The expanding role of semiconductor devices in telecommunications. J. R. TILLMAN	82
The impact of solid-state electronics on the development of radar systems. C. C. FIELDING and J. B. G. ROBERTS	91
The influence of semiconductor devices on the evolution of computer systems. G. G. SCARROTT	99
Transistor circuits in television: some evolutionary aspects. A. MARTINEZ	103
The impact of semiconductor devices on electrical power engineering. Professor J. J. BATES and R. E. COLYER	115
Microelectronic devices for surgical implantation. P. E. K. DONALDSON and J. G. DAVIES	125
The influence of semiconductors on the evolution of typical laboratory instruments. J. B. IZATT	133
The influence of semiconductors on the teaching of electronics—a review. K. J. DEAN	140
Dominant trends affecting the future structure of the semiconductor industry. I. M. MACKINTOSH	149

MARCH

The bigger the better	177
Coupling a position finding system to a marine automatic pilot without the use of an intermediate computer. W. H. P. CANNER	179
Corrugated conical horns with arbitrary corrugation depth. M. S. NARASIMHAN	188
An overview of point matching: discussion contributions on the paper 'Point-matched solutions for propagating modes on arbitrarily shaped dielectric rods'. R. H. T. BATES, R. F. MILLAR, J. R. JAMES, and I. N. L. GALLET	193
An experimental differential p.c.m. encoder-decoder for Viewphone signals. G. A. GERRARD and J. E. THOMPSON	201
Direct conversion s.s.b. receivers: a comparison of possible circuit configurations for speech communication. S. R. AL-ARAJI and Professor W. GOSLING	209
Adjustment of digital filter characteristics after optimization. L. G. CUTHBERT	216
An approach to the control of processes with pure time delay. P. ATKINSON, Professor P. B. FELLGETT, and T. G. SWANN	219
Binary transversal filters using recirculating shift registers. G. B. LOCKHART and S. P. BABARY	224
Designing asynchronous counters. J. C. MAJITHIA, A. PUGH, and H. DUNDERDALE	227

APRIL

A new deal for technicians	241
Theory of cylindrical antennas with lumped impedance loadings. Professor B. D. POPOVIC	243
The enhancement of spurious signals in non-linear frequency multipliers. R. G. STILL	249
A method of measuring negative impedance. L. W. ELLEN and A. P. OODAN	253
On the design of equal ripple delay filters with Chebyshev stopband attenuation. Professor B. D. RAKOVICH and V. S. STOJANOVICH	257
An experimental adaptive echo canceller or long distance telephone circuits. H. BRUEGGEMANN, G. KIDD, L. K. MACKECHNIE, and A. J. SEYLER	267
An investigation of integrated circuit destruction by noise pulses. T. H. APPLEBY	279

PRINCIPAL CONTENTS

MAY

Patterns of research in the seventies.	297
Multiple channel u.h.f. reception on naval ships. H. P. MASON	299
Receiver innovations for single-sideband broadcasting. J. F. CRANE and R. C. V. MACARIO	312
Diversity reception for v.h.f. mobile radio. J. D. PARSONS and P. A. RATLIFF	317
Sensitivity of narrowband cascaded bandpass filters. L. T. BRUTON	325
A method of analysis and design of linear high-order systems. C. F. HO	329
Transient analysis on a small computer. K. G. NICHOLS, G. ABBAS and B. M. G. CHEETHAM	336
Impulsive noise reduction in radio receivers. Professor W. GOSLING	341

JUNE

The European prospect for electronics	353
A method of generating a high-quality circle test pattern for television. P. LAPPALAINEN	355
Correlator design for flow measurement. A. M. HAYES and G. MUSGRAVE	363
The application of a commutated filter to the design of a frequency response analyser. C. J. PAULL and W. A. EVANS	369
Design and application of active compensation circuits for servo control systems. D. R. WILSON and M. BURL	379
Excitation of dielectric-loaded through waveguides by an aperture. N. B. SADDLER and J. A. STANFORTH	385
The effect of variations in temperature and in material parameters on the velocity-field characteristic of gallium arsenide. R. J. CLARKE	389

JULY

Journals under attack	405
A v.h.f. surveillance receiver adapted for the reception of suppressed-carrier double-sideband transmissions. R. C. V. MACARIO	407
A technique for gating short microwave pulses. Professor D. E. N. DAVIES and M. A. F. S. RIZK	418
Electrolytic capacitors: their fabrication and the interpretation of their operational behaviour. A. R. MORLEY and Professor D. S. CAMPBELL	421
Electron beam techniques for magnetic bubble device fabrication. R. A. HARRIS, W. W. CLEGG, P. M. PICKARD, S. F. GOURLEY, C. J. HARDY	430
Circuit technology in a large computer system. D. J. KINNIMENT and Professor D. B. G. EDWARDS	435
A direct conversion v.h.f. receiver. S. R. AL-ARAJI and Professor W. GOSLING	442

AUGUST

Hybrid microelectronics	457
Speech scrambling by the matrixing of amplitude samples. V. J. PHILLIPS and J. K. WATKINS	459
An active filter for use in an a.c. carrier control system. R. J. SIMPSON and C. S. GLEDHILL	471
A goniometer for use with high-frequency circularly disposed aerial arrays. J. HOCKLEY	475
The assessment of connector reliability. R. T. LOVELOCK	486
Use of switching circuits as redundant multiplier elements in canonic digital networks. J. K. STEVENSON	490
The use of logic simulation in the design of a larger computer system. HILARY J. KAHN and J. W. R. MAY	497

SEPTEMBER

A Maxwell centenary. Professor H. M. BARLOW	521
Fault diagnosis using time domain measurements. H. SRIYANANDA and Professor D. R. TOWILL	523
Signal/noise ratio of travelling-wave dipole. T. S. M. MACLEAN	534
Matrices for dual representation of four-terminal non-uniform transmission lines. P. BOWRON	537
The effect of amplifier gain-bandwidth product on the performance of active filters. Professor E. A. FAULKNER and J. B. GRIMBLEBY	547
Hybrid computer simulation applied to digital communication systems. R. J. MORROW and C. S. WARREN	553
A comparison of modulation schemes for binary data transmission. J. R. EDWARDS	562

OCTOBER

The next stage in television	597
Data compression techniques as a means of reducing the storage requirements for satellite data: a quantitative comparison. L. F. TURNER	599
Non-linear resistors. K. W. STANLEY	609
The choice of data transmission system for efficient use of transmitter power. J. R. EDWARDS.	613
Noise and dynamic range in lossy delay lines with compensation amplification. R. A. WALDRON	622
Linear microwave amplification using impatt diodes. G. B. MORGAN	625
Synthesis of wideband cascaded double-pole crystal lattice filters. J. K. STEVENSON	631

NOVEMBER

'Optical Fibre Research and Communications'

Fibers, lasers and communications. Professor W. A. GAMBLING	653
Optical fibres for communications. D. MARCUSE.	655
The challenge of fibre-optical communication systems. C. P. SANDBANK	665
Use of laser amplifiers in a glass-fibre communications systems	675
Effect of loss on propagation in multimode fibres. Professor W. A. GAMBLING, D. N. PAYNE and H. MATSUMURA	683
Design of a staggered-p.r.f. moving target indication filter. JAMES K. HSIAO and FRANK F. KRETSCHMER	689
The frequency limitations of a gyrator circuit. H. G. BRIERLEY	695

DECEMBER

The engineer's pay, progress and prospects	713
The computation of the best windward and running courses for sailing yachts. J. ELLIOT	715
The design of a precision video delay line. L. E. WEAVER	729
Static voltages on the guy insulators of m.f. and l.f. broadcast tower antennas. Professor J. V. SURUTKA and D. M. VELICKOVIC	744
The theory of coupling in a tapered waveguide. R. A. WALDRON	751

Subject Index	(vi)
Index of Persons	(xii)

Non-Destructive Testing .. 514
 Digital Computers in Measurement .. 514
 Mathematics of Telecommunications Traffic .. 514
 Frontiers in Education .. 515
 1974 IFAC Symposium on Multivariable Technological Systems .. 515
 Power Electronics—Power Semiconductors and their Applications .. 515
 Signal Processing in Feedback Control Systems .. 706
 The Engineer in Society .. 706
 Evaluation of the Action of the Space Environment on Materials .. 706
 Fourth European Microwave Conference and Microwave 74 .. 707
 Advances in Airborne Equipment for Navigation and Flight Control .. 707
 Conference on Hybrid Microelectronics—provisional programme .. 453
 Conference on Video and Data Recording—provisional programme .. 289
 Contributors to this issue .. 156, 178, 187, 208, 242, 252, 256, 298, 354, 362, 388, 406, 420, 441, 458, 474, 522, 533, 544, 598, 664, 693, 694, 702, 728
 Control of processes with pure time delay, An approach to the .. 219

CONTROL ENGINEERING

An approach to the control of processes with pure time delay .. 219
 Design and application of active compensation circuits for servo control systems .. 379
 Failure-to-danger potentialities of solid-state logic control systems .. 266
 Fault diagnosis using time domain measurements .. 523
 Method of analysis and design of linear high-order systems .. 329
 The impact of semiconductor devices on electrical power engineering .. 115
 Convention of National Electrotechnical Societies of Western Europe .. 234
 Corrections .. 200, 395
 Correlator design for flow measurement .. 363
 Corrugated conical horns with arbitrary corrugation depth .. 188
 Coupling a position finding system to a marine automatic pilot without the use of an intermediate computer .. 179
 Cylindrical antennas with lumped impedance loadings. Theory of .. 243

Data compression technique as a means of reducing the storage requirements for satellite data: a quantitative comparison .. 599
 Design and application of active compensation circuits for servo-control systems .. 379
 Design of equal ripple delay filters with Chebyshev stop-band attenuation .. 257
 Design of a precision video delay line .. 729
 Design of a staggered-p.r.f. moving target indication filter .. 689
 Digital filter characteristics after optimization, Adjustment of .. 216
 Direct conversion s.s.b. receivers: a comparison of possible circuit configurations for speech communication .. 209
 Direct conversion v.h.f. receiver .. 442
 Diversity reception for v.h.f. mobile radio .. 317

EAST ANGLIAN SECTION

Feedforward: yesterday's techniques applied to tomorrow's amplifiers? .. 173
 5 km radio telescopes .. 173
 Video recording .. 173
 Acoustic surface waves—the prospects for device applications .. 173
 The transistor: its history and consequences .. 173, 239

An anti-collision radar employing storage of radar pictures on tape .. 519
 Radio astronomy .. 519, 593
 Sonar and underwater communications .. 519, 593
 Situation display—a new and unique approach to radar presentation .. 519, 593
 The RAF *Red Arrows* aerobatic team .. 593, 647
 Tomorrow's world in radio communications .. 710
 Planning for u.h.f. television coverage .. 710, 766
 Advances in display technology .. 766
 Digital measurement techniques .. 766

EAST MIDLAND SECTION

25 years with the transistor .. 174
 Modern dynamic measurement techniques .. 174
 Application of digital logic .. 174, 240
 Delta modulation systems .. 520, 595
 Space instrumentation .. 595
 Fourier analysis of video telephone systems .. 595, 647
 The impact of advances in electronics in electrical heating processes .. 647, 711
 Interfacing strategy on real time computer systems with particular reference to CAMAC .. 711, 767
 Opto-electronics .. 768

EDITORIALS

The first 25 years of the transistor .. 1
 The bigger the better? .. 177
 A new deal for technicians .. 241
 Patterns of research in the seventies .. 297
 The European prospect for electronics .. 353
 Journals under attack .. 405
 Hybrid microelectronics .. 457
 A Maxwell centenary .. 521
 The next stage in television .. 597
 Fibres, lasers and communications .. 653
 The engineer's pay, progress and prospects .. 713
 Effect of amplifier gain-bandwidth product on the performance of active filters .. 547
 Effect of loss propagation in multimode fibres .. 683
 Electrical connectors (Meeting report) .. 545
 Electrolytic capacitors: their fabrication and the interpretation of their operational behaviour .. 421
 Electron beam techniques for magnetic bubble device fabrication .. 430
 Electronics progress shown on stamps .. 641
 EMI-Scanner .. 164

ENGINEERING IN NORTH AMERICA

Proposals for Pensions for US Engineers .. 448
 Civil Anti-trust Suit against US Engineers .. 448
 New Canadian Immigration Regulations .. 448
 Enhancement of spurious signals in non-linear frequency multipliers .. 249
 Eric Megaw memorial award .. 454
 European component survey—international technical Seminars .. 290
 Excitation of dielectric-loaded trough waveguides by an aperture .. 385
 Experimental adaptive echo canceller for long distance telephone circuits .. 267
 Experimental differential p.c.m. encoder-decoder for viewphone signals, An .. 201

Failure-to-danger potentialities of solid-state logic control systems .. 266
 Fault diagnosis using time domain measurements .. 523
 Finance and accounting, New diploma in .. 399
 Forthcoming conferences and exhibitions .. 176, 238, 291, 396, 455, 514, 706
 Forthcoming Institution meetings .. 173, 239, 296, 349, 519, 593, 646, 710, 766
 Frequency limitations of a gyrator circuit .. 695

SUBJECT INDEX

<i>Geos</i> : a European scientific satellite	384	Reduced Rates for IEE Publications	703
Goniometer for use with high-frequency circularly disposed aerial arrays	475	The Graham Clark Lecture	703
GOVERNMENT AND PARLIAMENT		Membership Subscriptions for 1974	703
Industrial Technologies Committees Structure Complete	399	Appleton Commemorated in Renaming of SRC Laboratory	703
Technical Harmonization within the EEC Engineers' Registration Board	399	Index for 1973	761
EEC and British Patents	399	Colloquium on Leaky Feeder Radio Communication Systems	761
Hybrid computer simulation applied to digital communication systems	553	New Director for EEA	761
IERE NEWS AND COMMENTARY		The Clerk Maxwell Lodge	761
Education and Training for Multidisciplinary Subjects ..	229	Impulsive noise reduction in radio receivers	341
Mr. Philip Horton, M.V.O.	229	INDUSTRIAL NEWS	
MacRobert Award Lecture	229	Safety Information Sheets	401
Student Recruitment—Evidence Needed	229	British Standard for Insulated Screwdrivers	401
SERT Elects its First Vice-President	229	A Record Year for Consumer Electronics in Great Britain	401
CEI Annual Report, 1972	288	Explaining BS 9000	401
Professional Societies' Publishing Association	288	EEA and CAMA	401
National Electronics Review	288	Germany Equipment Safety Law	401
Advance Notice of Institution Dates	348	The Indian Computer Industry	401
1973 Survey of Professional Engineers	348	Japanese Television Production Statistics	402
Overseas Recognition of the IERE	348	Conference of the Electronics Industry—BEAMA Joint Working Party	402
Microwave 73	348	Another Golden Jubilee in the Electronics Industry ..	454
An Industry Golden Jubilee	348	Fire Losses in British Engineering Industry	454
Survey of Professional Engineers	394	Queen's Awards to Industry for 1973	454
Election of the 1973–74 Council of the Institution ..	394	PAL Tolerances and Television Receiver Design	512
New Council has its First Meeting	394	New Defence Supply Quality Requirement	512
Transfers and Elections to Corporate Membership and 'C. Eng.' Registration	394	EEA Publication on EEC	512
Leeds Electronics Exhibition	394	Shipboard Selective Calling Equipment	512
IEE Conference Publications	394	Electronics Assembly as a 'Cottage Industry'	513
Correction	395	Conference Public Address Control System	513
Design Council's 1974 Engineering Awards	395	Institution premiums and awards	447
Engineering unemployment in Canada Increases	395	Integrated circuit development	39
New educational films	395	(See also under Semiconductor Devices)	
Institution Premiums and Awards	447	Integrated circuits for analogue systems	58
Chief Officer of Technician Education Council	447	Investigation of integrated circuit destruction by noise pulses	279
Dinner of Council and Committees	506	Joint United Kingdom—Canadian study of lasers	335
Formation of New Zealand Division	506	KENT SECTION	
East Midland Section Members and the Schools	506	Optoelectronics	173
Guidance for Authors	506	Instrumentation in a nuclear power station	239
Institution Christmas Cards	506	Recent advances in radio navigation	519, 594
Two Further DTL Requirements Boards	506	Electronics in the commercial vehicle industry	594, 646
Winston Churchill Travelling Fellowships	507	Electronics systems for the space environment	647, 710
The I.M.C. Thomson Lecture 1973	507	Medical electronics	710, 767
Assistance for Travel to International Standards Meetings	507	Multiphonic organs	767
Dinner of Council and Committees	588	LETTERS:	
1973 Royal Garden Parties	588	Diplomas and associateships	169
Programme of London and South East England Meetings 1973/4	588	Electronics aids for the tuning of musical instruments ..	227
IERE Christmas Cards 1973	588	Designing asynchronous counters	227
CEI Conference on Total Technology	588	The next stage in television?	764
Woolmer Memorial Lecture	588	Quality and the engineer	764
Guidance for Authors	588	Insulation faults revealed by voltage surge tests	400
Private Treatment in Illness	588	Education in semiconductor technology	294
Engineering Industry Training Levy Order	589	Linear high-order systems, A method of analysis and design of	329
The Costs of Communications	589	Linear microwave amplification using impatt diodes	625
Dinner of Council and Committees	638	Logic simulation, The use of in the design of a large computer system	497
IERE Christmas Cards 1973	638	London Electronic Component Show 1973	449
Role of New Technician Education Council	638	LONDON MEETINGS	
Commonwealth Engineers Meet in London	638	A brief review of techniques of foetal, infant and child audiology	173
IEEE Travelling Scholarship	638	Transistors—the first 25 years (Colloquium)	173
Royal Aeronautical Society Appoints New Secretary ..	639	Digital phase lock loops	173, 766
The 1974 Graham Clark Lecture	639	Optical communications	173
Pilot Scheme on Individual Design Consultants	639	The feedback classroom	173
Royal Society Mullard Award	639	Image techniques in medicine and biology	173
European Science Foundation	639		
CNA Reports a Year of Expansion	640		
First General Assembly of the ERB	640		
Conference on Gas Discharges	640		
Trading with Japan	640		
Applications for Transfer and Election	703		

SUBJECT INDEX

NORTHERN IRELAND SECTION

Reliability in electronics—fact or fiction	176
The Eric Megaw memorial award	240
Outside broadcasting	240
'T.Eng. and all that'	518, 596
Forum on designing for reliability	649

NORTH WESTERN SECTION

Noise reduction techniques in audio	174
Modern dynamic measurement techniques	174
Satellite communication systems	174, 239
Facsimile—a review	239, 296
Video cassette recording	595
Automatic testing	595
Automatic electrical inspection	648
The application of electronics in telephone exchange switching	648, 712
The Texan stereo amplifier	712, 768
Data transmission—present and future	768

Notice of Annual General Meeting	508
--	-----

Obituary ..	168, 235, 293, 349, 397, 450, 507, 643, 705, 765
Optical fibres for communications	655

Point matching: discussion contributions on the paper 'Point-matched solutions for propagating modes on arbitrarily shaped dielectric rods'	193
Power, frequency and bandwidth, The struggle for	49
Prehistory of the transistor	10

Receiver innovations for single-sideband broadcasting	312
---	-----

REPORTS FROM AUSTRALIA

Plans to Accelerate Australian Technology	596
Electronic Goods to be Cheaper	596
Sonic Measuring of Wool	596
ICAO to look at Interscan	596

SCOTTISH SECTION

The work of the Design Council	176
The industrial uses of lasers	176
Seismological measurements	176
Fifty years of broadcasting	176
Medical and industrial electronics—from text book to shop floor	649
Electronic aids for medical and biological studies	649, 712
Electronics in ocean technology	712
From Morse code to data Networks	712, 768
Concorde electronics	768

Semiconductor devices on electrical power engineering, The impact of	115
--	-----

Semiconductor devices in telecommunications, The expanding role of	82
--	----

Semiconductor digital circuits, Trends in	67
---	----

Semiconductors on the evolution of typical laboratory instruments, The influence of	133
---	-----

Semiconductors on the teaching of electronics, The influence of	140
---	-----

SEMICONDUCTOR DEVICES

Semiconductor device developments in the 1960s	11
Dominant trends affecting the future structure of the semiconductor industry	149
The technology of semiconductor manufacture	29
The technology of semiconductor materials preparation	21
Semiconductors for microwave frequencies	75
The pre-history of the transistor	10
The first decade of transistor development: a personal view	3
Integrated circuit development	39
Integrated circuits for analogue systems	58
Sensitivity of narrowband cascaded bandpass filters	325
Services qualifications and T.Eng. requirements	296
Signal/noise ratio of travelling-wave dipole	534

Solid-state electronics on the development of radar systems, The impact of	91
--	----

SOUTHERN SECTION

Acoustic surface wave devices and applications	175
Design of British scientific satellite	175
Technical visit to Southampton Docks radar installation	175
Advances in MOS device technology	175
Modern dynamic measurement techniques	175
Communication u.h.f. modules	175
Application of control to artificial limbs	175, 240
Aspects of stereo broadcasting	175, 240
Southampton road traffic control system	240
Carry on civil engineering	520, 594
Charge coupled devices	520, 594, 767
Multiphonic organs	520, 594
Exploring the deep oceans	520, 594
Solid state microwave sources	594, 647
Colour television	594, 647
What's new in multilayer printed wiring board manufacture?	594, 647
Cash credit and electronics	594, 647
Inertial navigation	647, 711
Stored program control of telephone exchanges	647, 711
Future telecommunications projects in space	711
Compact mobile transmitters—improvements for high stress environments (Colloquium)	711, 767
Meteorological telecommunications systems engineering	767
Design of displays for radar data handling systems	767
Submillimetre waves	767
Project management in the 1970s	767

SOUTH MIDLAND SECTION

How high is hi-fi?	175
Telecommunications in the year 2000	175
New radio receiver development	240, 296
Colour television displays—the next stage	520
Provision of communications for remote clustered visual display units	595, 648
Value for money in project management	595
R & D on passive components in the UK	648
The use of radar in meteorology	711, 768
Integrated circuits for radio receivers	768

SOUTH WALES SECTION

A short-hop radio-relay system at 20 GHz	175
Modern measurement techniques in control engineering	176, 240
Some recent research on electrical contacts	240
New integrated circuits for television receivers	518, 595
Recent developments in the design of transfer function analysers	518, 596
Solid state microwave power amplifiers	596, 649
Developments in data communications	649, 712
Electronic instrumentation for respiratory monitoring	712
Electronic music	768

SOUTH WESTERN SECTION

Marine satellite communication systems	175
Concorde flight test data recording systems and their use	175
Sound in synchs	175
Modern dynamic measurement techniques	175
Yacht electronics	520
Optical fibre communications	518, 595
The planning of Maplin Airport	595, 648
Developments in digital transmission systems	595, 648
Video recording	595, 648
Space technology and the future	648, 711
Liquid crystals	648, 711
New electronic components using amorphous semiconductors	711, 768
High fidelity sound reproduction	711, 768
More and more for less and less (integrated circuits)	768
Digital instrumentation	768
Special rates for IEE publications	291

Speech scrambling by the matrixing of amplitude samples ..	459	Underwater communication systems	707
Standard Frequency Transmissions ..	170, 228, 290, 340, 404, 417, 496, 552, 624, 709, 743	Use of laser amplifiers in a glass-fibre communications system	675
Static voltages on the guy insulators of m.f. and l.f. broadcast tower antennas	744	Use of logic simulation in the design of a large computer system	497
Streamlined job service for 1973	294	Use of switching circuits as redundant multiplier elements in canonic digital networks	490
Synthesis of wideband cascaded double-pole crystal lattice filters	631	V.h.f. surveillance receiver adapted for the reception of suppressed carrier double-sideband transmissions ..	407
TELEVISION		Variations in temperature and in material parameters on the velocity-field characteristic of gallium arsenide, The effect of	389
A method of generating a high-quality circle test pattern for television	355	WEST MIDLAND SECTION	
An experimental differential p.c.m. encoder-decoder for viewphone signals	201	Modern dynamic measurement techniques	174
Television standards converter using digital techniques ..	230	Sonar and underwater acoustic communications ..	174, 240
Transistor circuits in television: some evolutionary aspects	103	Thyristor gadgets for home entertainment	240
Television interference from ignition systems	763	The electronic control and communication network employed on the Midland Links Motorways	520, 594
THAMES VALLEY SECTION		Pin-wheels to pulses: electronics—servant of postal sorting	594, 648
Digital communications in the mobile environment ..	174	Electronic Ignition systems	711, 768
Fault-tolerant computing systems	239	Low frequency navigational aids	768
Digital phase lock loops	519, 594	X-ray image intensifier systems	504
Stereophonic and ambisonic reproduction of sound ..	594, 647	YORKSHIRE SECTION	
Digital filters	594, 647	Induction motor speed control by use of permanent magnetic materials	174
Mini-computers—whatever next?	766	Developments in radio telephone communications ..	174
Theory of coupling in a tapered waveguide	751	Radio communication within the North Eastern Gas Board	174, 240
Three men who changed our world	2	Modern developments in hi-fi reproduction	520
Tin—its role in soldering and plating	517	Suspension bridges	520, 594
Transient analysis on a small computer	336	World wide communication	594, 647
Transistor circuits in television: some evolutionary aspects	103	Faraday lecture	647, 711
Transistor development, The first decade of: a personal view	3	The problems of radio systems above 10 GHz	711, 767
Transistor, The prehistory of the	10	Mini-computers and their application	767

Index of Persons

Names of authors of papers or articles published in the volume are indicated by bold numerals for the page reference.

Abbas, G. A. M.	298, 336	Cheesbrough, J. W.	167	Ellams, Wing Cdr. G.	450
Ager, G. V.	507	Cheetham, B. M. G.	298, 336	Ellen, L. W.	253, 256
Ajilogba, A. A.	235	Christie, S.	516	Elliot, J.	715, 728
Al-Araji, Dr. S. R.	178, 209, 406, 442	Christoforou, A. E.	705	Elven, J. N.	398, 765
Allaway, P. A.	167, 510, 591	Clark, Flt. Lt. G. S.	235, 591	Embrey, D. M.	704
Allchurch, S.	292	Clarke, P. A.	642	Eunson, R. F.	516
Apel, Dr. Konstantin	704	Clarke, R. J.	354, 389	Evans, W. A.	354, 369
Appleby, T. H.	242, 267	Cleeve, Major W. J.	235	Evans, W. F.	450
Armstrong, Henry	235	Clements, M. J.	704	Ezerendu, I. S. I.	235
Atigh, G. K.	350	Clements, T.	292		
Atkinson, P.	178, 219	Close, A. B.	167	Fagge, P.	591
Awala, E. O.	705	Coates, J. G.	167	Farthing, H.	450
		Coderre, Capt. P. C.	398	Fashola, V. K.	292
Babary S. P.	178, 224	Colyer, R. E.	115, 156	Fatimilehin, O.	167
Bagchi, A. K.	167	Cooney, Wing Cdr. W. R. F.	642	Faulkner, Professor E. A.	522, 547
Baker, D. K.	765	Cook, D. F.	292	Fawell, R. C.	765
Baker, J. A.	765	Cooke, R.	350	Fellgett, Professor P. B.	178, 219
Baker, K. A.	235	Cooper, Miss Y. M. D.	168	Fidler, D. M.	765
Baker, K. F.	704	Cornish, L. S.	400	Fielding, C. C.	91, 157
Barham, K. R.	398	Cotterell, J.	765	Findlay, I. M.	704
Barlow, Professor H. M.	521	Cotton, B. N.	398	Findlay, I. M.	704
Barlow, M. O.	516	Cox, Frank	704	Fingall, E. V.	292
Barnett, K. E.	398	Cousins, D. J.	350	Finnie, W.	705
Bassom, G. P.	167	Craig, D. K.	235	Fisher, A. J.	292
Bates, Professor J. J.	115	Craig, Lt. Cdr. B.	167	Fitzgerald, A. G.	704
Bates, R. H. T.	193	Cropper, R.	235	Foster, P. A.	235
Bedford, L. H.	170	Craine, J. F.	312	Fox, C. R.	511
Bell, A. M.	704	Cross, A. F.	398	Foye, S. O.	705
Bent, R. A.	235	Crossland, P.	350	Franklin, M. R.	292
Beresford, G. F. L.	397	Crossley, Captain W. J.	235	Frias, D. E.	397
Blackburn, H.	511	Curry, W. R.	765	Friedlaender, E. R.	450
Blakeborough, P.	516	Cuthbert, L. G.	178, 216		
Blakeley, Ronald	450			Gallett, I. N. G.	193
Blenkinsop, Major D. E.	765	Dahele, J. S.	167	Galliver, G.	292
Boghossian, G. H.	235	Darby, P. J.	167	Gambling, Professor W. A.	653, 683, 694
Bowman, A. M. A.	704	Dare, R. M.	292	Game, R. B.	350
Bowron, P.	537, 544	Das, T. K.	292	Garrad, Lt. Col. R. A.	642
Babary, S. P.	178, 224	Davidson, A. J.	516	Gerrard, G. A.	201, 208
Brice, Dr. J. C.	21, 156	Davidson, Air Cdr. S. M.	509	Gibbons, D. E. G.	765
Brierley, H. G.	695, 702	Davies, B. T.	591	Gibbs, D. J.	591
Briggs, Sqn. Ldr. T.	642	Davies, Professor D. E. N.	418, 420	Gibbs, G. J.	398
den Brinker, Carl S.	49, 156	Davies, Col. E. H.	591	Gilly, T. M. A.	292
Brothers, J. S.	39, 156	Davies, J. G.	125, 156	Gledhill, C. S.	471, 474
Brown, A.	591, 764	Dawson, D. M.	350	Goodfellow, Sqn. Ldr. J. H.	235
Brown, A. G.	450	Dean, Dr. K. J.	67, 140, 156, 294	Gordon, I. F.	643
Brown, P. L.	704	De Ville, R. L.	450	Gore, W. G.	504
Browning, I. J.	292	Dickins, Sqn. Ldr. T. P.	167	Gosling, Professor William	10, 58, 157, 178, 209, 341, 442, 509
Brueggemann, H.	242, 267	Diver, F. G.	764	Gossage, Sqn. Ldr. W. A.	235
Brunt, W. D.	398	Dixon, D. M.	591	Gourley, S. F.	406, 430
Bruton, L. T.	298, 325	Dolan, Capt. P. C. V.	704	Grady, Lt. Cdr. J.	704
Bull, L. A.	350	Donaldson, P. E. K.	125, 157	Gray, Lt. Col. P. R.	450
Burl, M.	354, 379	Dowden, B. E.	167	Green, M. R.	167
Butcher, J. B.	294	Dudley, M. W.	765	Grierson, D. W.	167
		Duguid, G. A.	591	Griffiths, Sqn. Ldr. A.	704
Cairns, D. J.	516	Dummer, G. W. A.	545	Grimbleby, J. B.	522, 547
Cameron, W. R.	642	Dunderdale, H.	227	Grimston, Sqn. Ldr. D. F.	765
Campbell, Professor D. S.	406, 421	Dunn, K. G.	765	Gruszka, S. H.	398
Canner, W. H. P.	179, 187	Dunstan, P. C.	292		
Canton, Flt. Lt. B. V.	704	Dyson, A. A.	1	Hall, D. A.	704
Carrier, R.	235			Hardman, Sqn. Ldr. K. P.	450
Carroll, D. V.	293	Eagle, D.	399	Hardy, C. J.	406, 430
Carter, Sub. Lieut. B. G.	235	Eckert, Flt. Lt. P. M.	591	Harris, R. A.	406, 430
Chadwick, D.	292	Edwards, Professor D. B. G.	435, 441	Harrison, A. F.	292
Chaplin, Prof. G. B. B.	510	Edwards, D. R.	350	Harrold, A. H.	765
Chapman, R.	643, 705	Edwards, J. C.	167	Hartnagel, Professor H. L.	75, 157
Chappell, E. J.	167	Edwards, J. R.	522, 562, 613	Haslam, F.	350
Chawner, M. H.	591			Hayes, A. M.	354, 363

INDEX OF PERSONS

Hayns, P. R.	705	Loader, Capt. R. J.	704	Pearson, J. E.	643
Hayward, A. C.	450	Lockhart, G. B.	178, 224	Pengelly, J. F.	167
Henderson, Wing Cdr. C.	292	Lockley, N. A.	705	Peters, J. M.	235
Henshaw, J.	705	Lokyer, K. G.	516	Phillips, G.	511
Herring, W. T.	591	Lokanatha, Wing Cdr. I.	292	Phillips, S. M. A.	350
Hewson, D.	292	Lovelock, R. T.	458, 486	Phillips, V. J.	458, 459
Hill, M. R.	516	Lowe, J. M.	516	Philps, C. L.	397
Hills, Wing Cdr. D. W.	350	Lowen, Lt. Cdr. K. A.	704	Pickard, R. M.	406, 430
Hills, K. C.	450	Ludditt, A.	705	Pinder, D. G.	516
Hills, R. C.	510	Luto, Sqn. Ldr. A. T.	591	Poll, Inst. Capt. P. J.	642
Hin Chung Chok	516			Popovic, Professor B. D.	242, 243
Hitchen, E.	591	McAllister, G. J.	292	Povall, A. G.	642
Hlaing, Q.	643, 705	McBride, R.	292	Powell, J.	511b
Ho, C. F.	298, 329	McFall, E.	516	Price, B. K.	450
Hockley, J.	458, 475, 350	McPherson, M. D.	450	Pridham, G. J. T.	292
Hodgson, W. S.	398	McSweeney, W.	591	Pugh, Dr. A.	227
Holford, H. N.	292	Mackechnie, L. K.	242, 267	Pursey, H.	169
Holliday, H. R.	765	MacKenzie-Orr, Lt. Col. M. H.	398		
Horton, P.	229	Mackintosh, I. M.	149, 157	Quah, B. H.	705
Hounsfield, G.	164	Maclean, Dr. T. S. M.	522, 534		
Howard, P. G.	643, 705	Macario, Dr. R. C. V.	312, 407	Rajagopalan, K. S.	642
Hsiao, J. K.	689, 693	Maddock, I.	509	Rakovich, Professor B. D.	242, 257
Hudson, D.	350	Maddox, W. F.	704	Ratliff, P. A.	298, 317
Hughes, T.	704	Majithia, J. C.	227	Read, C. W. W.	704
Huggins, P.	591	Makan, C. S.	591	Reavill, Major B.	704
		Manku, H. S.	450	Record, Cmdr. R. J.	516
Izatt, Dr. J. B.	133, 157	Marcuse, D.	655, 664	Reid, T. P.	704
		Martinez, A.	103, 158	Renwick of Coombe, Lord	643
Jackson, M. R.	235	Mason, D. H. J.	167	Reynolds, P. H.	398
James, L. R.	193	Mason, H. P.	299	Richardson, C. E.	507
Jamil, M.	705	Matsumura, H.	683, 694	Richings, W. V.	350
Jansz, E. V.	705	Maughan, H. B.	350	Rickards, A. J.	292
Jarvis, C. V.	397	May, J. W. R.	458, 497	Rickman, Major S. R.	349
Javid, H.	398	Melton, Capt. K. G.	450	Riley, Group Capt. H. R.	642
Jetha, S. D.	292	Millar, R. F.	193	Rivkin, P.	516
Jones, A. G.	169	Mingay, O. F.	765	Rizk, Mrs. M. A. F. S.	418, 420
Jones, M. R.	235	Monks, S. F.	643, 705	Roberts, John	398
Jones, R. J.	292, 643	Montgomery, R. J.	167	Roberts, J. B. G.	91, 158
Joy, Capt. R. N. A.	167	Moore, M.	292	Robertson, P. A.	642
Joyce, B. A.	21, 157	Morgan, G. B.	598, 625	Rome, Major N.	765
		Morgan, S. L.	168	Rutter, J. A.	765
Kahn, H. J.	458, 497	Morley, A. R.	406, 421		
Kay, A. A.	704	Morley, D. H.	642	Saddler, Dr. N. B.	385, 388
Keen, N. J.	170	Morrison, Lt. Col. S. P.	168	St. Johnston, A.	509b
Kendall, H. G.	398	Morrow, R. J.	522, 553	Sandbank, C. P.	665, 694
Kent, HRH the Duke of	510	Mothersole, P. L.	235, 510	Sanders, H. S.	292
Kenward, A. J.	350	Munroe, E. F.	704	Sansom, Sqn. Ldr. F. B.	704
Khoo, P. T.	705	Murray, J. K.	167	Savage, W. B.	349
Kidd, G.	242, 267	Musgrave, G.	354, 363	Scarrott, G. G.	99, 158
Kinniment, D. J.	435, 441	Myler, J. M.	398	Schicketanz, D.	675, 694
Kirwan, P. N.	398			Scott, B.	350
Knowles, Brigadier R.	398	Nambiar, Wing Cdr. K. M. K.	397	Scott, T.	516
Kocsis, F.	591	Narasimhan, Dr. M. S.	178, 188	Scott, T. L. B.	705
Kretschmer, F. F.	689, 693	Newman, J. C.	765	Scrivens, R. C.	292
Krieger, H. A. C.	591	Newton, R. B.	169	Sears, J.	398
		Nichols, K. G.	298, 336, 510	Selby, J. A.	704
Lamb, E. G.	516	Norman, F. B.	643	Seyler, A. J.	242, 267
Lambert, K. W.	516	Nye, R. A.	642	Shafik, I. A. M.	292
Lappalainen, P.	355, 362			Shepherd, A. A.	11, 158
Laurence, R. D.	705	Okuwa, O.	292	Siddiqi, M. S.	516
Law, D. T.	704	Ollivant, M. S.	761	Simpson, R. J.	471, 474
Lawrance, R. D.	643	Omosule, A. S.	350	Sloan, A. E.	350
Lawrence, A. J.	591	Oodan, A. P.	253, 256	Smee, B. G.	642
Lawson, C. L.	591, 643	Osime, S. E.	643	Smith, A.	705
Leach, Flt. Lt. P. A. G.	642	Osman, I. B.	516	Smith, D.	642
Leadbitter, A. C. F.	450	Owen, M. W. F.	705	Smollett, M.	29, 158
Leake, F. A.	349			Smulian, L. A.	292, 591
Leeston-Smith, M.	292	Pakes, A. R.	765	Sparkes, Professor J. J.	3, 158
Lewin, Professor D. W.	511	Parr, F. E.	350	Spreadbury, E. A. W.	292
Lincoln, J.	516	Parsons, C. W.	516	Sriyananda, H.	523, 533
Lindley, J. V.	292	Parsons, J. D.	298, 317	Staniforth, Dr. J. A.	385, 388
Line, L. D.	643	Parsons, J. W.	292	Stanley, K. W.	598, 609
Lintern, S. C.	398	Paull, C. J.	354, 369	Staples, D. R.	398
Lloyd, W. J.	765	Payne, D. N.	675, 694	Stephenson, M. D.	516

INDEX OF PERSONS

Stevenson, Dr. J. K.	458, 490, 631	Thrower, K. R.	516	Watkins, J. K.	458B, 459
Still, R. G.	249, 252	Tillman, J. R.	82, 159B	Watson, R. I.	705
Stillitano, M.	705	Tindall, B. F.	450	Weaver, L. E.	728, 729
Stojanovich, V. S.	242, 257	Tinkler, A.	292	Webb, P. R. W.	167
Stopford, Major S. R. A.	292	Todhunter, R. V.	642	Webber, M. J.	643
Stott, P. B.	292	Towill, Professor D. R.	523, 533	Weisbloom, N.	350
Streater, B. B.	292	Townsend, L. J.	642	White, N. W.	704
Sucker, R. R.	398	Tucker, J. D.	450	White, R. G.	643
Sudbury, B. R.	516	Turner, L. F.	598, 599	Wicks, J. E.	642
Sumner, P.	398			Wilkins, S. R.	510
Surti, A. M.	167	Vacquier, Wing Cmdr. A. T.	292	Williams, G. A.	642
Surutka, Professor Jovan V.	728	Veale, B. R.	765	Willis, W. S.	643
Swann, T. G.	178, 219	Velickovic, D. M.	728, 744	Wilson, D. R.	354, 379
				Wilson, Sqdn. Ldr. T. H. W.	516
Tan See Keng	643	Waldron, R. A.	598, 622, 751	Wood, A. R.	398
Taylor, M. H.	642	Wales, S. A.	704	Wood, Wing Cdr. D. R.	516
Teed, C. F. H.	420	Walker, J. C.	292	Worrall, L. W. B.	167, 704
Tempest, K.	292	Walker, P. B.	292, 642	Wright, T. C.	398
Terry, H. J.	642	Walsh, M. L.	705		
Thomasson, D. W.	642	Walwyn, P. R.	642	Yeun Chung Sam	516
Thompson, J. E.	201, 208B	Ward, R. B.	704		
Thong Saw Pak	642	Warren, C. S.	522, 553	Zeidler, G.	675, 694
Thorpe, Sqn. Ldr. A. A. P.	705			Zepler, M. M.	511

Printed in Great Britain by The Whitefriars Press Limited, London and Tonbridge.