Acoustics Bulletin

July 1988 Volume 13 Number 3

INSTITUTE OF ACOUSTICS

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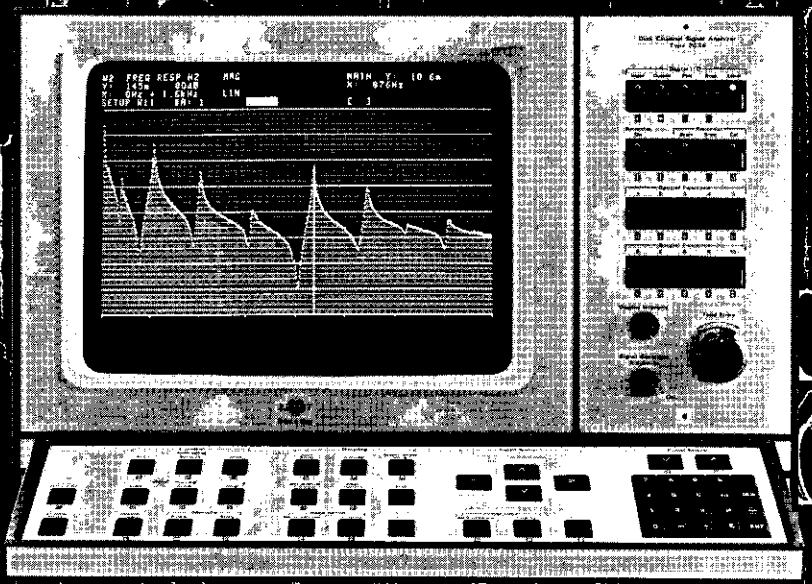

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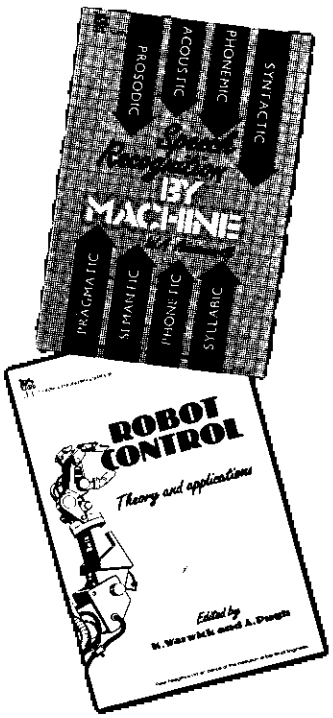
IEE BOOKS



COMPUTING AND CONTROL

IMPORTANT NEW BOOKS FROM THE IEE

Speech recognition by machine

by W. A. Ainsworth **£35**

Speech recognition by machine explains how feasible this is at present. It begins with a description of the nature of speech and its production and perception by human beings. This is followed by a discussion of the problems involved in speech recognition by machines, problems which may be solved by three kinds of processing: signal processing, pattern processing and knowledge processing. The techniques involved are introduced and their applications to speech recognition are evaluated. Although many problems remain to be solved, a number of partial solutions have been found. Applications employing these solutions are described. Finally some new approaches which are being explored are outlined.

216pp, 229 × 148mm, casebound, ISBN 0 86341 115 0, 1988

Robot control: theory and applications

K. Warwick and A. Pugh (Eds.) **£27**

This text provides a wide ranging coverage of recent research and development in the field of robot control, and serves as an excellent text for those wishing to obtain an overview of the whole subject area. It is based on papers which were given at the 1988 IEE International Workshop on 'Robot Control'. The papers are divided into several cohesive areas: sensory systems, adaptive manipulator control, modelling, trajectory control, implementation, robust robot control, manipulator workspace and incorporated intelligence. Each area, important in its own right, can be treated separately if desired, relationships between other areas being considered when necessary. Overall, the book gives an up-to-date picture of the present world-wide robot control research scenario, and is a useful source for those wishing to become more acquainted with the topic.

250pp, 229 × 148mm, casebound, ISBN 0 86341 128 2, 1988

Singular perturbation methodology in control systems

D. S. Naidu **£48**

The material of the book falls in the areas of modelling and control of large-scale systems, perturbation techniques and model simplification. It is aimed at both engineers and applied mathematicians interested in studying the field of singular perturbations and time scales, and can also be used for teaching graduate students in systems and control engineering. The background required for understanding the book is elementary theory of differential and difference equations, matrices, control systems and optimal control.

304pp, 229 × 148mm, casebound, ISBN 0 86341 107 X, 1988

Electromagnetic suspension: dynamics and control

P. K. Sinha **£48**

Intensive research over the last two decades in the area of magnetic levitation, or 'maglev' as it is now commonly called, has resulted in the development of a new concept in transportation. The advantages of this system, whereby conventional mass-spring suspension is replaced by a 'magnetic cushion' supporting the vehicle on a purpose-built guideway, are obvious in terms of fuel efficiency and environmental appeal. The book is suitable for both undergraduate and post-graduate courses in electrical systems and control engineering. It will also be of interest to practising engineers associated with dynamical analysis, simulation and control of electromechanical systems in general, and vehicle suspension systems in particular.

304pp, 229 × 148mm, casebound, ISBN 0 86341 063 4, 1987

Implementation of self-tuning controllers

K. Warwick (Ed.) **£32**

This text is an extremely useful guide for those wishing to investigate the application of self-tuning control systems. The contents have been chosen in order to restrict the amount of theoretical detail to that necessary for explanation purposes, whilst application examples and programming suggestions are highlighted. The overall text is suitable for those wishing to gain the flavour of adaptive control, although those already familiar with self-tuning techniques will find the problem solutions discussed to be most attractive. Parameter estimation, numerical solutions and software aspects are all considered at length, while simplified procedures and predictive self-tuning schemes are shown in terms of fundamental concepts.

312pp, 229 × 148mm, casebound, ISBN 0 86341 127 4, 1988

Temperature measurement and control

J. R. Leigh **£30**

This book treats the theory and practice of temperature measurement and control, and important related topics such as energy management and air pollution, at a level suitable for engineering and science undergraduate and postgraduate students and in a manner designed to make the book valuable to practising engineers. The aim has been to produce a practically oriented text within a firm theoretical outline. The first half is an application oriented survey of temperature measurement techniques and devices. The second half is concerned mainly with temperature control in both simple and complex situations.

208pp, 229 × 148mm, casebound, ISBN 0 86341 111 8, 1988

Control 88

IEE Conference Publication number 285 **£72**

Applications within industry. Artificial intelligence techniques. Biomedical systems. Computer aided control system design. Computer control systems. Fault diagnosis. Flexible manufacturing systems. H^{∞} methods. Large scale systems. Man-machine interfaces. Marine and aerospace. Measurement and instrumentation. Nonlinear systems. Optimisation and numerical methods. Robotics. Robust control systems design. Self-tuning and adaptive control. System identification and signal processing. Transport systems.

698pp, 133 papers, 297 × 210mm, soft covers, ISBN 0 85296 360 2, 1988

Automotive electronics

IEE Conference Publication number 280 **£39**

Includes: Fuel and ignition control systems. Diesel fuel systems controls. Vehicle condition monitoring. Vehicle security systems. Microprocessor Development Tools. Vehicle navigation and location systems. Sensors and actuators (transducers). Smart power devices. Reliability, quality and serviceability.

288pp, 54 papers, 297 × 210mm, soft covers, ISBN 0 85296 354 8, 1987

Advances in command, control and communication systems

C. J. Harris and I. White (Eds.) **£48**

The future for command systems. Design and structure of C^3 systems. Mosaic concepts for the future deployment of air power in European NATO. C^3 effectiveness studies. Databases for C^3 systems. Communications. Standards. The man-machine interface. Advanced processing.

424pp, 229 × 148mm, casebound, ISBN 0 86341 109 4, 1987

and coming soon:

Application of artificial intelligence to command and control systems
C. J. Harris (Ed.)

Parallel processing in control—the transputer and other architectures
P. J. Fleming (Ed.)

Software engineering 88
IEE Conference Publication number 290

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The Institute of Acoustics was formed in 1974 by the amalgamation of the Acoustics Group of the Institute of Physics and the British Acoustical Society and is now the largest organisation in the United Kingdom concerned with acoustics. The present membership is in excess of one thousand and since the beginning of 1977 it is a fully professional Institute.

The Institute has representation in practically all the major research, educational, planning and industrial establishments covering all aspects of acoustics including aerodynamic noise, environmental acoustics, architectural acoustics, audiology, building acoustics, hearing, electroacoustics, infrasonics, ultrasonics, noise, physical acoustics, speech, transportation noise, underwater acoustics and vibration.

Membership of the Institute of Acoustics

Membership of the Institute is generally open to all individuals concerned with the study or application of acoustics. There are two main categories of membership, Corporate and Non-corporate. Corporate membership (Honorary Fellow, Fellow, Member) confers the right to attend and vote at all Institute General Meetings and to stand for election to Council; it also confers recognition of high professional standing. A brief outline of the various membership grades is given below.

Honorary Fellow (Hon FIOA)
Honorary Fellowship of the Institute is conferred by Council on distinguished persons intimately connected with acoustics whom it specially desires to honour.

Fellow (FIOA)
Candidates for election to Fellow shall normally have attained the age of 35 years, have had at least seven years of responsible work in acoustics or its application, and have made a significant contribution to the science or profession of acoustics.

Member (MIOA)
Candidates for election to Member shall normally have attained the age of 25 years, must either (a) have obtained a degree or diploma acceptable to Council and have had experience of at least three years of responsible work in acoustics, or (b) possess an equivalent knowledge of acoustics and cognate subjects, have had experience for not less than seven years of responsible work in acoustics or its application, and must have been a Non-corporate member of the Institute in the class of Associate for not less than three years.

Associate
Candidates for election to the class of Associate shall have attained the age of 18 years and (a) have received a general education approved by Council, and (b) be engaged or interested in acoustics or a related discipline.

Student
Candidates for election to the class of Student shall normally have attained the age of 16 years and at the time of application be bona-fide students in acoustics or in a related subject of which acoustics forms an integral part; they should also (a) have received a good general education, or (b) pass a satisfactory preliminary examination. Normally a student shall cease to be a Student at the end of the year in which he attains the age of 25 years or after five years in the class of Student, whichever is the earlier.

Sponsor
Sponsor membership is open to firms, organizations or persons having an interest in acoustics, whose support can advance the aims and objects of the Institute.

Full details and membership application form are available from: The Secretary
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25 Chambers Street
Edinburgh EH1 1HU.

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President's Letter

Dear Fellow Member,

The growth and international status achieved by the Institute since its formation in 1974 are quite remarkable, bearing in mind the interdisciplinary nature of our subject. The original intent was to form a 'loose association of workers with a broad range of interests in acoustics' who would meet regularly, and as a rather humble and junior member of the engineering profession grow as opportunity presented itself. Bearing in mind that the majority of us have other complementary professional allegiances, it is most creditable that we are now acknowledged as the foremost single organization concerned with the profession of acoustics in the UK. This is due to a combination of wise Presidents, good housekeeping and the hard work and freely given time of a relatively small number of dedicated people working closely with the permanent secretariat in Edinburgh.

There is no cause for complacency however, and a lot more effort will be required if we are to capitalize on this rapid growth and achieve the long term goal of becoming a fully Chartered Institute. The effort and consequent stresses of running the IOA are no different from those of running any business, and whilst it is my intention to try and contain the load on headquarters I will also be seeking to create a number of additional professional benefits for all. Not surprisingly these ventures will require an increase in revenue and Council is already considering new initiatives, although increased membership and attendance at meetings are the most immediately viable ways of increasing the financial base.

Another important feature of these initiatives will be to provide greater opportunities for our younger colleagues who will become the future backbone of the Institute. They should be given the chance to join as graduates with more clearly defined career routes to progress to corporate member and chartered/technician engineer status. In addition I would like to encourage them to be more active by presenting papers at meetings, by taking increasing responsibility in Group and Branch affairs and by making their views known to members of Council and its Committees.

As your newly installed ninth President I would like to encourage everyone to be more involved, to make nominations for our various Medals and Awards, to contribute to the Bulletin, *which provides an interesting and convenient way of communicating with each other, and most of all to use the Council which has been elected to look after your interests.*

I look forward to an exciting term of office and hope that you will support my moves to expand our professional base.

Yours sincerely,

Chris Rice

NEW PUBLICATIONS

Acoustics and Electroacoustics

By Mario Rossi, PhD. Published by Artech House Books, 650 pages. ISBN 0-89006-255-2, Price £60.00.

Offering a more practical than theoretical approach, this book helps develop an understanding of audio engineering applications by working through 1300 equations and numerous examples. Several models and over 500 figures illustrate the practical methods discussed. Contents include: Fundamental concepts, Sound sources, Propagation, Mechanical and Acoustical systems, Transducers, Loudspeakers, Microphones, Sound Recording, Humans and Sound, Basic Room Acoustics, and Glossary, Bibliography and Index.

The Key Technologies: Some implications for Education and Training

Published by the Engineering Council and the Further Education Unit.

This booklet urges companies to identify those 'key technologies' which are likely to have most impact on their future business so that they are in a good position to use them and stay competitive. The Engineering Council defines key technologies as newly emerging topics in science and engineering which are likely to have major evolutionary effects on existing products or processes or may lead to revolutionary new products or processes. Engineers and technicians must recognize the importance of key technologies and also have the educational background to work with them. To that end, educational establishments should identify which of the changing technologies they should use as examples in their teaching. Regular reviews of technology based curricula would ensure that course content and methods of learning would be up to date.

Those working in industry and commerce need to have learned general principles and have the ability to select and understand the key technologies in their business area, says the document. Staff at all levels should be aware of key technologies and the concept should be incorporated into the curriculum from problem-solving in primary schools through to the continuing education and training for engineers and technicians.

Enquiries to: Ron Kirby, Director of Public Affairs of the Engineering Council, Tel: 01-240 7891.

Musical and Digital Technology

Latest in a series of International Conference Proceedings published by the Audio Engineering Society.

The Audio Engineering Society has published the proceedings of the AES 5th International Conference: *Music and Digital Technology*. In May 1987 34 experts in digital music-making drew engineers and musicians from many countries to an intensive three-day conference, which explored all aspects of an art in transition, in sessions ranging from history of digital music making to the frontiers of computer-assisted music.

Musical and Digital Technology, consisting of 20 of the papers presented at that conference, is timely and valuable reading for engineers, musicians and audiophiles. Details from: AES British Section, Lent Rise Road, Burnham, Slough SL1 7NY. Tel: Burnham (062-86) 63725. Prices – members, £20.00; non-members, £30.00. For orders of two or more volumes, cost of each copy is: members, £18.00; non-members, £27.00. Cheques payable to Audio Engineering Society.

Continued on p. 5

Letters to the Editor

Indicators of noise annoyance

At the recent IOA meeting on New Sources of Transportation Noise the question of the suitability of the A weighted decibel dB(A) as the sole indicator of noise annoyance was again raised. On this occasion it was in relation to the effect of noise from the Docklands Light Railway on nearby residents. More commonly it is discussed in connection with road traffic noise, particularly low frequency noise from heavy lorries.

There is little doubt that the dB(A) serves a useful purpose in assessing the response of the human ear to noise arising and heard out of doors. However, because of the negative weighting given by the dB(A) to low frequency noise, and the fact that low frequency noise is transmitted more easily over distances, over barriers and through walls and windows than higher frequency noise, it is likely that the subjective reaction of residents indoors may be underestimated by external dB(A) measurements. Moreover, this may well be accentuated by resonances set up in the room due to low frequency noise – 'airborne vibration' – which would give a low reading on the A-scale.

This suggests that noise climate evaluation and, even more importantly, noise emission standards, based solely on the dB(A), could be misleading and detrimental in considering people's noise exposure while indoors. The use of the dB(A) by itself may also influence vehicle manufacturers to concentrate on reducing noise emission in the mid frequencies, while perhaps neglecting the low frequencies.

There are of course also very good arguments that the present system should be kept. The dB(A) is a simple easy unit to measure, it is well known, and it is enshrined in a great deal of legislation and environmental assessment procedures. But if it were to be shown that keeping the dB(A) as the sole unit for these purposes is misleading, would these arguments be strong enough to justify no change? Perhaps using a C-weighting or a single low-frequency band in addition to an A-weighted measurement would give a better indication for noise heard indoors. It would be useful to get views and proposals on this.

The subject has often been raised as an incidental but as far as I know has never been fully discussed in depth. May I suggest that the time has come for the IOA to arrange a full day meeting on this so that there is an opportunity for the issue of the dB(A) to be fully aired and a decision taken on whether or not any changes for assessing noise exposure indoors, and setting noise emission standards for vehicles need to be considered.

The views expressed in this letter are personal ones and do not necessarily represent those of London Scientific Services or its staff.

From George Vulkan, London Scientific Services, County Hall.

Hearing aid research

I am writing to you, not as a member of your Institute, but as a member of the public asking help from you and your members. I am hearing-impaired but unfortunately I find that a hearing aid is not much use to me. However, as a research worker I am aware that we should not give up when we reach difficult problems. My interest in helping the hearing-impaired has led me to become involved at the national level and I am consequently now a member of the Technical Committee of the British Association of the Hard of Hearing (BAHOH).

Recently we have been endeavouring to find out what research is being done to improve the performance of hearing aids. Of course our goal is to find something which restores hearing to normal but as you may well be aware this is well-nigh impossible. We find that although there is something like £2 million available for research into hearing loss none of it seems to go towards developing the hearing aid. Most of the money goes to the Medical Sciences via MRC and as far as I know SERC has never handled any money for grants for the hearing-impaired. Technological advances in hearing aid manufacture seem to be mainly in the miniaturization of the device rather than in the improvement of its performance and most of this work is done by the manufacturers themselves. I have approached electrical engineers in the university where I work (University of Surrey) and as far as I can tell there is nobody interested in the hearing aid. I was directed to you by Dr Bowsher from the Physics Department, who told me that the problems were as much acoustical ones as electrical engineering ones. We in BAHOH are prepared to press for money to be directed towards the development of the hearing aid if we can find someone interested in the subject.

I, my fellow committee members, and the 10 million or so hearing-impaired in this country, would be very grateful for any help you or your colleagues could give on this sorely neglected subject.

From Judith Cohen (member of BAHOH Technical Committee).

Publications continued

Inter-noise 87 – Noise Control in Industry

The Proceedings of the 1987 International Conference on Noise Control Engineering, held in Beijing, China on 15–17 September, are now available in two vols. (1684 technical pages) at $100.00 per set, shipped post paid (but $35.00 more for air shipments overseas). Apply to: Noise Control Foundation, PO Box 2469, Arlington Branch, Poughkeepsie, NY 12603 USA.

Catalog of Acoustical Standards

Published by the Acoustical Society of America, this, the 7th (1988) revision of the ASA Standards catalogue, lists 62 acoustical standards published by ASA and 22 published by ANSI (American National Standards Institute). Details from: Standards Manager, Standards Secretariat, Acoustical Society of America, 335 East 45th Street, New York, NY 10017-3483, Tel: (212) 661-9404.

Spring Conference Report

The editor regrets that the publication of a report on the 1988 Spring Conference (Acoustics '88) has been unavoidably delayed – but this *will* appear (suitably illustrated) in the October issue of *Acoustics Bulletin*.

RNID launches major consumer guide series

Many microphone-type television listening aids are badly-designed, substandard in construction and over priced. These are some of the conclusions of a new consumer guide to these popular aids, published by the RNID and aimed at people with hearing impairment and professionals who work with them.

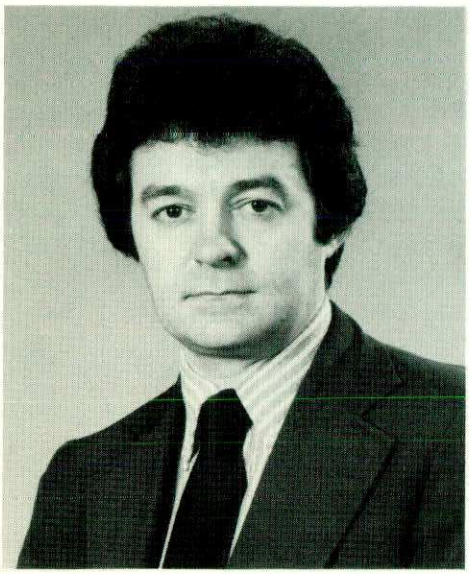
The report is the first of a major new series of guides to appliances for hearing-impaired people produced by the RNID's Technical Awareness Service. For the first time ever hearing impaired people are being offered comprehensive and independently-researched information to enable them to choose the best systems for their needs, the RNID says.

Microphone-Type TV Listening Aids, Technical Awareness Series Test Report No. 1, costs £4.95 (p&p inc.) and is available from the Information Department, RNID, 105 Gower Street, London WC1E 6AH, or £14.50 for an annual subscription (three issues).

CITATIONS

RAYLEIGH MEDAL 1988

David George Crighton



David Crighton is one of today's foremost modellers of acoustical phenomena. His way of addressing fundamental problems by rigorous mathematical argument inspires the subject's theoreticians world-wide. No one is better or more versatile at that kind of analysis.

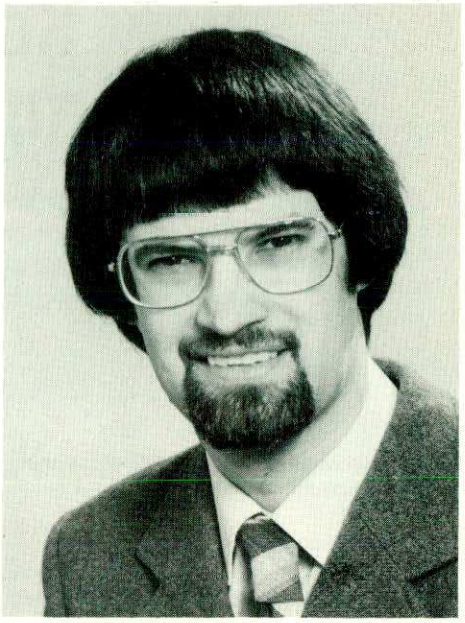
Turbulence and its interaction with sound was his first research topic. He mastered that in a work that has become the subject's standard over twenty years. Water, and bubbles in water, are acoustically fascinating but never more so than when excited by turbulence, another phenomenon laid open by Crighton's early work. Diffraction and the generation of sound by diffraction effects near complex sources is another field where current understanding is largely due to Crighton, particularly when the sources are of a hydraulic kind. This study of structural vibrations and their coupling to sound is immeasurably simpler because of Crighton's work, and the fluid loading effects have become a routine matter in his hands. Non-linear acoustics and the model equations of various forms have fallen into an ordered pattern because of his work and his students seem also to have acquired much of that skill.

Crighton is a world figure in both acoustics and applied mathematics. His prodigious ability to pose and solve important problems is matched only by his talent to inspire others. He leads today's fundamental thought in the subject and is devoted to making British technology benefit from the scientific advances he and his colleagues make. A magnificent researcher whose work and achievement are celebrated by all serious acousticians.

The Institute of Acoustics is delighted to be able to award David Crighton its Rayleigh Medal for 1988.

A B WOOD MEDAL and PRIZE 1988

Victor F Humphrey



Victor Humphrey was born in 1953 at Bedford. He studied Physics at Bristol University, receiving his BSc (First) in 1975 and his PhD in 1981. His PhD project was on the experimental observations of waveform dislocations in pulsed wavefields. He was a Research Officer at the School of Physics, University of Bath in the period 1978–1985, taking up a Lectureship in the same School in 1985.

At Bath, his research work has mainly involved the use of parametric sources in laboratory-scale acoustic experiments in water, leading to the setting up of excellent facilities for accurate measurement of acoustic transmission, reflection and scattering. He is also actively involved in the investigation of finite-amplitude effects in medical ultrasound, in collaboration with the Medical Physics Department of the Wessex Regional Health Authority.

Apart from his family his main 'outside' interest would appear to be Morris dancing. However, if one enquired about his favourite pastime at the moment, the response could easily be the filling of forms – for completion of lectureship 'probation' reports and such like.

Those in contact with his work know his appreciation of physics in general, and how he brings in this understanding of the fundamentals to the work in hand, with meticulous care – he worries about measurement errors of fractions of a dB! Victor has our best wishes for continued development of his work in the future.

The Institute of Acoustics is pleased to award Victor Humphrey the A B Wood Medal for 1988.

Helping entrepreneurs to get companies 'off the ground'

A booklet *Innovators need more than ideas!* has recently been published by The Engineering Council, and encourages inventors entering for The Prince of Wales Award for Industrial Innovation and Production to seek help and advises them on how to get it. It gives advice on finance, design, marketing, sales and distribution, business partners, planning, commercial and technical support, and is published with the support of British Venture Capital Association, Business in the Community and the United Kingdom Science Park Assn.

In a foreword, HRH The Prince of Wales welcomes the work of The Engineering Council in putting together a brochure 'which highlights the issues British innovators should be thinking about, and points them in the direction of people who are willing and able to provide a helping hand'.

The Award, organized by The Engineering Council, is open to a wide range of people and organizations who are attempting to create profitable businesses based on British inventions or new ideas. The aim is to identify new products and processes and encourage the inventor or entrepreneur to get them into production and on to the market as soon as possible.

The booklet, together with the rules, conditions and entry form for the Award are available free from: The Prince of Wales Award for Industrial Innovation and Production, The Engineering Council, Savoy Hill House, Savoy Hill, London WC2R 0BU. Telephone 01-836 7334.

Proceedings of the Institute of Acoustics – Abstracts

New Sources and Problems in Urban Transportation Noise

One-day Meeting organized in collaboration with the Chartered Institute of Transport, the Institution of Environmental Health Officers and the Royal Environmental Health Institute of Scotland, and held at the Society of Chemical Industry, London, 23 May 1988 (Conference Organizer, R M Galbraith)

The effectiveness of noise criteria in planning for new residential developments

W Stubbs
Wimpey Laboratories

Many UK Planning Authorities have their own noise criteria for new residential development. Most are based on Department of the Environment Circular 10/73 'Planning and Noise' but significant differences occur in the interpretation of the guidance given in 10/73.

Many Local Authorities will not allow the construction of dwellings where future façade noise levels exceed 68 dBL_{A10} (18 hr), even where the façade has no windows. The level of 68 decibels is taken from the compensatable noise level of the Noise Insulation Regulations 1975. Other Local Authorities will allow thermal double glazing with a 12 mm air gap for windows exposed to more than 70 dBL A_{10} (18 hr).

There appears to be no consistent approach to noise standards. Circular 10/73 does allow for Local Authorities to adopt their own standards based on 10/73. Where local noise policies have been established, their application is usually inflexible. It is unusual for account to be taken of the demand for housing when making planning decisions on noise.

The question of whether to install mechanical ventilation in double glazed rooms depends upon the Local Authority in question. Some require it, others do not.

This paper will describe the application of noise criteria to road traffic noise and railway noise, with illustrations from case histories.

Light rail transit – noise and vibration impact

J Hinton, Birmingham Environmental Services Department
K Scobell, West Yorkshire PTE
J Bird, Midland Metro WMPTE

This is an important time for passenger transport in the United Kingdom. At the moment many transport authorities are investigating the possibility of introducing modern light rail transport (LRT) as an integral part of future mass transit systems. In the West Midlands a study has been undertaken to evaluate the impact of LRT in terms of noise and vibration. The methods employed have been based on standard acoustic techniques, a study of available literature, first hand experience from visits to a number of existing systems and noise and vibration measurements on such systems. A computer program has been developed which carries out the necessary calculations to predict noise from both road traffic and LRT with a high degree of confidence. The results of the study have been used to predict the environmental impact on a route in Birmingham which was at one time to have been the first line of an LRT network. Details of the methods of assessing the impact and the results from the case study route will be outlined in the paper. In addition the paper will go on to look at the application of the impact assessment methods in the light of the latest proposals for LRT systems in the West Midlands and West Yorkshire.

A survey of noise levels from the Docklands Light Railway

B M Shield, J P Roberts, M L Vuillermoz
Acoustic Group, Institute of Environmental Engineering, South Bank Polytechnic

The new Docklands Light Railway is having a considerable impact on the noise climate of the local environment with many residents complaining of sleep disturbance and annoyance. This paper will present the results of a noise survey carried out both inside and outside dwellings along the length of the railway.

The construction of the railway varies along its length and the level and character of the noise along a particular section depends on the construction of that section. The lowest noise levels have been recorded where the track runs at ground level or on Victorian brick viaducts or embankments, whereas the highest noise levels measured occur along the new elevated sections of track. A feature of the noise associated with the new viaducts is high levels of low frequency noise which is causing considerable annoyance to local residents.

Some practical properties of antivibration mounts

C D Mathers and R Walker
BBC Research Department

To reduce the flow of vibrational energy into or out of a structure, the usual technique is to support it on antivibration mounts (AVMs). At low frequencies, the structure may be regarded as a mass, and the AVMs as compliant elements with some internal damping.

At higher frequencies, structures cease to behave as masses, and exhibit complex modal behaviour, the analysis and prediction of which is a well-established science. Similarly, AVMs cease to behave as compliances at higher frequencies, although much less has been written about their modal behaviour. Some experiments are described in which various AVMs are loaded with masses whose first modes are known to be above the frequency of interest, so that the behaviour of the AVMs alone can be observed.

Some effects of friction have also been demonstrated. This is a non-linear loss mechanism, and although usually present in very small amounts, may be far from negligible in its effect. In systems where the level of vibration is very small, friction can render AVMs completely ineffective.

London City Airport – noise problems and solutions

Roy E Cadoux
Directorate of Operational Research and Analysis
Civil Aviation Authority

London City Airport is one of the most environmentally sensitive recent developments in London. This paper describes how noise considerations have had a vital influence on the design and development of the project since its inception.

Following some forceful local opposition and a public inquiry, unprecedented restrictions were imposed on the type, number and time of operations. The runway length was limited to 2500 ft, and the approach glideslope set at 7½°. Aircraft types are limited both by these performance constraints, and by strict noise limits based on certificated levels.

These restrictions are described in detail, showing their effect on the current operation of the airport, and on future plans.

In addition, an agreement between the developers and local authorities led to further operational constraints and noise alleviation measures, and a noise exposure limit of 35 NNI at representative locations around the airport. The role of the CAA in measuring and calculating the noise exposure is described with examples showing the extent of predicted contours around the airport.

Noise considerations also had a major impact on the airport layout, such as the use of the terminal building as a noise barrier to shield nearby houses. Overall, the airport authority has made and is continuing to make a major effort to minimize all sources of noise nuisance, and to be a good neighbour to the residents of Docklands.

London City Airport: avoiding a problem at Britain's first STOLport

P Henson and J G Charles
Bickerdyke Allen Partners

The increasing congestion and delay at the London Airports was foreseen in 1981, and led John Mowlem to develop a proposal for an airport for 1 million passengers per year near the City of London.

The site found was the central quay between the disused Royal Albert and King George V Docks, less than six miles from the Bank of England.

The airport was specifically designed for use by fully pressurized 50-seat airliners that can operate from a 762 m runway. The runway and the terminal are within a few hundred metres of a well established residential community.

The development of the STOLport within London's Docklands, has involved not only the design of airport facilities, but also the planning and design of features to avoid an urban noise problem. The authors will describe the work required to demonstrate these features to the Planning Inquiry Inspector and the relationship of that early predictive work to initial measurements and community response near the working airport. Also the new elements that have arisen with regard to environmental noise impact of an urban airport since the Inquiry will be discussed, such as maintenance ground noise.

European Community aeroplane noise legislation – the next step

A J Rowland
Commission of the European Communities

With effect from 1 January this year, the final part of the European Community's Directives on aeroplane noise came into force. From that date non-noise-certified aeroplanes from third countries could no longer operate from Community airports, although Member States may grant limited exemptions based on well defined and strict criteria.

Having removed non-noise-certified aeroplanes from Member States fleets and stopped their operation inside the Community by third countries, the European Commission must now address the problem of removing certified – but still very noisy – Chapter 2 aeroplanes. This can best be achieved by a two-pronged approach: a non-addition rule, i.e. after a certain date (01.01.1990), no further Chapter 2 aeroplanes may be added to the civil air registers of Member States, and a non-operation rule, i.e. after a certain date (still to be decided) Chapter 2 aeroplanes may not operate within the Community. To ensure the greatest environmental benefit, this non-operation rule must apply equally to third countries.

In order to obtain the best environmental benefit with the minimum of disruption to airlines, it is essential that a harmonized approach to the problem be pursued. Ideally, the lead should come from the International Civil Aviation Organisation (ICAO). However, if – for whatever reason – this lead is not forthcoming, then an EEC-European Civil Aviation Conference-United States solution must be found.

Inaudibility in the Assessment of Noise Nuisance

One-day Meeting organized by the Scottish Branch in collaboration with the Institution of Environmental Health Officers and the Royal Environmental Health Institute of Scotland, and held at the Meadowbank Sports Centre, Edinburgh, 27 April 1988 (Conference Organizers, Robert Chalk, MIOA, David MacKenzie, MIOA, and John Stirling, MIOA)

Over 85 delegates attended this meeting which is clear evidence of the growing interest in 'inaudibility' for assessing nuisance.

The first papers described how 'inaudibility' has been used in Edinburgh for the assessment of nuisance from amplified music, mainly from licensed premises. A range of speakers including an Environmental Health Officer, the Clerk to the Licensing Board and consultants gave their views on the use of 'inaudibility'. Later papers discussed general issues including the application of 'inaudibility' to sound transmission problems, the relation between noise level and loudness, the measurement of audibility and the moral and legal implications of 'inaudibility'.

The general feeling of the speakers and most delegates was that when used intelligently 'inaudibility' provides a useful method of assessment. Whilst some reservations were expressed about the possible abuse of a purely subjective criterion it was felt that the shortcomings of 'inaudibility' were much less than those of objective criteria for problems involving amplified music.

R Craik

Review of entertainment noise nuisance in Edinburgh

R J M Craik
Heriot-Watt University, Edinburgh

In the early 1980s a survey was carried out in Scotland to determine the extent of nuisance caused by entertainment noise. The results showed that the incidence of complaints was increasing rapidly. The survey also showed that objective criteria, usually based on the Wilson report or BS 4142, were not adequate since in many cases the noise levels were assessed as not being a nuisance when subjectively they were a nuisance.

To overcome these difficulties the criterion 'inaudibility' was introduced and enforced initially through by-laws and the Licensing Board. Over the last three years the criterion has been used successfully for a large number of cases both for assessing complaints and as a planning aid. The criterion is now widely accepted and has been found to be an effective method for assessing certain types of noise.

Inaudibility for the control of noise nuisance

J G Sanderson
Environmental Health Officer, Edinburgh

In dealing with a complaint of amplified music, the Environmental Health Officer has to determine if a nuisance exists under the Control of Pollution Act 1974. The criterion normally adopted is that contained within the Wilson Report, i.e., a tentative estimate of noise levels within dwellings at night should not exceed for more than 10 per cent of the time a level of 35 dB(A) within the Urban Area.

It has been found in Edinburgh since the introduction of the Control of Pollution Act 1974 and the extended hours permitted under the Licensing (Scotland) Act 1976 that with levels of amplified music set to comply with the Wilson criterion, the music was still audible and interfered with the normal enjoyment of the living standards one would expect in one's dwelling house.

It was therefore decided to seek a more acceptable criterion in dealing with this type of complaint and a criterion has been agreed and the vehicle of enforcement was made by the City of Edinburgh Licensing Board under the by-laws for Licensed Premises. This criterion has been determined as being any music to be inaudible within the nearest noise sensitive dwelling house.

Inaudibility: the sound of music

D J MacKenzie
Heriot-Watt University, Edinburgh

The concept of inaudibility, or 'I do not want to hear the sound of your music', has been used during the design stages and commissioning of a number of discothèques in the Edinburgh area. This paper includes a discussion on the measurement techniques that can be used by planning officers to assess whether a proposed use of an existing building will constitute a noise nuisance. It is then shown how inaudibility can be used as a powerful design tool during the initial construction and possible refurbishment stages.

Although inaudibility is a subjective criterion the design for effective noise control is based on objective measurements and calculations. These and other aspects will be discussed.

Controlling the sound of music legally

D J Quinn, Senior Solicitor

There are several different legal means of controlling noise nuisance caused by music. This paper looks briefly at each of the methods currently in use and then goes on to consider the difference between the criteria set by the Wilson Report in 1963 and the concept of inaudibility as a basis for Court action. Finally the legality of inaudibility is discussed.

Inaudibility – so what is new?

K Dibble
Consultant, The Sound Practice

A discussion of the basic characteristics of entertainment noise, putting the hypothesis that inaudibility has always been in effect the unwritten

criterion, and looking at some case histories elsewhere in the country to illustrate the point. A number of slides and field measurement data are included.

Implications of an audibility criterion for assessing noise between dwellings

W A Utley
Building Research Establishment

Jeanette Brooks and K Attenborough
Open University

Research on acceptable standards for sound insulation between dwellings has generally involved surveys of residents and a comparison of their responses with some measure of insulation performance. This paper adopts an alternative approach in which known source levels and values of sound insulation are used to derive levels received in an adjoining dwelling.

Measurements of television listening levels, domestic appliance noise levels and internal ambient noise levels have been obtained by Open University students undertaking Course T234, 'Environmental Control and Public Health'. The student data have been supplemented by measured levels from other sources and by analyses of noise spectra. Details of the sound insulation performance of various party wall and floor constructions have been obtained from the BRE data bank of measurements in dwellings. The data have been analysed to derive typical transmitted levels of noise in a neighbour's dwelling.

The results of the analysis are used to consider the feasibility of adopting a criterion based on audibility given current standards of sound insulation. The implications of such a criterion for performance requirements for party wall and floor insulation are also discussed.

The relevance of audibility, intrusion, annoyance and likelihood of complaint in the assessment of noise nuisance

W Stubbs
Wimpey Laboratories

Reactions to different types of noise source will be discussed with the descriptive terms used in various UK legislative standards and guidelines. Definitions of each of the terms will be given along with an assessment of the operation of relevant noise rating procedures.

The positive action of making a complaint must result from the occurrence of an annoying noise. Annoyance is an adverse reaction to an intruding noise, and for a noise to be intrusive, it must be audible above the background noise. An intruding noise need not necessarily be a nuisance. Apart from the level of a sound its nature and information content is important as well as whether it is continuous or intermittent.

Examples of various types of noise will be discussed. The audible sound of amplified music in a neighbour's bedroom at night-time can clearly be a nuisance, while sounds which are part of the normal expected acoustic environment can be intrusive without being annoying.

Different approaches to environmental noise impact assessment will be discussed with the example of the Stansted Airport Public Inquiry where the objectors used an intrusion assessment based on the principles of BS 4142 while the developer relied upon an absolute noise level related to community annoyance.

The principles used in the assessment of noise from an Edinburgh discothèque in a recent consultancy case will also be discussed.

The equivalent annoyance level as an objective assessment of entertainment noise

K Scannell
Lucas CLE

One of the main reasons that objective assessment of entertainment noise has proved difficult is that the measurements have been based on loudness rather than annoyance.

The 'A' weighted sound pressure level, originally developed as a simplified measurement of loudness, has been used as an assessment of noise annoyance. Where temporal variations of the noise occur the equivalent continuous level (LAeq) has been used. This loudness measurement seems to give a reasonably good correlation to annoyance where the stimulus is broad band, shows no spectral peaks, is non-impulsive and the frequency and level are intermediate.

Unfortunately typical entertainment noise annoyance shows none of these attributes. It is low level, low frequency, complex tone with pronounced spectral peaks. It is also a repetitive impulse noise. It is not surprising, therefore, that measurements based on 'A' weighted sound pressure level, LAeq, or Noise Rating curves give a poor correlation to annoyance.

This paper describes a method of measurement that starts by measuring the noise only in the frequency range that is relative to the annoyance; it then applies correction factors such as:

1. Sound pressure level to loudness due to the low frequency content of the complex tone.
2. Sound pressure level to loudness due to the impulsive characteristics.
3. Loudness to annoyance for low loudness levels.

The final result is known as the equivalent annoyance level (EAL) in decibels. The EAL provides an assessment of the annoyance that is equivalent to the annoyance assessment of a broad band, continuous noise using the LAeq as a descripter.

The effect of masking on the audibility of sound through walls and floors

L S Mair
Glasgow College of Technology

There is a great deal of information available on the subject of masking of one sound by another, particularly by pure tones and wide or narrow band white noise. Intelligibility of speech is described by the Articulation Index or the Speech Interference level, but these refer to the comprehension of meaning rather than the audibility of the sound and do not apply to the problem of music noise.

This paper reports an experimental determination of absolute audibility of speech and music in the presence of background noise and provides information about levels of sound which can just be detected to be present when masked by wide band noise.

The experimental procedure involves the presentation of subjects with examples of speech and music whose spectrum has been shaped in accordance with various levels of sound insulation by walls and floors. The wide band masking noise is derived from white noise but the spectrum levels are also shaped to correspond to background levels in buildings.

The audibility information is presented in terms of three variables, the level of noise at source, the wall or floor insulation and the level of background noise.

Inaudibility – practicality and principle

R J Bowdler
Consultant, *New Acoustics*

While inaudibility as a criterion has advantages for the Environmental Health Officer, it poses problems of practicality for the consultant, and raises questions of principle. Designing for inaudibility requires a detailed knowledge not only of the source sound, but more important, of the background noise in the complainant's room. The paper examines the design problem that the consultant faces, and discusses typical sound insulation values that are required to achieve inaudibility. These values are compared with values necessary to meet alternative criteria, and with current building practice. The paper also views the principles involved in adopting such a criterion. It questions whether common law nuisance which considers the 'reasonable person' is being bypassed and new law in effect being created by actions under the Control of Pollution Act and through the Licensing Courts. It questions whether the 'unreasonable person' is the one who benefits from this criterion at the expense of the 'reasonable person' and perhaps to the detriment rather than the enhancement of the environment as a whole.

Noise from Neighbours – New BRE Video Learning Package

A common cause of complaint in housing is the unwanted sound of other people's activities – noise from neighbours. The way noise is transmitted from one house to another and practical solutions for both house conversions and new build are explained in easily understood form in 'Noise from Neighbours', a new video learning package launched on 26 May by BRE Director, Roger Courtney.

Produced by a Building Research Establishment team and based on BRE research, the 30-minute video is aimed at both the building designer and the constructor, and should also benefit local authorities and housing associations challenged by sound insulation problems, building students and professionals – possibly as part of continuing professional development.

The package also includes an introduction to the video, and BRE publications on sound insulation within the building envelope: four Information Papers, four Digests, three Defect Action Sheets and a booklet containing the video commentary. The complete package costs £60 (+ £9 VAT) from Publication Sales, Building Research Establishment, Garston, Watford WD2 7JR.

Contributions and information for the October issue of *Acoustics Bulletin* should reach Marjorie Winterbottom at 14 Witney Road, Long Hanborough, Oxon OX7 2BJ, no later than Thursday, 11 August.

THE INSTITUTE OF ACOUSTICS FOURTEENTH ANNUAL REPORT OF THE COUNCIL 1987

On 17 December 1987 the Engineering Council at its meeting approved an application by the Institute of Acoustics to become an 'Institution Affiliate' and as such be entered on the list of nominated bodies. This will enable suitably qualified members to apply for registration as Chartered Engineers. This application has been one of the major policies of Council in recent years and the successful outcome is a very satisfying achievement. The standing of the profession of acoustics will be improved and this will give engineering based graduates in acoustics the same opportunities for career development as they could expect in the more classical engineering disciplines. There is, however, still much to be done and the next stage will be for the Institute's Engineering Division to ratify the requirements and procedures to allow members to apply for Chartered Engineer status.

The Meetings programme has not been as full this year as in the previous year and this has led to a reduction in revenue. There continue to be difficulties in attracting as many delegates as we would like and members are urged to support their Institute by attending its scientific meetings whenever possible.

The 1987 Spring Conference was held at the Management Centre, Portsmouth Polytechnic. The convenience of having the accommodation, seminar rooms and lecture theatre all under the same roof made for a very relaxed and successful conference. The proceedings featured very well-supported technical sessions and introduced special sessions for contributions by students. This latter venture was most successful and it is something that it is hoped to extend over the next few years. The Hydro Hotel at Windermere was again the venue for two November conferences, the third in the Reproduced Sound series and the Autumn Conference which dealt with Industrial Noise. As usual these conferences were well supported, thoroughly enjoyable and are a credit to those responsible for the organization.

In terms of its overall Membership, the Institute has continued to grow and details are given in Table 1. However, as Tables 2 and 3 show, there has in general terms been a small decrease in individual membership of Groups and Branches although in the case of the latter the formation of the London Branch has radically realigned the distribution. It is possible that the apparent discrepancy is due to members failing to take up the option of joining or renewing membership of at least one Group and one Branch when they complete their annual return. Overall it is clear from reports in *Acoustics Bulletin* and elsewhere that interest in Group and Branch activities is increasing, and that it is vitally important that all Groups and Branches have a well planned and publicized programme. To this end Group and Branch Secretaries have been encouraged to use the *Bulletin* to both advertise and report meetings and events.

As in previous years both the Speech Group and Underwater Acoustics Group have been active on the

Table 1. Details of Institute Membership

Grade	1986	1987	*Applications in* 1987	*Successful applications in* 1987
Fellow	211	200	11	8
Member	761	779	67	46
Associate	406	437	97	97
Student	39	37	7	7
Total	1417	1453	182	158
Hon. Fellows	14	15	—	—
Sponsors	13	15	—	—

Table 2. Group Membership

Group	1985	1986	1987
Underwater Acoustics	128	123	105
Industrial Noise	537	551	445
Speech	95	102	95
Musical Acoustics	81	94	86
Building Acoustics	331	336	318
Physical Acoustics	68	61	69

Table 3. Branch Membership

Branch	1985	1986	1987
North East	44	42	41
Southern	391	391	174
South West	71	72	62
North West	112	123	103
Yorkshire & Humberside	48	48	37
Hong Kong	74	67	64
East Midlands	99	102	68
Scottish	58	63	53
London	—	—	223

international scene. The UAG hosted two international conferences, both of which were well attended, with many delegates from overseas. In addition to a full programme of meetings the Speech Group have held discussions with their European counterparts with a view to forming a European Speech Commmunication Association. They have in addition launched a Group newsletter entitled *Speakeasy* which they plan to publish bi-monthly.

The Physical Acoustics group held its first AGM and accepted the constitution prepared in conjunction with the Institute of Physics. Attendance at PAG meetings by IOA members is increasing and we now have two representatives on the committee.

The Musical Acoustics Group made a significant contribution to the programme at the Spring conference at Portsmouth and plan to divert from their normal three-year cycle by organizing a session at the next Spring conference at Cambridge. They are also considering the possibility of relaunching a newsletter. On the other hand there was little co-ordinated activity from the Building Acoustics Group although individual members continue to play significant roles in Institute activities. The conference planned for the autumn of '88 may provide an opportunity to renew interest in the BAG.

The new committee of the Industrial Noise Group excelled in their first event when they organized the technical programme for the 1987 Autumn Conference. It is expected that the ING will follow up that meeting by organizing specific meetings on BS 4142 and the HSE code of practice.

Activities in Branches have been quite varied. The Southern, North West and East Midlands Branches have each continued their normal programme format of lectures and visits, most of which have been relatively well attended. The Scottish experiment of limiting activities to two half-day meetings per year is working well but with variable attendances reported. The embryo London Branch has embarked on an ambitious programme of both evening and full day meetings which is proving popular. The Scottish and London Branches plan meetings in 1988 which will form part of the Institute's formal meetings programme.

Other branches appear to be in some difficulties however. The North East Branch membership is suffering from the effects of the recession in local industry. Fortunately, despite a reduction in membership, the enthusiasts in the Branch have adopted a strategy of encouraging joint meetings with other local professional Institutions and the programme for the immediate future should prove attractive to established and potential members. Both the Yorkshire and Humberside Branch and the Hong Kong Branch have been dormant throughout the year, however both report that meetings are planned for 1988. Unfortunately an international seminar, planned as a contribution to the European Year of the Environment and organized in part by the South West Branch, had to be cancelled because of lack of support. This has been a recurring problem with the South West Branch and there does not appear to be an immediate solution.

The physical difficulty of travelling over relatively long distances to attend meetings continues to be the cause of many of the problems facing Branches and the most successful appear to be those with a concentrated catchment area. A suggestion to form an Eastern Branch was therefore resisted until it became obvious that there could be sufficient members living around the Colchester area to form a viable nucleus.

The student societies at the Universities of Salford and Southampton continue to flourish and close ties are being maintained with the local Branches.

Most Groups and Branches have programmes planned to the end of 1988 and beyond and it is hoped that the membership will respond positively to the considerable efforts made on their behalf by the various committees.

Of the various Officers of Council, Mr M S Ankers, Mr G Kerry, Dr G M Jackson and Mr R C Hill were all due to retire at the AGM but being eligible for re-election will continue in the same posts. Professor J A Powell and Professor J B Large retired as ordinary members and Dr B E Richardson and Mr S C Bennett were elected to replace them and are warmly welcomed to Council.

The Secretariat seem to have been busier than ever this last year. Council are greatly indebted to Cathy Mackenzie and all her staff for the huge effort that they put in on behalf of the Institute. One sad item has to be recorded: Heather Flinn who very capably took over much of the organization of Meetings has left to join the RAF. We are sorry to see her leave but wish her every success in her new career.

STANDING COMMITTEES

The operation of the Institute is guided by Council through the following Standing Committees: Membership, Meetings, Publications, Education, and Medals and Awards. There is also a Finance Committee, the Committee of the Engineering Division and the Institute's involvement in the Noise Council.

Membership Committee

During 1987 there were a total of 78 applications for the corporate grades of Fellow and Member, and a total of 54 of these were successful. The figure for acceptance to the grade of Member was substantially less than during 1986, but even so the number of Members increased by 18 during the year. Although there were 8 new Fellows elected in 1987, the total number of Fellows decreased by 11. Presumably some Fellows have not continued their membership after retirement, even though half-rate subscriptions are available to retired members. In spite of the decrease in the number of Fellows, it is pleasing that the total number of Corporate members continues to rise. When combined with the noncorporate grades, the Institute's membership at the end of the year had increased by 36, to 1453 (excluding Honorary Fellows and Sponsors). The details are shown in Table 1.

Tables 2 and 3 show Group and Branch membership respectively. It can be seen that the total number of Group memberships is only just over 1100, and for Branches the figure is not much more than 800. As some members belong to more than one Group or

Branch, there is obviously a substantial proportion who choose not to belong to either. It is worth reminding members that they can belong to one Group and to one Branch without payment of further subscription. It seems likely that the low figures and large annual fluctuation of Group and Branch membership is merely a result of inadvertent failure of members to mark the Group or Branch codes on the paper that accompanies their subscription renewal. For example, the Industrial Noise Group had 537 members in 1985, followed by an increase to 551 in 1986, but in 1987 the figure was only 445. Similar fluctuations have occurred for most other Groups. In the Branch figures the most striking feature is a substantial drop in membership of the Southern and East Midlands Branches, mostly transferring to the newly-formed London Branch.

Publications Committee

The Committee membership has undergone some changes. Dr Delany has resigned as he is entering pastures new. The Committee, and indeed the Council, are grateful to him for his efforts and support and wish him well in his new career within the Church of England. Three new members were welcomed and have already proved their worth: Dr Ian Hempstock of Salford University, Dr Bernard Richardson of University College, Cardiff and Dr John Roberts of South Bank Polytechnic. The Committee has been considerably strengthened by their presence.

During 1987 the Institute was fortunate in obtaining for *Acoustics Bulletin* the services of Mrs Marjorie Winterbottom as executive editor and Dr Paul Nelson as associate technical editor. Mrs Winterbottom is very experienced in the preparation of technical journals for printing, the major part of the work involved in producing the *Bulletin,* and Dr Nelson is an acknowledged expert in the field of transport acoustics with many contacts with acousticians worldwide. Together with the existing associate editors, Mr John Sargent (New Products), Dr Tony Pretlove (Book Reviews) and Dr R W B Stephens, the *Bulletin* is in competent hands.

Having solved the immediate problem of editing the *Bulletin* the Committee tackled the task of changing the printer to Newnorth-Burt of Bedford who are a modern progressive firm who will enable the committee gradually to improve the presentation and style of the *Bulletin* using the most modern printing techniques. This will be a very gradual process and few readers will have noticed that the October 1987 issue was produced by the new printer. A close examination will, however, reveal an improvement in print clarity and in the reproduction of half tone pictures. The balance of content of the *Bulletin* has also been given considerable attention by the Committee and it is intended to increase the number of technical articles in relation to 'house' and other general content.

Other topics discussed during the year have included the format of the Institute *Proceedings.* Dr Roy Lawrence has continued to put in a great deal of work on this publication and the discussions have been directed towards finding ways of reducing the effort required whilst retaining the usefulness and status of the Proceedings as an adequate vehicle to promote the importance of the Institute in the international acoustics world. This year has seen the first edition of another publication masterminded by Roy Lawrence which has brought great credit to the Institute. *Acoustics Index* is a loose leaf production providing those working in acoustics and related subjects with a comprehensive reference book on materials, techniques and application theory. It will be updated regularly.

The Committee would like to thank Mr Sydney Jary who has continued to handle advertising on behalf of the Institute in his usual efficient and competent way.

Meetings Committee

The year has been somewhat disappointing in terms of the number of meetings held, the attendance at them and the income derived from them. It also proved necessary to reschedule or cancel several meetings, resulting in a reduced programme. Nevertheless, there was nothing wrong with the quality of the remainder, and overall there was very little criticism of topic or content. The happier consequence of procrastination is that we now have a healthy 'backlog' of subject matter upon which to draw for 1988 and beyond.

The Spring Meeting, held at Portsmouth, was doubly notable. It was the first time that this main Institute meeting had been held at a Polytechnic since 1976 (Liverpool) and it demonstrated that Universities do not have the monopoly on facilities, accommodation and catering. Indeed, the Business Centre proved to be an almost ideal venue for a conference of 110 delegates. It would be most pleasing, however, if more than a mere ten per cent of our corporate membership could manage to attend the Spring Meeting, even for just the AGM and Annual Dinner. An innovation was the students' session which proved to be so successful that the Committee had no hesitation in suggesting a similar provision at Cambridge in 1988.

Special mention must again be made of the two Windermere conferences organized by Dr Roy Lawrence. Ever striving to extend the sphere of influence of the Institute, the third conference on Reproduced Sound attracted not only our new and old friends from the recognized fields of audio recording and reproduction, but also a large and participating contingent from television. The Autumn Conference proper was organized by the Industrial Noise Group, and again produced new dimensions of breadth and depth of presentation, with workshop formats proving to be popular for topics under current development. After nine meetings at this venue, it might be thought that delegates and organizers alike would be jaded, but it seems clear that the particular (not to say peculiar) advantages of the location have generated a continuing demand for more.

It is generally appreciated that the organization of even the most simple of one-day meetings involves a considerable amount of very hard work by the programme organizer, the local organizer, their respective committees, the Meetings Committee, the Secretary and staff at Edinburgh, the typesetter and

INSTITUTE MEETINGS, 1987

February	Noise in mechanical services	London	58
April	Sonar transducers – past, present and future	Birmingham	110
April	Acoustics '87	Portsmouth	110
May	Applications for speech technology	London	33
May	Developments in instrumentation and computation	London	32
September	Outdoor sound propagation	London	34
November	Reproduced sound 3	Windermere	110
November	Autumn Conference	Windermere	120
December	Underwater communications and position fixing	Norwich	90
December	Vibration isolation of heavy structures	London	63

printer, the handbook collator and the 'envelope stuffers' employed on a casual basis at head office. It is to their credit that our meetings programme remains healthy and that the remainder of the membership are able to attend as delegates, seeing only the serene swan and not the frantic paddling beneath the surface. Our thanks must go to all those who contribute so much to the success of our meetings.

A list of meetings is shown above, with the numbers of participants.

Education Committee

The conduct of the Institute's Diploma in Acoustics and Noise Control was again the Committee's main concern. It is pleasing to note that the number of candidates taking the Diploma examinations again showed an increase over the previous year which means that the expected fall-off in numbers has not yet materialized.

The Distance Learning arrangement using tutored video instruction has commenced with four students presently registered with North East Surrey College of Technology.

The Committee initiated a number of steps to publicize the existence of the Diploma and it is hoped that this investment will pay a dividend in the form of increased recruitment during the years ahead.

Medals and Awards Committee

In 1987 the Rayleigh Medal was awarded to Professor Manfred R Schroeder of the University of Göttingen at the Spring Conference in Portsmouth and at the same meeting the R W B Stephens Lecture was given by Professor Sliwinski of the University of Gdansk. The A B Wood medal was presented to David Chapman of the Defence Research Establishment Atlantic, Dartmouth, Nova Scotia at the December conference organized by the Underwater Acoustics Group. All the presentations were enjoyed by large and enthusiastic audiences. This year also saw the first award of the Simon Alport Memorial Prize. Mr Julian Wright of Celestian Instruments Ltd will receive the 1987 prize for a paper entitled 'No Room for Loudspeakers'.

Noise Council

The main event of the Noise Council's second year of operation was a one-day meeting held in June 1987 on 'Occupational Noise – The Way Ahead'. The Noise Council is grateful for the support of the Institution of Occupational Safety and Health which bore the major administrative load in organizing the meeting. Papers were read which gave the technical background and presented legislative, employer and Trade Union views of the problem.

In addition to this public event, working groups have been established by the Noise Council to present views in several major areas of noise problems. The working groups will report in due course and it is anticipated that published documents will result.

On the financial side, there was a surplus from the Occupational Noise meeting and an appeal to local authorities has resulted in a large number of small donations, which together produce a significant total. The Noise Council has also been awarded a small priming grant from the Department of the Environment which is an encouraging indication of acceptance of the potential value of our work.

REGIONAL BRANCHES

The Branches of the Institute of Acoustics have been established to further the technical and social activities of the Institute at a more local level. The liaison between the Branches and the Meetings Committee is particularly important in extending the technical meetings programme of the Institute.

North East Branch

The Branch is currently experiencing probably the most difficult period of its existence. Many of the major industrial groups in the Northern Region have suffered the full impact of the recession and for a variety of reasons have cut back on their activities in industrial and applied acoustics with staff being made redundant or deployed to different areas of activity. Consequently the active Branch membership has dwindled significantly, although happily we still have a core of enthusiasts determined to ride out the storm.

The strategy adopted in facing the current difficulties has been to encourage joint meetings/functions with other professional institutions, such as the IEEE, IERE, IEHO, IMechE, etc., in subject areas of mutual interest. These have included, in addition to a number of social gatherings, consideration of problems associated with sound transmission in dwellings, visits to radio and TV studios, noise control at mineral extraction sites, digital sound synthesis. The Branch Committee have prepared a programme for the

immediate future which we hope will not only reflect the interests of our current membership (including vibration aspects of condition monitoring, speech synthesis and a visit to a refurbished theatre etc.) but will also attract new members to participate in and contribute to the Branch activities.

North West Branch

In comparison with 1986 the year has been one of reduced activity, at least in part due to the members of the Branch Committee each having increased business or personal commitments and resulting in the arrangement of fewer events. Those meetings which were held, however, retained the high quality of speaker or venue to which the Branch has become accustomed. A total of 79 members and guests attended four meetings during the year, and there were four Committee meetings in addition.

East Midlands Branch

The activities of the East Midlands Branch for 1987 were confined to the autumn when two technical visits and one evening meeting were arranged. In September members and guests visited BBC Radio Nottingham. A conducted tour of this typical local radio station took in the newsroom and studios and included a description of the news gathering facilities and outside broadcast vehicle. While enjoying some unexpected refreshments, the group listened attentively to the BBC's senior acoustician describing the sound insulation methods employed in the conversion of the building to enable broadcasting to take place.

In October the party moved to the Ratcliffe-on-Soar coal-fired power station in Nottinghamshire. Prior to a comprehensive tour of the station the visitors were shown a video about the operation of a typical coal-fired power station generating electricity. Ratcliffe itself burns some 20,000 tonnes of coal every 24 hours at full load, all delivered by rail from a number of collieries in the Nottinghamshire coalfield. The station was first commissioned in 1967 and soon established itself as one of the most efficient in the country. It was the first power station in Britain to generate 10,000 million kilowatt hours of electricity per annum and has subsequently achieved 15,000. Regrettably the visit which proved to be most interesting was very poorly attended. The bad weather and an open day a few weeks before the visit may have contributed to the poor turnout.

The year was rounded off with a talk at Loughborough University by Dr John Walker of ISVR on the subject of Railway Noise. The presentation briefly recalled the various studies that have been carried out in the past 20 years on the effects of railway noise on communities and highlighted the various noise criteria that apply at both local and national level in various countries. Comparisons were made between the levels of response attributed to railway noise and other transportation noise sources. It is now recognized that for the same degree of noise exposure railway noise provokes lower levels of response than either aircraft or road traffic noise. John Walker's suggested criterion for a 'fair' railway noise environment was 65–70 LAeq (24-hour) with the possibility of special night time criteria of 55 LAeq and 80 LAmax.

It was most encouraging to find individuals attending this evening meeting from as far afield as London and West Yorkshire. Unfortunately it soon became apparent that of the 18 people present only one individual other than Committee Members was affiliated to the East Midlands branch. The proposed AGM was therefore hastily abandoned and the existing Committee had no alternative but to retire to the University bar to formulate a programme of activities for 1988.

Scottish Branch

In accordance with the policy decision approved by the Scottish Branch at its AGM in January, two events were held in 1987. The first was a meeting on 'the Wilson Report – twenty years on' which preceded the AGM at Heriot-Watt University and the second a visit in November to the Department of Otolaryngology, Edinburgh Royal Infirmary. It was a matter of some regret that the limited programme did not attract larger attendances although the attendance in January was a healthy 22. The Branch Committee believe that the interest and enthusiasm shown by the members who attend the meetings make their efforts worthwhile and it must be remembered that there are only 53 members in Scotland.

The plans for 1988 include a visit to the new acoustic facilities in the Department of Building, Heriot-Watt University, Riccarton Campus in February, after which the AGM will be held. Later in the year it is hoped to arrange meetings on musical acoustics and sound insulation in buildings. No doubt many Scottish Branch members will also attend and contribute to the meeting on 27 April jointly organized by the Institute and Edinburgh District Council entitled 'Audibility as an assessment of noise nuisance'.

In summary, the Committee believes the Scottish Branch made reasonable progress in 1987 and look forward to continued and increasing support from Scottish members in 1988.

Yorkshire and Humberside Branch

The Yorkshire and Humberside Branch has been largely inactive during 1987 as they have been unable to find someone with the time and energy to take the lead in organizing Branch activities. A joint meeting with the British Occupational Hygiene Society has been planned for early in 1988 and it is hoped that at the Branch AGM that will follow some volunteers will be found to get things moving again.

Southern Branch

Once again it is a pleasure to report another successful year with a full and varied programme of meetings. The year started with what was possibly a record attendance to hear Dr R Small of KEF Loudspeakers summarize, with the aid of some state-of-the-art equipment, what modern loudspeakers are capable of. Our first joint meeting of the year was with RIBA

when Roy Alphey gave a detailed and very well received account of BRE's work on lightweight high-performance partitions in buildings converted into separate dwellings. In February, Geoff Jackson and T F Murphy of Atkins Research addressed a most attentive joint meeting with the Institute of Environmental Health on environmental impact assessment.

Two rather more specialist meetings then brought us up to the summer break. Alan Martin gave an excellent account of the investigation and treatment of hearing disorders which was all the more appreciated for his making it of considerable interest to the non-medical audience members. Chris Rice's excellent presentation to the May meeting of his fascinating work on subjective reactions to mixed noises also generated a great deal of interest, again to a largely non-specialist audience.

The winter session opened with a colourful and profusely illustrated lecture by Dr G Borello of CNES, France, on noise and vibration problems with the Ariane launch vehicle programme. That meeting was held jointly with the Southampton Branch of the Royal Aeronautical Society. November's meeting, also a joint one this time with ISVR, was treated in every sense of the word to Professor C A Taylor's first class demonstrations in aural perception. More demonstrations followed in December when Chris Lawn of CEGB Marchwood brought his musical flame along to illustrate his excellent analysis of the mechanisms of boiler combustion resonances.

Throughout the year audiences have varied in number from the largest at 66 for one lecture in particular, to anywhere between a dozen or so and 30 for the rest. They have certainly not varied, though, in their interest and response to the subject matter in hand. For this, all our speakers are to be warmly congratulated and the Southern Branch is grateful indeed for their efforts.

Another highlight of the year has been the visit of the Spring Meeting to Portsmouth Polytechnic. Its success has already been reported elsewhere but the efforts of the Portsmouth-based members whose enthusiastic work contributed so much to that success are acknowledged and appreciated.

One sad note this year: the Committee is losing Geoff Charnley, Phil Nelson and Martin George, all of whom have given sterling service in organizing our activities over past years. Geoff in particular, as many will know, has been Branch Treasurer for more years than he can remember exactly, and we are especially grateful for his stewardship over all that time.

London Branch

London evening Meetings are back! The London Branch formally came into being at an inaugural meeting on 21 October with a membership of 223 of whom between 20 and 30 regularly give support to the monthly meetings held at County Hall. It is the policy of the Committee to widen the technical interest of the LEMs beyond the traditional 'environmental health' issues to give members a flavour of the wider interests covered by the Institute.

The first meeting after the long break brought about by the abolition of the GLC was addressed by Jeff Charles who spoke about 'Aural craftsmanship'. Jeff was instrumental, with Rob Hill, in organizing the first LEMs back in 1977 when the inaugural topic was 'Should night flights be banned or restricted?' – times don't seem to change much! Other speakers dealt with the design of brass musical instruments, the Pyestock noise test facility, railway noise, applications of sound intensity measurements, computer based acquisition systems, theoretical noise generation models and the work of the NSCA noise committee.

Full day and half-day meetings are planned for 1988 and the current series of LEMs will run until June. The new series starts in September and will continue to cater for the widest range of interests.

Hong Kong Branch

Numerically this Branch remains strong but little is reported of their activities. What communication there has been indicates that, like many of the UK Branches, the business commitments of the Branch officers can have a serious impact on the organization of Branch activity. It is hoped that these difficulties will be overcome and an active Branch will emerge again.

SPECIALIST GROUPS

The Institute as a whole reflects the broad span of the Science of Acoustics and a number of Groups have developed to foster close contacts between members in various specialisms within this multi-disciplinary subject.

Building Acoustics Group

The Building Acoustics Group had a relatively quiet year and did not organize any meetings as a Group. However, various individual members contributed to a session at the Spring Conference in Portsmouth and at the meeting on Mechanical Services Noise.

1988 will be a much more active year with the Autumn Conference at Windermere being organized by the Group.

Industrial Noise Group

The Industrial Noise Group Committee was re-established in March 1987 with a full complement of six people. The principal task during the year was the organization of the Institute's Autumn Conference which was held at Windermere at the end of November. This event was a resounding success where some 130 delegates heard fifty papers of a very high technical standard. The programme also included three invited lectures and two workshop sessions which provided the forum for some vigorous debate on the subjects of Sound Power and the revision of BS 4142.

Four one-day meetings are currently planned for 1988–89 and at the end of that period it is intended to run another Autumn Conference on the subjects of Industrial and Environmental noise.

Group membership is currently around 445. This figure includes the Aerodynamic Noise Group which, although still showing no signs of becoming an active

group once again, will be heavily involved in the Institute's 1988 Spring Conference at Cambridge.

Musical Acoustics Group

The main activity of the year was the Spring Conference in Portsmouth, with seventeen papers in the musical acoustics session on instruments as various as guitars and gemshorns.

In July, members visited the Bentley Piano Factory in Stroud and saw many stages of piano construction, from action assembly to the finishing of the casework – and of course tuning.

Unseasonal weather in October kept some members at home chopping trees, while others enjoyed a visit to Whitechapel Bell Foundry; established in 1570, it takes more than a hurricane to disrupt their routine. An interesting and amusing visit is reported.

The Committee has been discussing the need to co-ordinate research, keep members informed of work in progress, and collaborate on projects. In a field where many workers are pursuing personal and 'unofficial' interests, it is a perennial problem which the Group secretary notes in the hope that putting it in writing will force her to do something about it.

Physical Acoustics Group

During the year the Physical Acoustics Group, which is a joint group of both the Institute of Acoustics and the Institute of Physics, held four meetings with attendances between about 30 and 40 delegates. These meetings were Acoustic Microscopy and its Applications (London); Physics and Applications of Acoustics Wave Devices (London, joint meeting with IEE); Ultrasonic Studies of Bone (Hull) and Progress in Physical Acoustics and Ultrasonics (Surrey).

The draft constitution was at last presented to the membership of the Group at the AGM held at the University of Surrey. This constitution was approved by the membership and a Committee was formally elected to office.

Speech Group

1987 was an active year for the Speech Group with a number of national and international technical meeting taking place as well as the launch, towards the end of the year, of the Speech Group's own newsletter – SPEAKEASY. It is hoped that this bi-monthly publication will provide a useful and informal vehicle for airing news-and-views within the UK speech research community. Two issues were produced in 1987 and the third issue appeared in February 1988.

The technical meetings for 1987 started with an afternoon conference at University College London on 'Disorders of Speech Perception' organized by Mr Stuart Rosen. In May there was a one-day Institute meeting on 'Speech Technology Applications' in London, and in June the Group organized a joint meeting with the Groupe Communication Parlée of the Société Française d'Acoustique in Lannion, France.

September heralded the first European Conference on Speech Technology which took place in Edinburgh; the Institute was a co-sponsor of the event. Finally, in December, Steve Beet of the Speech Research Unit organized a two-day meeting and workshop on Auditory Modelling at the Royal Signals and Radar Establishment.

1987 also saw the beginning of discussions between the Speech Group and its European counterparts aimed at considering the establishment of a European Speech Communication Association (ESCA). A working party headed by Renne Carre from ICP-Grenoble has been tasked by the Speech Group and the French Groupe Communication Parlée to investigate the issue.

The Speech Group has also initiated a survey of UK speech research workers and laboratories. When published this document will provide a useful reference to the interests and activities of the whole community.

The Speech Technology Assessment Group (STAG) steering committee held two meetings in 1987, the main business being concerned with progress of the Alvey Speech Technology Assessment (STA) project and the ESPRIT Speech Assessment Methodology (SAM) project. Mike Taylor from NPL is the current STAG chairman and the committee membership (now ratified annually at the Speech Group AGM) has expanded to include CSTR, STC/ICL and Cambridge University.

The programme of Speech Group technical meetings for 1988 is expected to include Prosody, 11 March, at Cambridge; 2nd Anglo-French meeting, 4-6 July, at Sussex University; 7th FASE Symposium (SPEECH-88) 22-26 August, in Edinburgh; and Linguistic and Phonetic Knowledge Representation, December, at Essex University.

Underwater Acoustics Group

The main activity of the Underwater Acoustics Group continues to be the organization of technical meetings for the underwater acoustics community. During 1987 two more meetings were held: a two-day international conference on 'Sonar Transducers – Past, Present and Future', at Birmingham in April and a two-day international conference on 'Underwater Communication and Position Fixing', at the University of East Anglia in December. Both meetings were well attended with a good international representation.

Sales of the Proceedings of past meetings of the Group have continued well throughout the year. The Group has stocks of all 22 Proceedings of its meetings, the earliest of which dates back to the first conference of the Group, 'Acoustic Surveying of Fish Populations', held in 1975. During 1987 sales of these past Proceedings totalled 167 copies and they included at least one copy from each of the 22 meetings. It was encouraging to note that more than 30% of these sales were from abroad.

The A B Wood Memorial Lecture, 'Surface-Generated Noise in Shallow Water: a Model', was given by Dr David Chapman of the Defence Research Establishment Atlantic, Dartmouth, Canada, at the December conference and he was also presented with the associated Medal by the Institute's President.

NEW ELECTIONS

The following elections to corporate and non-corporate Membership of the IOA have recently been approved by Council.

Member

S Allan
P R Blewden
H F Chan
S M M Cheung
R A Cox
S Dart
I H Flindell
R M Hamson
E Hill (Bylaw 17)
A W James
K M Li
J Longman
M C Lower
E J Mangan
S Miller
H R Nowell
H J Rushby-Smith (Bylaw 17)
A K Sharif
S M Sheridan
J G Staunton
K A Wade
J R Wright

Associate

G Adamson (D)
P M Anakwue
G R Anderson (D)
J M Anderson (D)
M A Baker
N A Beardsley (D)
C D Beer (D)
H M Bellinger (D)
J L Boyle (D)
C A Brown
M J Brown (D)
G Butler (D)
R Carroll (D)
G F Carter (D)
A J Crighton (D)
D Cudmore (D)
B W Dale (D)
T J Deveaux (D)
J M Dimberline (D)
P Doughty (D)
N J Felgate
J M Fletcher (D)
B B Fulford (D)
K M Gentles
K W C Gong (D)
V E Harrison (D)
B G S Heywood (D)
J C Hope (D)
S M Hutchins
P I Insley
J E Kaczmarkyk (D)
E W Kelley (D)
S Lockwood (D)
P R J Mansfield
R Martin
T A Mawdwsley (D)
G J Middleton (D)
G J McCann
I J McKechnie
D Patterson (D)
J M Plumb (D)
A Prosser (D)
M C Rayns
I Robertson (D)
P M Robertson (D)
M A Rowell
I J Sams (D)
M J Saxon
M J Scott (D)
C R Sharp (D)
L G Shepherd (D)
A L Silverman (D)
K L Soon
E G Staley (D)
J M Staniforth (D)
S Stenson
P Sunderland (D)
E R Thekiso
D P Tilleray (D)
A J Turnbull
K A Wallace (D)
B J White (D)
H J Williams (D)
S J Wilson (D)
A N Woodger
D Wright
M B Yeodon (D)

Student

M F Furtak
A R Raymond
J D Tate
G D Wills

INSTITUTE OF ACOUSTICS COUNCIL 1988-89

President
Mr C G Rice, FIOA

President Elect
Mr M S Ankers, MIOA

Immediate Past President
Prof. H O Berktay, FIOA

Vice-Presidents
Dr W A Ainsworth, FIOA
Mr G Kerry, FIOA
Prof. P Lord, FIOA

Honorary Treasurer
Dr G M Jackson, MIOA

Honorary Secretary
Mr R C Hill, FIOA

Ordinary Members
Mr S C Bennett, MIOA
Mr B F Berry, MIOA
Dr R C Chivers, FIOA
Dr T I Hempstock, FIOA
Dr D C Hothersall, FIOA
Mr R B Mitson, FIOA
Dr B E Richardson, MIOA
Dr J P Roberts, MIOA
Mr B V Smith, FIOA

DIPLOMA IN ACOUSTICS AND NOISE CONTROL

Institute of Acoustics Prize

This Institute of Acoustics prize for the highest achievement in the (1987) Examinations was recently presented to Andrew Weaver, an Environmental Health Officer with the London Borough of Havering. Andrew studied for the Diploma at the Colchester Institute and the presentation by Mr R Hill (Hon. Secretary of the Institute of Acoustics) took place during the Annual Awards Ceremony of the School of Manufacturing and Systems Engineering.

At the same ceremony, the Salex Trophy, for the best Colchester Diploma Course performance, was presented to Karen Cattle, an E H O with the St Edmundsbury Borough Council.

Mr R Selwyn, Lucas CEL Ltd, presented their prize for the best project to Simon Ferenczi, a Noise Control Engineer with Fleet Engineering Ltd, Maldon, Essex. Simon produced a very interesting piece of work on the transmission of noise through anti-vibration mountings.

The Colchester centre has consistently achieved very high national results. It also offers a range of courses in Acoustic, Noise and Vibration Control, to meet industrial as well as environmental needs, with various modes of study including short courses.

D G Bull

Diploma Project Prizes

The Association of Noise Consultants has awarded prizes for the best Institute of Acoustics Diploma Project to the following:
1986 Project Prize: Mr M Sawyer, Tottenham College.
1987 Project Prize: Mr S Ferenczi, Colchester Institute.

Conference Organizers

Please remember to send Abstracts of your Conference to the *Bulletin* Editor for publication, at the earliest possible date. (Send to: 14 Witney Road, Long Hanborough, Oxon OX7 2BJ.)

Technical Articles

The editorial board would welcome offers of technical articles on Acoustics and related subjects likely to be of general interest. Please contact the Editor, John Tyler, at Pooh Corner, Chalkhouse Green, Reading RG4 9AG.

COURSES

CEL Instruments Courses 1988

The following one and two day seminars are offered by CEL Instruments for 1988. These continue the previous courses with updating to take account of recent changes in the relevant legislation, etc., where appropriate.

All courses place great emphasis on the two-way interchange of ideas in the free discussion sessions. Extensive practical periods are built into the courses and course notes will be available to the delegates at the start of each session.

A Certificate of Attendance will be issued to those attending the seminars.

Course title	Dates	Cost (inc. VAT)
Industrial noise	7/8 September 23/24 November*	£150 or £85 per day
Digital signal processing	5/6 October	£240
Vibration condition monitoring	2/3 November	£240
Building acoustics	23 September	£30
Sound power	21 October	£30
Environmental noise	11 November	£30

All courses will be held in the CEL conference centre in Hitchin, Herts., except that marked* which will be held at the Manchester/Cresta Court Hotel, Altrincham.

For further information contact: Mrs Caron Sparks, Sales & Marketing Administrator, Lucas CEL Instruments Ltd., 35/37 Bury Mead Road, Hitchin, Herts. SG5 1RT. Tel: 0462 422411.

ISVR Short Courses 1988/9

1988

12-16 September	Industrial Audiology and Hearing Conservation
13-15 September	Introduction to Mechanical Vibration Measurement Techniques
19-23 September	Advanced Course in Noise and Vibration*
19-23 September	Technical Audiology
26-28 September	The Practice of Industrial Sound Intensity Measurements
27-29 September	Engine Noise and Vibration Control

1989

20-22 March	Vibration Measurement using Laser Technology
20-22 March	Active Noise Control
4-6 April	Image Processing
4-7 April	Digital Audio Signal Processing
11-13 April	Adaptive Signal Processing
11-13 April	Engine Noise and Vibration Control
17-21 April	Clinical Audiology
18-20 April	Condition Monitoring

International Conference – FASIG 1989
(Fringe Analysis Special Interest Group)
3-6 April 1989

*This course is divided into two distinct parts dealing with vibration and structural topics and with acoustical topics.

The course is aimed at researchers and development engineers in industry and research establishments, and people in other spheres who are associated with noise and vibration problems. Registrants should be of degree standard or equivalent, and should have a basic knowledge of acoustics and vibration. The lecturers are from or are closely associated with, ISVR. All are specialists in the field.

Further information regarding the above courses may be obtained from: ISVR Conference Secretary, Institute of Sound and Vibration Research, The University, Southampton SO9 5NH. Tel: 0703 559122 ext. 2310. Telex 47661 SOTONU.

Part-time MSc Course in Noise and Vibration at Cranfield

Cranfield Institute of Technology have recently announced that their existing one-year MSc course on Noise and Vibration has been modified to enable a part-time, in-company option to be offered.

The course will be directed at graduates who wish to gain an MSc degree whilst remaining at work. Attendance at Cranfield is limited to 30 days per year over two years, and various forms of financial support are available.

A technique orientated syllabus and in-company project will ensure that this form of accelerated training will be of direct relevance to industry's needs.

A brochure and information pack detailing the course are available from Mr M A Tomlinson or Dr R H Bannister, School of Mechanical Engineering, Cranfield Institute of Technology, Cranfield, Bedford MK43 0AL. Tel: (0234) 750111 Ext. 2287 or 2286.

Hakuto International Courses Sound and Vibration Techniques Using Digital Signal Analysis

A new range of training courses designed to give the novice and the qualified engineer further insight to the latest techniques of digital analysis are to be held by Hakuto.

Two courses are available:

Condition Monitoring 19th–20th October.

Digital Signal Analysis 16th–17th November

As delegates will all be using equipment the numbers are strictly limited and will be dealt with on a first come, first served basis.

For further details please contact: D Coffey, Hakuto International (UK) Ltd., 33-35 Eleanor Cross Road, Waltham Cross, Herts. EN8 7LF. Tel: 0992 769090.

CEI-Europe/Elsevier Courses on Signal Processing and Communication

Discrete-Time Signal Processing, Filtering and Estimation

Digital Image Processing: Analysis, Coding, VLSI Implementations

Data Transmission: Theory and Practice

Modern Digital Modulation Techniques

For further information on these and other courses please contact: Elsevier Seminars, Penny Moon (Ms), Mayfield House, 256 Banbury Road, Oxford OX2 7DH. Tel: (865) 512242.

New Products

Submissions for inclusion in this section should be sent direct to J W Sargent, Building Research Establishment, Garston, Watford WD2 7JR.

CRL 2.39B hand held real time analyser

The CRL 2.39B can store up to 16,000 separate octave spectra in its internal memory. It operates in real time with all 10 octaves plus the Sound Level channel being measured in parallel.

Three different acquisition rates are supported, corresponding to Impulse, Fast and Slow responses which allows the CRL 2.39B to record such transient data as reverberation time as well as simple environmental spectra. Data taken at these speeds can be replayed on the internal matrix display of the unit in true time or speeded up to show noise trends.

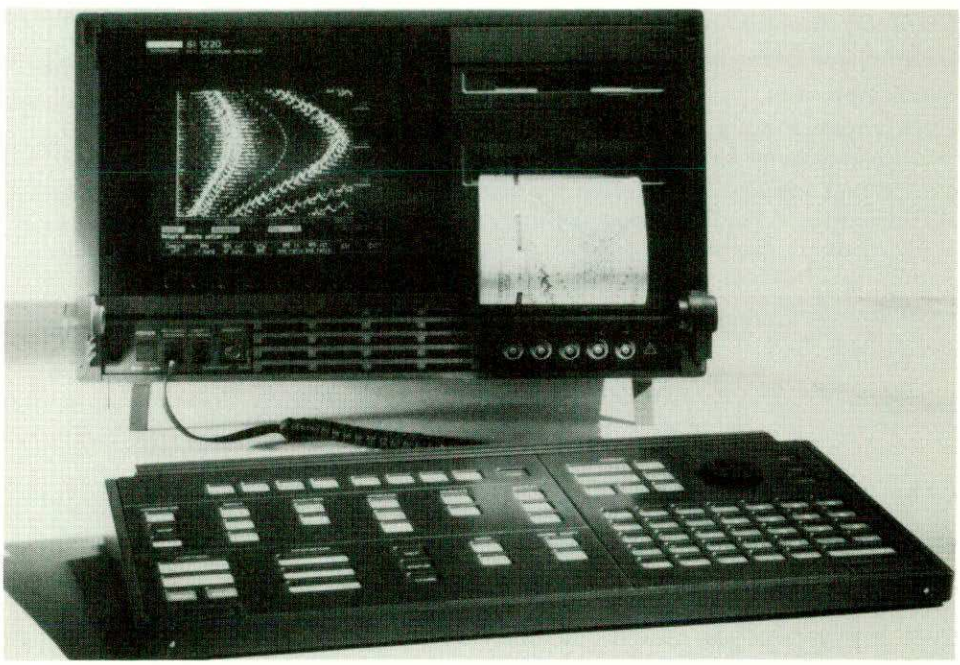
Auto-ranging and auto-calibration are fitted and the internal memory follows all changes of range, speed and function. All these are faithfully recorded for replay.

The memory contents can be copied to a desktop computer for analysis. Nearly any acoustic index can then be calculated with Cirrus software or by other specialist packages written for the device.

Further information from Cirrus Research Limited, Acoustic House, Bridlington Road, Hunmanby, North Yorkshire YO14 0PH. Tel: 0723 891655.

Schlumberger 1220 FFT spectrum analyser

Schlumberger's new spectrum analyser is available as a two-channel instrument which is enhanced to four channels by the simple insertion of an extra input card. The four channel version offers genuine 4 × 4 averaging, that is the ability to simultaneously measure frequency response functions between all channel pairs.



The instrument operates over a frequency range 0 to 50 kHz with up to 1000 lines frequency resolution and powerful realtime zoom. It has been designed to give the user a wide range of facilities for stimulation of systems, capture and analysis of results, and data output in compact easy-to-use package.

The availability of four input channels brings a new level of measurement capability and convenience to a wide range of applications. In structural testing response measurements can be made simultaneously in three planes. In vibration analysis of rotating machinery, orbit plots can be simultaneously obtained and overlaid for two sets of bearings. Input from multiple microphones can be analysed for more accurate location of noise sources. In analysis of loop frequency response, feed forward and feedback paths can be measured simultaneously, with the loop closed using measured data.

The measurement and display facilities are accessed through a system of colour-coded hardkeys supported by an interactive menu system using softkeys whose functions are reproduced on the display.

Standard readings memory is 256K samples but a 1 Megasample transient memory is available as an option. The user can choose from seven analysis modes to provide the spectral information required using realtime or non-destructive zoom, true logarithmic frequency resolution, octave analysis, twin band analysis, and swept sine analysis. Single, dual and quad displays are available and the four results can be viewed with multiple overlays of any two pairs. Results can be waterfalled or displayed in greyscale format. Results can be output via the built-in thermal printer.

One or two floppy disc drives are (retrofittable) options for data storage. Communications interfaces include IEEE 488 and two RS423 ports, and plotter, RGB and composite video outputs are also available.

Further details from Schlumberger Instruments, Victoria Road, Farnborough, Hants. GU14 7PW. Tel: 0252 544433.

PC based ultrasonic system

Cogent Inspection's new ultrasonic system uses a series of plug-in kernel cards which transform a PC into a powerful, digitally based ultrasonic instrument which combines the best of digital and analogue methods. Applications extend from precision measurement to the in-

spection of composites – both non-metallic and metallic, from flaw detection in advanced metal or ceramic components to bond inspection in small electronic devices.

Kernel cards available include two pulser receivers to cover the 20-75 MHz and 1-20 MHz ranges, a gated detector, analogue and digital input/output and fast analogue to digital converters. The units can be provided as kernel cards alone, installed in an Olivetti (IBM compatible) computer or as a complete inspection system. One example of such a system is the Cogent Inspection scanning acoustic microscope for high frequency imaging with a spatial resolution of 7.5 μm. For a comprehensive leaflet of each item please contact: Cogent Inspection, Sunrise Parkway, Linford Wood, Milton Keynes MK14 6LS. Tel: 0908 666033.

CEL 262/2 environmental noise analyser

The CEL 262/2 environmental noise analyser is a development of the CEL 262 which provides simultaneously an ASCII output through the RS232 interface and a hard copy of the data output on a 20 column fast printer. Output from the RS232 interface can be recorded on suitable Data Recorders which can be solid state, tape-based or disc based. Processed environmental noise data which have been recorded in the field can be replayed in the laboratory into speadsheet packages such as Lotus 1-2-3, where extensive report generating facilities exist.

The CEL 194/2 outdoor microphone system connects directly into the CEL 262/2 and the system is suitable for use in low temperatures, and conditions of high humidity. The seven-day battery life of the CEL 262 has not been affected by the enhancements.

Further details from Lucas CEL Instruments Ltd., 35-37 Bury Mead Road, Hitchin, Herts. SG5 1RT. Tel: 0462 422411.

New software takes the guesswork out of sound prediction

A new computer program has been introduced by Dynamic Engineering, international consultants in noise and vibration measurement and analysis.

Sysnoise is a program for predicting sound distribution inside and outside structures, such as vehicles, buildings and fluid-filled vessels. Capable of operation on mainframe, mini or workstation computers, the new software also models the effects of sound-absorbing materials and their ability to dissipate energy from the air or fluid. It uses the finite element method for closed regions and the boundary element method for open regions, where sound radiation to infinity is calculated. Geometry can be one, two or three dimensional.

The program calculates real and complex eigen-modes, modal superposition and direct response to given frequency inputs. Input is by a free-format command language, with interactive graphics and links to standard mesh generators. A major feature is the ability to couple structural models to the acoustic model, to calculate interaction effects correctly.

According to Dynamic Engineering, the software has been tested against known analytical solutions and results have been correlated with test measurements. Applications include acoustic fields inside cars, coaches and railway vehicles, and the effects of vibrating parts of the surrounding structure and sound absorption in seats and linings, tuning of exhaust pipes, sound transmission through water from ships and submarines, noise radiation from highways and acoustic behaviour in rooms and public spaces.

Further information from: Colin McCulloch, General Manager UK, Dynamic Engineering, Bennett House, Pleasley Road, Rotherham S60 4HQ. Tel: (0709) 366376.

BRANCH AND GROUP NEWS

Formation of an Eastern Branch

A group of eight members from across the eastern region met at Bury St. Edmunds on the evening of 24 May to discuss the formation of an Eastern Branch. There was unanimous support for such a venture, with thoughtful optimism that a good base membership would actively support a branch, particularly based on industrial type acoustics from environmental noise through to HVAC interests.

It has been proposed that an inaugural meeting be held on Tuesday 11 October 1988 in Bury St. Edmunds. This meeting would be to formally set up the branch and elect officers, followed by a well known speaker on a topical subject, e.g. New Considerations of Industrial Noise – BS 4142 etc. More details will follow, as will a mailing of information to all members in the region.

David Bull on Colchester 570271 will be pleased to answer any queries.

David Bull

Speech Group

Auditory Modelling – meeting and workshop held at the Speech Research Unit, RSRE Malvern, on 14 and 15 December, 1987

This event took the form of an afternoon meeting followed by a workshop session the next morning, both sessions being well attended. Papers were presented covering many aspects of auditory modelling, with the emphasis on three main areas: perception of speech, implementation of models and automatic speech recognition.

Ray Meddis (Loughborough) started the meeting with a paper on a model of pitch perception using an autocorrelation approach, looking at inter-spike intervals. This model appears to offer good agreement with human perception except at low frequencies, where it is somewhat overenthusiastic in detecting the presence of 'pitch'. Aspects of fundamental frequency identification were raised again, later in the afternoon, with Quentin Summerfield's (MRC IHR) description of his investigation of human perception of two simultaneous talkers. This work concentrated on simultaneous vowels with differing fundamentals, allowing different parts of the spectrum to be allocated to each. This provided a realistic model of human behaviour for this class of stimuli. Aspects of perception were also described by Roy Gardner (Sussex) who considered the effects of phase shifts near the first formant. Comparison of psychoacoustic and physiological data with the output of his auditory model showed that timing information beyond the 'mean firing rate' was necessary to predict the perception of formant frequencies.

The first paper covering implementation issues came from Roy Patterson (MRC APU) who described an efficient and accurate IIR approximation to his 'roex' model of the basilar membrane transfer function. This 'gammatone' filter also has a well-defined phase response and looks like a potential standard, with several groups expressing a keen interest. Ted Evans (Keele) later described his hardware model of the peripheral auditory system and made a convincing case for its accuracy, presenting considerable amounts of physiological evidence. This model also has a great speed advantage over software models, even though DSP-based auditory filter banks are now within the realms of possibility.

The remaining papers were all concerned with speech recognition, with Franz Seitz (Oxford) using feature extraction to achieve high accuracy recognition of place of articulation. His results also showed the superiority of an auditory representation in 'across-talker' experiments. David Deterding (Cambridge), on the other hand, described his attempts to compare Hermansky's perceptually modified LP analysis with Bladon and Lindblom's auditory transform and with Hunt's LP root matching. However, Hermansky's algorithm had not performed as well as expected, providing a rather negative (but none the less significant) result. Finally, Martin Cooke (Sheffield) described his ideas about the application of psychoacoustic grouping concepts to auditory data. His aim was to generate an 'auditory speech sketch' containing information about multiple events and their relationships for input to a higher-level symbolic recognition algorithm. He also described the problems he anticipated in the implementation of such processing (including the definition of the 'auditory speech sketch' itself), but was confident that these could be overcome.

The workshop (chaired by Roy Patterson, who also took an active part in the discussion) centred around implementation questions, including discussion about the degree of accuracy that

Continued on p. 23

Letter from the Vice-President Groups and Branches

I have just spent some time discussing, with our new President, the rôle of Groups and Branches within the Institute. The creation of the Engineering Division and the route to chartered status will lead to renewed interest in the Institute and its activities not only by existing members but also by others who work in the profession of acoustics.

The President has started a membership drive to persuade those people to join and help enrich the life of the Institute and further the profession. I would like Group and Branch committees to consider how they can help and how they can meet members' changing needs.

There will be an opportunity to discuss ideas at the Group and Branch Representatives meeting planned for 29 September. In addition the President has agreed to join me and visit as many Groups and Branches as possible during his two years in office. We would particularly like to have discussions with committee members but if this can be arranged to coincide with a meeting, so much the better. Please contact me if you have any particular dates in mind.

Communications at all levels in the Institute are important and there is room for improvement. Members often fight shy of raising matters, indeed the opportunities for doing so are few. My function as VP Groups and Branches is to liaise between the membership and Council so if you think that the IOA is letting you down in some way, let me know and I will raise it with Council or its officers.

One area where Groups and Branches can help Council is with nominations for the various medals and awards. Details of these are published regularly in the *Bulletin* and suggestions for suitable recipients are welcome at any time for consideration by the Medals and Awards committee.

Finally, I understand 64 members have so far shown interest in the formation of an Eastern Branch so the steering committee should be calling a meeting in the near future.

Geoff Kerry

was actually required of an auditory model, and about which aspects of physiological and psychoacoustic data are most important. Another topic which was identified as needing attention was the vast amount of data produced by a full auditory model. The level to which this can be reduced without significant loss of information (or usefulness) was not certain, although experience appeared to indicate that the data could be reduced to the same rate as the original signal for some applications. On several occasions, Ted Evans provided definitive answers to questions about auditory phsyiology, which many of those present found enlightening. The relative performance of various models was also discussed, with the conclusion that the outputs of Meddis' and of Evans' models, at least, were very similar.

Papers presented

A computational model of pitch perception (*R Meddis and M Hewitt*).

Does rate or timing code the intensity of harmonics near F1? Perceptual, neurophysiological and computational evidence (*R B Gardner and C J Darwin*).

Modelling the perception of 'double' vowels (*Q Summerfield and P F Assmann*).

Auditory approaches to recognition of British English sibilant consonants (*P F D Seitz and I M C Watson*).

A gammatone solution to the roex phase problem (*R D Patterson*).

Perceptual linear prediction and vowel recognition (*D Deterding*).

Hardware modelling of the peripheral auditory system (*E F Evans*).

The auditory speech sketch: a proposal (*M P Cooke*).

S W Beet

Prosody in Speech Recognition and Production – a half-day meeting held in Cambridge on Friday, 11 March, 1988.

This was a well-attended meeting, with a diverse audience of more than sixty-five people from academic departments, research establishments, and industry.

Prosody, considered in very broad terms as the description of the rhythmic and tonal patterns of speech, involves the study of many component features, pitch, stress, duration, tempo/rate, for instance. These features accompany and condition the perception and production of speech sound segments. Prosody has long been of interest to a very wide variety of disciplines. In recent years there has been much interest in using prosodic information to extend the efficiency and acceptability of speech recognition and production devices. The programme reflected this diversity of interests in prosody, half the speakers presenting research with immediate applications in machines. The eight papers were also divided evenly between aspects of prosody in speech recognition and production.

Prosody in speech recognition

Location of syllables and stress in the acoustic stream can enable automatic recognition of speech by providing additional information for searching the lexicon, indicating reliable spectral information, and aiding the interpretation of segmental information. Ghassan Freij described his development of an automatic technique for estimating the stress pattern of English words based on hidden Markov models derived from training data. The technique has been successful in recognizing words differing in their stress pattern (e.g. 'PERfect' and 'perFECT') and is being extended to continuous speech. Using continuous speech, Briony Williams described work done with Jonathan Dalby on identifying the location of syllables and stress. They have had encouraging results in locating syllabic peaks and estimating syllable boundaries using an algorithm based on the energy contour of the 'sonorants' and a frication detector. The estimation of whether a syllable is stressed is based on a comparison of the relative energy and durations of three consecutive syllables.

Two papers described research with hearing-impaired and normally-hearing adults on the contribution of prosodic information to human speech perception. Teresa Ching reported on a technique for enhancing lip-reading of tone languages. Her research showed that lip-reading a tone language such as Cantonese can be greatly improved by providing a simplified fundamental frequency contour to represent the tonal information.

Jo Verhoeven addressed a theoretical issue about the appropriate linguistic description of intonation. He argued that the results from his two discrimination experiments which systematically varied intonation contours of controlled utterances in Dutch suggest that intonation is better described in terms of 'targets' than pitch movements.

Prosody in speech production

There is much interest in improving the naturalness of the synthetic speech generated by text-to-speech systems by incorporating prosodic information such as rules for varying segmental durations for different speech rates and generating acceptable intonation contours automatically. Nick Campbell reported on his work quantifying the relationship between rate of speech and the duration of syllables and segments. He described a technique for comparing syllabus durations predicted by an existing text-to-speech system with the durations observed in a spoken passage. Work is in progress to examine the factors associated with the discrepancies.

Alex Monaghan outlined and demonstrated the 'intonation module' incorporated in the text-to-speech system being developed at CSTR in Edinburgh. Using only syntactic and lexical information as input, the module applies rules assigning accent and rhythm and refines the rules as exceptions are defined. One of the tenets of the system's design is that the resulting contours should be acceptable rather than replicate human intonation contours.

Two papers dealt with issues about the role of prosody in human speech production. Catherine Johns-Lewis presented an analysis of a sample of spontaneous speech which explored the relationship between the structure of the discourse and rate factors (e.g. speech to silence ratio, words per speech burst, silence duration and frequency).

Susan Behrens presented experimental data which challenge recent assertions that the right hemisphere of the brain controls all the processing of prosody. Her data are derived from neurologically-normal people and people who had neurological damage in their right hemisphere. Unlike previous studies, her test materials examined prosodic features used to convey linguistic, rather than affective, information. Data from the neurologically-impaired speakers showed that they had preserved their ability to convey linguistic information through the prosodic component of their speech.

Sally Butterfield

Physical Acoustics Group

Digital Signal Processing and Display Techniques for Ultrasonics, 2 March 1988

This was a most successful meeting, cosponsored by the Physical Acoustics Group and Professional Group S6 of the Institution of Electrical Engineers. Dr C B Scruby (Harwell Laboratory) and Professor S B Palmer (University of Warwick) organized the programme on behalf of the Physical Acoustics Group. Sixty-five delegates attended the meeting, which was held at the Institution of Electrical Engineers in London.

As the title suggests, the purpose of the Meeting was to review recent advances in the field of digital signal processing as applied to ultrasonics. One special feature of the day was the

mixture of papers from medical ultrasonics and nondestructive testing, and the interchange of ideas and discussion that ensued. A small exhibition of commercial ultrasonic instruments that employ digital data analysis was also arranged. This was very successful in complementing the scientific presentations and providing a focus for discussion during breaks in the programme.

The day started with an introductory paper (F A Wedgwood, Harwell Laboratory) describing the practical motivation for automated signal processing and image analysis in industrial ultrasonics. For instance, the only way to accommodate the high data volumes and rates from the inspection of offshore structures is by systematic data reduction. The focus of the meeting then switched to medical ultrasonics with two papers covering different aspects of the field. The work presented by J C Bamber (Royal Marsden Hospital) on the analysis of ultrasonic speckle and texture from liver tissue demonstrated the impact that digital techniques involving statistical analysis could make on the characterization and monitoring of metastases in this organ. T K Hames (Southampton General Hospital) then described two aspects of the interaction of ultrasound with bone. Here digital methods had helped solve the problem of ultrasonic transmission through attenuative cranial bone to measure blood flow in the brain. In the second case, ultrasound was being used to characterize osteoporosis non-invasively, by means of variations in attenuation. The next presentation (R E Challis, University of Keele) provided the link with the other papers, by reviewing a wide variety of ultrasonics projects covering biological and industrial materials. A comprehensive suite of digital analysis programs was an essential feature of all his work.

There were four papers covering all aspects of automated defect discrimination. S Burch (Harwell Laboratory) presented a method based on statistical pattern recognition for classifying the most common defects found in welds, while V Green (UKAEA, Risley) described a digital system for discriminating between ultrasonic echoes from potentially harmful defects and from other scatterers. T Fenney (CEGB, Manchester) then described a selfcontained software system which enabled large volumes of ultrasonic data to be displayed graphically and quantified. Finally S Barton (British Coal, Burton) showed how digital techniques had significantly improved the ultrasonic inspection of shaft forgings under conditions of limited access. A new software package enabled data from cylindrical components of variable section to be assessed, in addition to introducing more uniformity into the whole inspection procedure. These papers together demonstrated the new dimension that digital techniques had given to ultrasonic inspection. Not only could inspection be automated, but defect assessment could be made in a more reliable and objective manner.

In the first of the two remaining papers, L Bond (University College London) presented the results of a theoretical study of the scattering of ultrasound from defects in solids. He had applied the Born Inversion Technique to the sizing of both weak and strong scatterers, and obtained a good measure of agreement with experimental data. Finally S Palmer (University of Warwick) demonstrated the important role digital signal capture and analysis had played in the development of laser ultrasonic techniques. Without high speed digitizers it would not have been possible to capture much of the broadband, single-shot data. Furthermore, the interpretation of much of the data relied upon computer signal processing methods such as Fourier transformation and digital filtering.

The discussion periods following each paper were notable for breadth as well as depth, and it was encouraging to observe such wide participation from the delegates throughout the day. It became clear as the meeting proceeded that digital techniques are now an essential part of all types of ultrasonic measurement. In addition to improving traditional ultrasonics, digital techniques enable new measurements to be made that would have been impossible previously.

C B Scruby

Forthcoming Conferences

Calls for Papers

Reproduced Sound 4

4th annual conference at the Hydro Hotel, Windermere, 3-6 November 1988

In collaboration with the Audio Engineering Society (AES), the Sound and Communications Industries Federation (SCIF), the Electroacoustic Music Association (EMAS), the Association of Professional Recording Studios (APRS) and the Association of British Theatre Technicians (ABTT). There will be presentations by eminent speakers and contributed papers on the following topics: Stereophony; TV sound; Studio acoustics; Auditorium acoustics; Instrument applications; Digital instrumentation; Loudspeakers and microphones; Digital audio; and Entertainment noise control.

Titles and brief abstracts of proposed papers to the Technical Organizer, please: Dr I H Flindell MIOA, ISVR, The University, Southampton SO9 5NH.

Noise In and Around Buildings

Autumn Conference 1988, at the Hydro Hotel, Windermere, 25-27 November 1988, organized by the Building Acoustics Group.

Contributions are sought on the following topics: Building regulations, conversions, refurbishment, façade insulation; Noise transmission in buildings, measurement, prediction, instrumentation; Building services, plant rooms, atria, large spaces (factories and leisure centres); Planning for protection against noise, external and internal layout, criteria, prediction, construction noise.

Brief abstracts of proposed papers should reach the Programme Committee Chairman by or soon after 15 July: Dr H G Leventhall FIOA, Commins-BBM Partnership, South Bank Technopark, 90 London Road, London SE1 6LN.

OBITUARY

James Moir

James Moir who died on 16 March at the age of 80 was born in Workington, of Scottish parents as his name suggests. After secondary education near his birthplace he went south to make a career with the British Thomson-Houston Company at their Rugby headquarters. In 1932 whilst a comparatively young man, he joined the Test Department in a section dealing with audio equipment, and meanwhile supplemented his knowledge by attending evening classes at Rugby Technical College. In three months he became Head of the Test Department, and remained there for a further two years until he was transferred to the Research Laboratories as a design engineer dealing with all the audio and radio equipment work in which the company was engaged. Within two years he was raised to the position of Chief Designs Engineer in a section responsible for the acoustic design of all cinemas fitted with BTH sound-film projection equipment (more than 200 large cinemas throughout Great Britain). In those days acoustics was not a part of any formal curriculum, and like many engineers of his era Moir was largely self-taught in that subject. So great was his enthusiasm for the cinema that in 1941 he was awarded a special premium by the Institution of Electrical Engineers for an outstanding paper on 'The Acoustics of Cinema Auditoria'.

In the early days of World War II he designed magnetic submarine detectors carried in all British aircraft. Later he joined a team of four scientists responsible for the first centimetric radar using the original high power magnetron.

At the end of the war he returned to the audio field as Head of the Audio and Acoustic section of the BTH research laboratories, and was responsible for the design of the company's extensive range of public address equipment, sound film systems, pickups, loudspeakers and microphones together with cable distribution systems for broadcast sound and television. During this period 105 patents were taken out in his name jointly with BTH.

In 1958 he joined Goodmans Industries at Wembley as Technical Director; in those days Goodmans was a noted producer of highly quality loudspeakers, and they also developed a range of electro-mechanical vibrators for industrial application. It was in the course of this work that he realized there was a great deal to be done in the application of electro-acoustic measurements, notably in commerce and industry.

In 1962 James Moir set up a consortium of consulting engineers practising as James Moir & Associates, and specializing in audio, noise and vibration problems. His success in this field was widely appreciated, notably in the design of recording studios, his work on the electronically assisted resonance system at the Royal Festival Hall, and noise reduction assignments at large electricity generating stations.

Moir published widely all his life: in the fifties he authored a text book, *High Quality Sound Reproduction,* published by Chapman and Hall. He published more than 100 technical papers on electro-acoustics subjects, and lectured frequently in the UK and the USA.

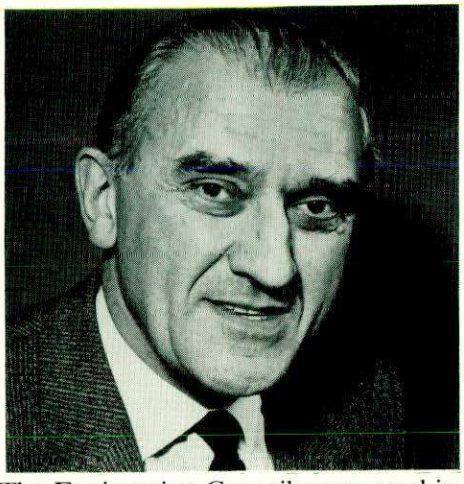
Moir was a great champion of learned societies; he was a Fellow of the Institution of Electrical Engineers, Member of the American Physical Society, and The Acoustical Society of America, Fellow of the Audio Engineering Society, and Honorary Fellow of the Institute of Acoustics. At one time or another he served nearly all of these societies as committee man, believing one should put back into industry as age, experience and good fortune allowed.

Above all Jimmy Moir was a practical audio engineer who had learned his craft by experience through many decades. His sparkling good humour and ready wit were always evident whenever he entered a discussion. This was his hallmark for which he will be very much missed by friends and colleagues alike.

Raymond E Cooke

MISCELLANY

The Engineering Council names new Director General



The Engineering Council announced in March that Mr Denis Filer, FEng, Director of Engineering at ICI, is to be the new Director General of the Council, taking up his post on 1 August 1988, on the retirement of Dr Kenneth Miller, FEng, who became the first Director General of the Council in July 1982. Dr Miller was appointed CBE in the Queen's Birthday Honours on 11 June 1988.

Sound Eighty-Nine

The Sound and Communication Industries Federation have announced that *Sound Eighty-Nine* will be held on Tuesday and Wednesday, 21 and 22 February 1989 at the Heathrow Penta Hotel. Information from: Sound and Communications Industries Federation, 4b High Street, Burnham, Slough SL1 7JH, Tel: 062-86 67633.

Environment Minister to open Enprotech '88

Enprotech '88 – the Exhibition of Environmental Protection Technology – will be held at Olympia 2 in West London, 18–20 October 1988. The event is sponsored by the Department of the Environment and will be opened by the Earl of Caithness, Minister of State for the Environment, Countryside and Water.

New Electronics Show

Trident International Exhibitions announce the launch of a new electronics show in Brighton in the autumn. The Brighton Electronics Show will be held at the Metropole Hotel, 18–20 October 1988 and will fill the slot vacated by Internepcon.

For further information please contact: Norma Thewlis or Neil James, Trident International Exhibitions Ltd., 21 Plymouth Road, Tavistock, Devon PL19 8AU, Tel: 0822 614671.

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NON-INSTITUTE MEETINGS

1988

21–25 August	*NOISE '88, 5th International Congress on Noise as a Public Health Problem.* Contact: Conference Secretariat, Noise '88, c/o Reso Congress Service, S-113 92 Stockholm, Sweden.
21–25 August	*5th International Congress of Audiology,* Tel Aviv, Israel.
21–27 August	IURAM Congress, Grenoble, France.
30 August–1 September	*Inter-Noise '88, 17th International Conference on Noise Control Engineering,* Avignon, France. Theme: The Sources of Noise. Contact Secretariat, Inter-Noise '88, BP 23, F 60302 Senlis Cedex, France.
5–7 September	*Noise Control '88*, Crakow, Poland. Information: Doc. R Panuszka, Gen. Sec., *Noise Control '88*, Institute of Mechanics and Vibroacoustics AGH, Al. Mickiewicza 30, 30-059 Crakow, Poland.
5–8 September	*Healthy Buildings '88.* CIB Conference organized by the Swedish Council for Building Research in collaboration with the National Institute of Environmental Medicine, with the co-sponsorship of the World Health Organization. Information from: The Swedish Council for Building Research, S:t Gorangsgatan 66, S-112 33 Stockholm, Sweden.
19–21 September	*COMADEM 88,* seminar on Condition Monitoring and Diagnostic Engineering Management, organized by the City of Birmingham Polytechnic in association with the Institution of Diagnostic Engineers. Contact: Dr Raj B K N Rao, Department of Mechanical and Production Engineering, City of Birmingham Polytechnic, Perry Barr, Birmingham B42 2SU.
3–5 October	IEEE Ultrasonics Symposium, USA. Details: W D O'Brien Jnr, University of Illinois, Bioacoustics Research Lab., Urbana, Illinois IL 61801.
4–7 October	27th Acoustical Conference on Electroacoustics, Štrbské Pleso, Czechoslovakia. Details: House of Technology, Eng. L Goralikova, Škultétyho ul.I, 832 27 Bratislava.
11–13 October	*Computer Aided Techniques in Inspection and Testing,* Essen, W. Germany. Contact: Eurotest Secretariat, rue du Commerce 20-22 Bte 7, B-1040 Brussels, Belgium.
17–19 October	*VDE Congress '88,* Mannheim, FGR. Details: VDE-Zentralstelle Tagungen, Stresemannallee 15, D-6000 Frankfurt 70.
20–24 October	*World Conference on Ergonomics, Occupational Safety and Health,* in Beijing, China, organized by the Chinese Society of Metals and the Darling Downs Institute of Advanced Education, Australia.
26–28 October	*Undersea Defence Technology 1988.* Conference and Exhibition, supported by IEE and IOA Underwater Acoustics Group. Contact: Microwave Exhibitions and Publishers Ltd., 90 Calverley Road, Tunbridge Wells, Kent TN1 2UN.
2–4 November	*Westpac III,* The 3rd Western Pacific Regional Acoustics Conference, to be held in Shanghai, China. Details: Secretariat of Westpac III, c/o Institute of Acoustics, Academia Sinica, 17 Zongguancun Street, PO Box 2712, Beijing, China.
14–18 November	Second Joint Meeting of the Acoustical Society of America and the Acoustical Society of Japan, Honolulu, Hawaii, USA.
15–18 November	Short course: *Control of Industrial Noise and Hearing Loss Protection.* Details from Pat Stenhouse, Course Secretary, Centre for Extension Studies, University of Technology, Loughborough, Leics. LE11 2TU. Tel: 0509 222161.
24–25 November	*Noise into the Nineties,* Annual Conference of the Australian Acoustical Society, to be held in Victor Harbour, South Australia. Details from: R. A. Piesse, Gen. Sec., Australian Acoustical Society, Science Centre Foundation, 35-43 Clarence St., Sydney, NSW 2000.
28 November–2 December	*POLMET '88* – Pollution in the Urban Environment, with emphasis on the Asian and the Pacific regions. Technical exhibition and site visits. Enquiries: Polmet 88 Secretariat, c/o Hong Kong Institution of Engineers, 9/F, Island Centre, Causeway Bay, Hong Kong.
6–8 December	British Medical Ultrasound Society, *Annual Scientific Meeting and Ultrasound Equipment Exhibition,* Scottish Exhibition and Conference Centre, Glasgow. Contact: Mrs L Blench, BMUS, 36 Portland Place, London W1N 3DG, Tel 01-636 3714.

1989

7–10 March	*86th AES Convention* to be held in Hamburg, FRG. Information from: H A O Wilms, Exh. Director, Zevenbunderslaan 142/9, B-1190 Brussels, Belgium.
3–5 April	Modern Practice in Stress and Vibration Analysis, University of Liverpool. Organized by the Stress Analysis Group of the Institute of Physics.
24 April (week of)	*8th Fase Symposium on Environmental Acoustics* in Zaragoza, Spain. Details from Secretariat: Viajes el Corte Ingles, Dpto. Congresos, Avda César Augusto, 14, 2.ª planta, 50004 Zaragoza (Spain).
25–29 April	International Conference on *Acoustics, Speech and Signal Processing,* in Glasgow. Details from: Institute of Electrical and Electronics Engineers, Inc., Conference Co-ordination, 345 E. 47th St., New York, NY 10017.
26–28 April	*Sixth Symposium on Maritime Electronics,* Rostock, DGR. Details from: Wilhelm-Pieck-Universität Rostock, Sektion Technische Elektronik, Albert-Einstein-Str.2, Rostock 1 2500.
22–26 May	Meeting of the Acoustical Society of America, New York. Details from: Murray Strasberg, 500 Sunnyside Blvd, Woodbury, NY 11797.
7–10 June	*6th Seminar and Exhibition on Noise Control,* to be held in Pécs, Hungary. Details from: The organizers, Optical, Acoustical and Film Technical Society, Föu.68. H-1027, Budapest II, Hungary.
16–18 August	*Noise and Vibration '89,* to be held in Singapore. Abstracts by 15th November, 1988. Details from: The Secretariat, International Conference Noise and Vibration 1989, c/o School of Mech. and Production Engineering, Nanyang Technological Institute, Nanyang Avenue, Singapore 2263.
24–31 August	*13th ICA Congress,* International Commission on Acoustics, Belgrade, Yugoslavia.
4–6 September	*Symposia:* Dubrovnik on *Sea Acoustics*; Zagreb on *Electroacoustics.* Details: Secretariat, Sava Centar, 11076, Belgrade, Yugoslavia.
October	28th Acoustical Conference on Physiological Acoustics: *Acoustics of Speech and Music.* Details: Secretariat, House of Technology, Eng. L. Goralikova, Škultétyho ul.1, 832 27 Bratislava, Czechoslovakia.
4–6 October	IEEE/UFFCS Ultrasonics Symposium, Montreal, Canada. Details: Allied-Signal Inc., Attn. H van de Vaart, PO Box 10221R, Morristown, NJ 07980, USA.
6–10 November	Meeting of Acoustical Society of America, St. Louis, USA. Details: Murray Strasberg, (see above).
6–10 November	Meeting of Acoustical Society of America, New York. Details from Murray Strasberg (see above).
4–6 December	Inter-Noise 89, Newport Beach, CA, USA. Details from: Internoise '89, Institute of Noise Control Engineering, PO Box 3206, Poughkeepsie, NY 12603.
December	European Symposium on Transportation Noise, Braunschweig, FGR. Details from: Deutsche Gesellschaft für Luft- und Raumfahrt e. V., Godesberger Allee 70, D-5300 Bonn 2.

Information relating to meetings of possible interest to readers should be with the Editor at the address on page 1 no later than four months before the date of the meeting.

Institute of Acoustics

Meetings

1988			
22–26 August	M	**7th FASE Symposium: Speech '88**	Edinburgh
October	UAG	Undersea Defence Technology (co-sponsors with others)	To be announced
November	M	PC Programmes in Acoustics	London
3–6 November	M	**Fourth Annual Conference: Reproduced Sound 4**	Windermere
24–27 November	M	**Autumn Conference: Noise In and Around Buildings**	Windermere
December	SB	Inaudibility in the Assessment of Noise Nuisance	To be announced
December	UAG	Interaction of Transducers and Structures	Weymouth
Late '88	M	The Acoustic Consultant – Professional Responsibility and Risk	To be announced
1989			
Early '89	M	Noise and Vibration from the Channel Project	To be announced
Early '89	M	New Methods for Measurement and Assessment of Environmental Noise	To be announced
21–22 March	UAG	Acoustics in Fisheries	Fisheries Lab., Lowestoft
3–6 April	M	**Acoustics '89**	University College, Oxford
December	UAG	Digital Sonar Processing	To be announced

Key

M = Meetings Committee Programme
BAG = Building Acoustics Group
ING = Industrial Noise Group
MAG = Musical Acoustics Group
PAG = Physical Acoustics Group
SG = Speech Group
UAG = Underwater Acoustics Group
LB = London Branch
EMB = East Midlands Branch
NEB = North East Branch
NWB = North West Branch
SB = Southern Branch
ScB = Scottish Branch
SWB = South West Branch
YHB = Yorkshire and Humberside Branch

Further details from:

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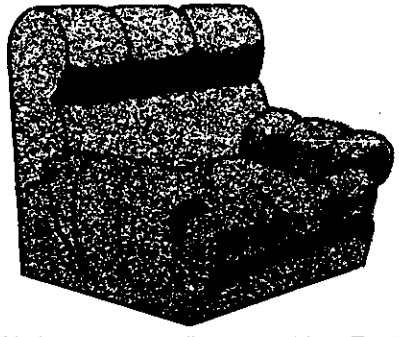

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TEL NO:.....

QUALIFICATIONS AGE.....

☐ NONE ☐ CG/HNC ☐ DEGREE ☐ OTHER

SALARY

☐ 0-£6000 ☐ £6-10000 ☐ £10-15000 ☐ £15000+

JOB ..... AB/GS