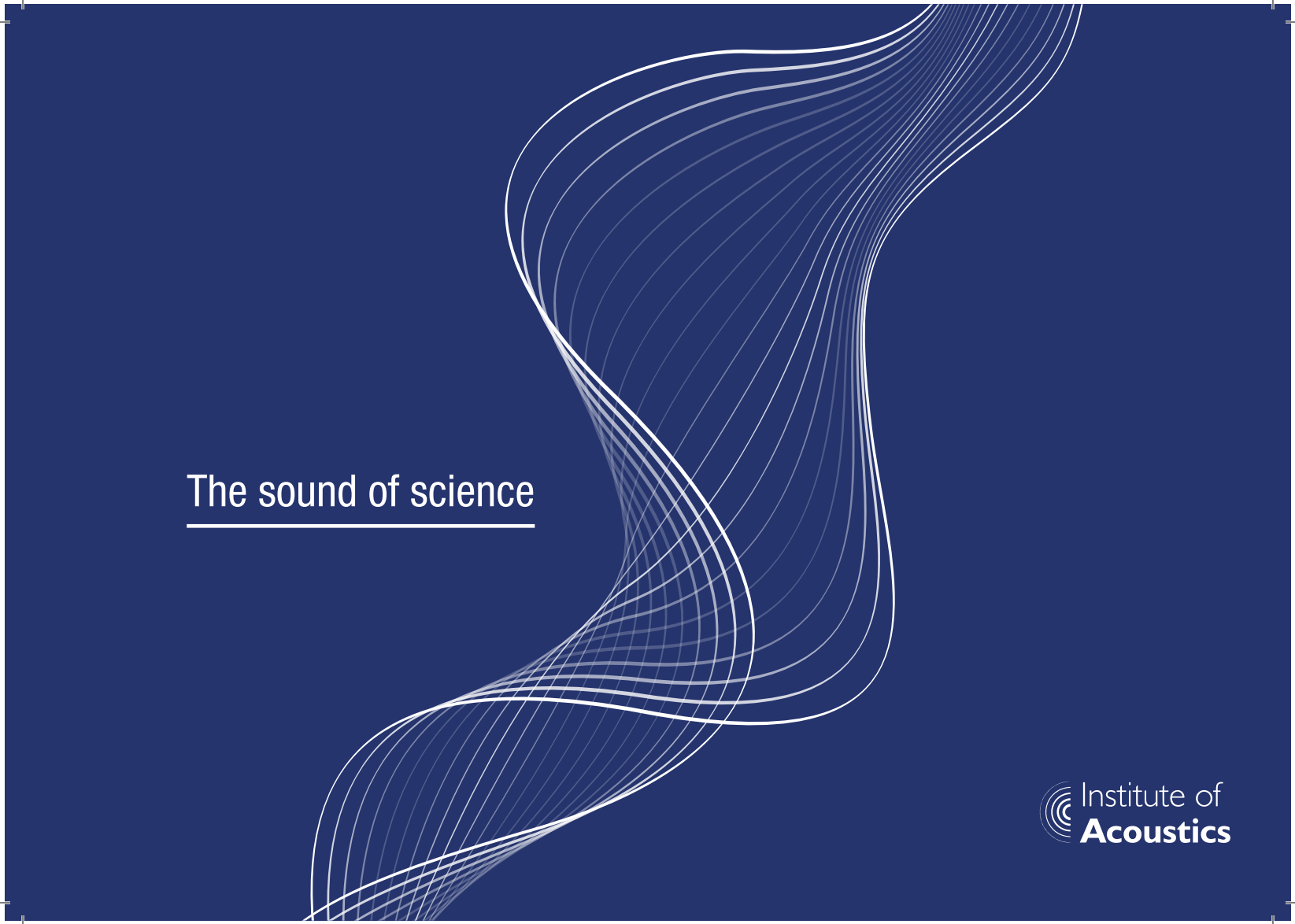

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WELCOME

The Institute of Acoustics (IOA) is the UK's professional body for those working in acoustics, noise and vibration.

Formed in 1974, it has 3,000 members, ranging from university students to qualified specialists working in a diverse range of organisations, from consultancies to public authorities, and from industry to academia.

Acoustics can be described formally as the science of sound, its production, transmission and effects.

This definition, however, fails to acknowledge the human dimension and the everyday impact it has on each one of us.

To give a few examples, consider the importance of good acoustics in the classroom or the concert hall, the need to shield people from excessive noise in the home, street and workplace, or the many medical uses to which ultrasound can be put. In each of these fields, the skill of the acoustician is paramount.

In this booklet, you will find a snapshot of the areas covered by the Institute's nine specialist groups, which are dedicated to the advancement of the science and sharing of knowledge.

Each overview contains a description of the different specialisms, underlining why acousticians make such a vital contribution to the world we inhabit in so many different ways.

We hope you enjoy this introduction to the fascinating world of acoustics and that it gives you a better understanding of why acoustics is so important to us all.

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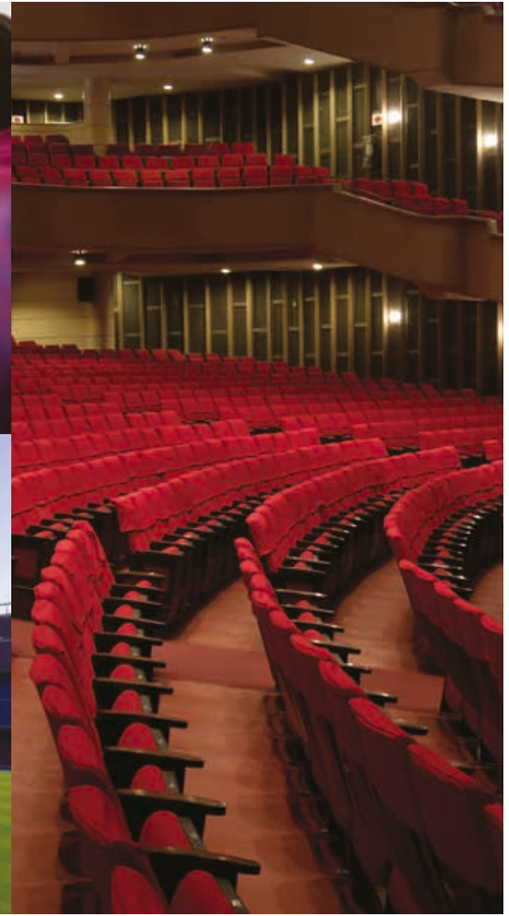
BUILDING ACOUSTICS



It is vital that all buildings and architectural spaces are acoustically ‘fit for purpose’.

This is true whether they are large prestigious concert halls, small nursery schools, churches or Olympic stadia.

Our members who are building acoustics specialists understand how important good acoustics are, and how to design buildings so they are suitable for music, speech, or other activities. They also know how to reduce unwanted sound – by, for example, insulating against noise from a nearby road.

During the past 40 years, our members have had a significant influence on government policy connected to the acoustics of buildings.

We helped draft Building Regulations related to the acoustic design of new dwellings (first introduced in 1985) and schools (2003). Our members also sit on many British and International Standards committees related to building acoustics, and are active in developing new standards or updating existing ones, such as those on sound insulation in dwellings and measurement of reverberation.

Research carried out by our members has helped form many of these regulations and standards.

Examples include studies of sound insulation, speech intelligibility, the effects of noise on pupils and teachers, and how to improve the acoustics of concert halls for the benefit of both players and audience.

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ELECTRO-ACOUSTICS

Electro-acoustics is a highly specialist field with ever-increasing importance in today's technology-driven world.

Our day-to-day lives are increasingly governed by high-tech equipment which relies on electro-acoustic design, from mobile phones to computers, home sound systems to the commercial cinema.

At its technical heart, electro-acoustics relates to the interface between audio technologies and acoustic spaces.

The most tangible examples can be found where there is a purpose that can be met with loudspeakers (and, equally, microphones) used in architectural environments such as music arenas or sports stadia.

These speaker/microphone combinations can be used to proficiently inform awaiting passengers, reassuringly direct a crowd of spectators, artistically uplift an auditorium audience or efficiently evacuate a public building.

In these examples, and many others, the loudspeaker and microphone choices, locations and orientation, the audio system engineered and commissioned to serve them, and the acoustic response of the space they work into are pivotal.

They add up – in equal measure – to the success of the combined result. Compromising any one of these elements risks the whole.

The IOA has a long history of progressing the science and appreciation of the considerations that serve good electro-acoustic design, predominantly through the annual series of Reproduced Sound conferences that have run since 1984.

Essentially, these events bring together practitioners and theorists, architects and engineers, end-users and manufacturers.

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ENVIRONMENTAL NOISE

Our quality of life is affected by the environment in which we live.

As expectations continue to rise, so too does the demand for a peaceful environment.

With growing evidence about the impact of noise on health, Institute members are constantly assessing the influence of noise, and working with planners and designers to minimise its negative effects.

The Environmental Noise Group is the largest specialist group in the IOA, and the most diverse, with members including local authority officers, consultants and representatives from all areas of industry.

Our understanding of the effects of noise has continually progressed since the Institute was founded in 1974 and regulation has developed in parallel.

We contribute to research on the effects of noise, and influence government policy and regulation through consultation.

We also share our understanding of environmental noise and its impact through our meetings programme.

Our members measure, predict, assess and mitigate noise every day of their professional lives.

Sometimes we are assessing existing noise problems that affect quality of life and require remedy.

On other occasions, we consider proposals for new developments that may be sensitive to noise, or new infrastructure like airports and rail schemes. Often there is much that can be done to reduce noise effects through good planning and design.

Our members work in multi-disciplinary teams to advise how environmental noise can best be managed and minimised to deliver more sustainable developments.

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MEASURING SOUND AND VIBRATION

Advancement of the science of measurement of sound and vibration is a core aim of the Institute.

We can hear noise and feel vibration.

However, once we wish to study the effects, there is a need to carry out objective measurement.

Mechanical vibration or changes in atmospheric pressure from sound waves can be measured but need further processing to be meaningful.

Transducers convert sound or vibration into electrical signals for instruments to provide the required parameters relevant to environmental impact statements, health hazards, human comfort, agreeable living spaces and the design of machines that sound right.

Many standards and regulations set criteria for damage to structures and human health from vibration.

Similar controls cover health and safety aspects of noise, which have to be evaluated.

The variability in susceptibility between individuals means statistical approaches are needed to develop damage risk criteria that will protect the population from physical harm.

Move a little further into the realms of nuisance and the inter-subject variability becomes even more complex. After all, what annoys one person may not annoy another.

The reduction of high noise levels and the design of quiet offices and auditoria require specific techniques and instrumentation as well as the important aspect of best measurement practice at all times.

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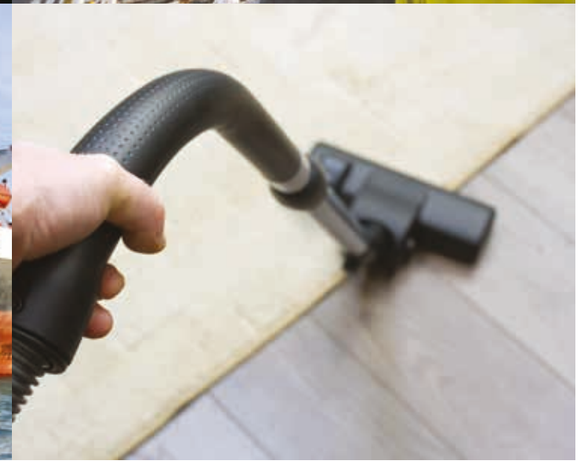
NOISE AND VIBRATION ENGINEERING



The world is full of machines that are vital to our modern lifestyle.

We travel in aircraft, trains, cars and ships; our factories are filled with the machines that produce consumer goods and industrial products; homes have vacuum cleaners, washing machines and fridges.

Our members understand why machines make noise and are able to design them to carry out their primary function within acceptable noise limits.

The secret is to tailor the forces that make the machine work and design the structure of the machine to reduce vibration, which ultimately causes radiation of noise.

Noise control at source and design stage is more cost effective than remedial treatment of a problem, but achieving this within the constraints of weight and cost is not easy.

Without the efforts of our engineers pushing the boundaries of low noise design, the world would be a much less pleasant place.

Noise around airports would be intolerable if modern aircraft were as noisy as their predecessors, factories would have dangerously high noise levels that would damage workers' hearing and traffic noise would pollute towns and countryside.

Such progress has been made in noise control that engineers working on consumer goods are now focusing much more on the issue of sound quality, ensuring a new car or washing machine sounds as good as it looks and is a pleasure to use.

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Musical acoustics concerns the physics of music.

Musical acoustics considers how instruments produce sound, how listeners perceive and respond to music, and how music can be created and manipulated by computers.

Traditionally, musical acoustics considered the physics, function and design of acoustic instruments as well as the influence of the spaces within which the music is being made. Of equal importance nowadays are electronic instruments and the synthesis of sounds.

One of the biggest changes over the Institute's lifetime has been the widespread introduction of digital technologies. The manipulation of digital signals through perceptual coding (e.g. MP3) has revolutionised the music industry and how we experience music. Other research has developed tools to recognise pieces of music and their genre from audio recordings.

Understanding the perception of music is at the heart of musical acoustics, for instance understanding how some combinations of notes sound dissonant and unpleasant. The application of modern brain imaging techniques is beginning to revolutionise our understanding of how we perceive music and why it has the ability to so readily manipulate our emotions. Research is investigating how the potency of music can be used in medical applications such as pain relief.

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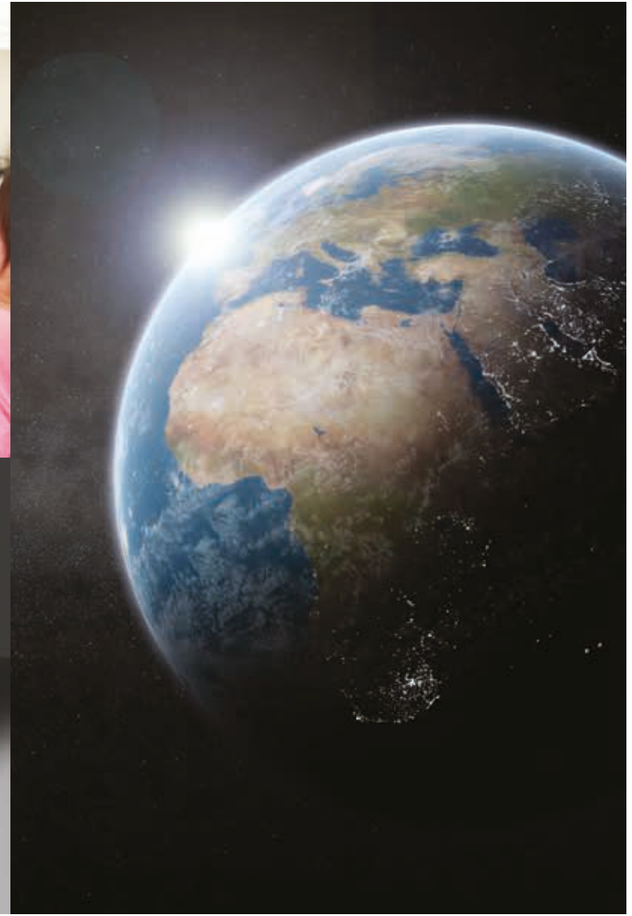
PHYSICAL ACOUSTICS



Physical acoustics involves a detailed knowledge and understanding of the fundamental properties of sound – how it travels through different media and interacts with complex solids and fluids.

An important topic in physical acoustics is ultrasound – sound at very high frequencies above the upper limit of human hearing.

Ultrasound is an important basis of many technologies that many of us take for granted these days.

It has many medical applications including low intensity ultrasound scanning of the foetus in the womb, monitoring osteoporosis in the heel by measuring broadband ultrasonic attenuation, and the use of high intensity ultrasound (HIFU) for the destruction of tumour tissue or kidney stones.

Likewise, ultrasound is used to verify the mixing of foodstuffs like mayonnaise, to detect the cracking of a material as it breaks (acoustic emission), in non-destructive testing (NDT), and for monitoring the health of structures and machines.

Physical acoustics also involves the use of sound for probing the Earth's structure and the atmosphere.

Institute members include physical acousticians at the forefront of research today.

Examples of some of the diverse areas in which they have made important contributions include sonic and ultrasonic cleaning, planetary acoustics, opto-acoustic hybrid techniques and monitoring of agricultural soils.

They have also been involved in the detection of buried objects, acoustic methods for hydraulic process monitoring, water purification and conservation and the development of acoustic meta-materials (materials with unusual properties as a result of inbuilt periodic structures).

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SPEECH AND HEARING

Speech and hearing are so fundamental to the way we communicate that there is a natural tendency for us to take them for granted until we encounter a problem.

Institute acousticians specialising in this field are engaged in a wide range of activities, aimed at improving our ability to speak clearly and understand what is being said to us.

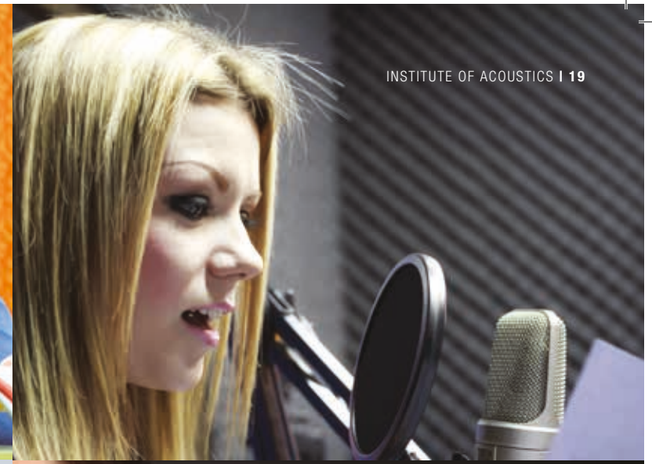
They include audiologists, who are people who make acoustic measurements to determine how a person's hearing may be impaired, make appropriate diagnoses and prescribe solutions, while speech and language therapists investigate the ways in which a person has difficulty communicating via speech.

Speech technologists research, design or develop new tools for processing, recognising and understanding human speech (including identifying speakers) and enabling computers to produce more 'natural sounding' synthetic speech.

Acoustic consultants are involved in the building and/or sound system design. They advise architects and engineers in aspects of the design and construction of buildings and systems for which speech being clearly audible plays a particularly prominent role, including schools and theatres.

Forensic phoneticians are experts who help the police or legal specialists analyse recorded samples of speech, which can involve acting as witnesses in court cases.

The Institute's Speech and Hearing Group organises regular meetings to raise awareness of all these areas and advance technical development through the sharing of knowledge and experience. Its members have been involved in the revision of the regulations on the acoustic design of schools, in relation to speech intelligibility in the classroom and the needs of hearing impaired pupils.



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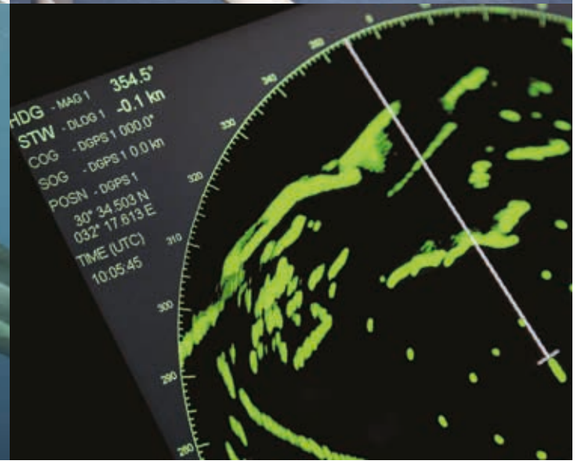
UNDERWATER ACOUSTICS



Neither light nor radio waves travel far in the ocean, but sound can be transmitted over long distances, sometimes hundreds of miles.

This is why underwater acoustics is a key underpinning technology in offshore oil and gas activities, is increasingly used in oceanographic and environmental studies, and plays a vital role in defence.

Acoustic signals are used to locate commercially valuable fish, to determine the safest routes for shipping, and to explore the Earth's geological formations searching for oil deposits beneath the ocean floor.

Acousticians who work in this highly-specialised field cover a diverse range of activities, such as designing sophisticated sonar hardware, computer modelling of sound propagation in the ocean or carrying out experiments and tests at sea.

In recent years, there has been growing concern about the impact of sound underwater on marine life.

The presence of such sound is escalating due to the building and operation of offshore wind farms, as well as oil exploration and the use of increasingly large ocean-travelling vessels.

Listening to underwater sounds has allowed scientists to measure global warming, earthquakes and the movement of magma through the sea floor during major volcanic eruptions, and record low-frequency calls of large whales.

Underwater Acoustics Group members are increasingly involved in research looking at the impact of underwater sound, suggesting ways to mitigate any harmful impact.

Members' experience is instrumental in development in a wide range of UK and international standards.

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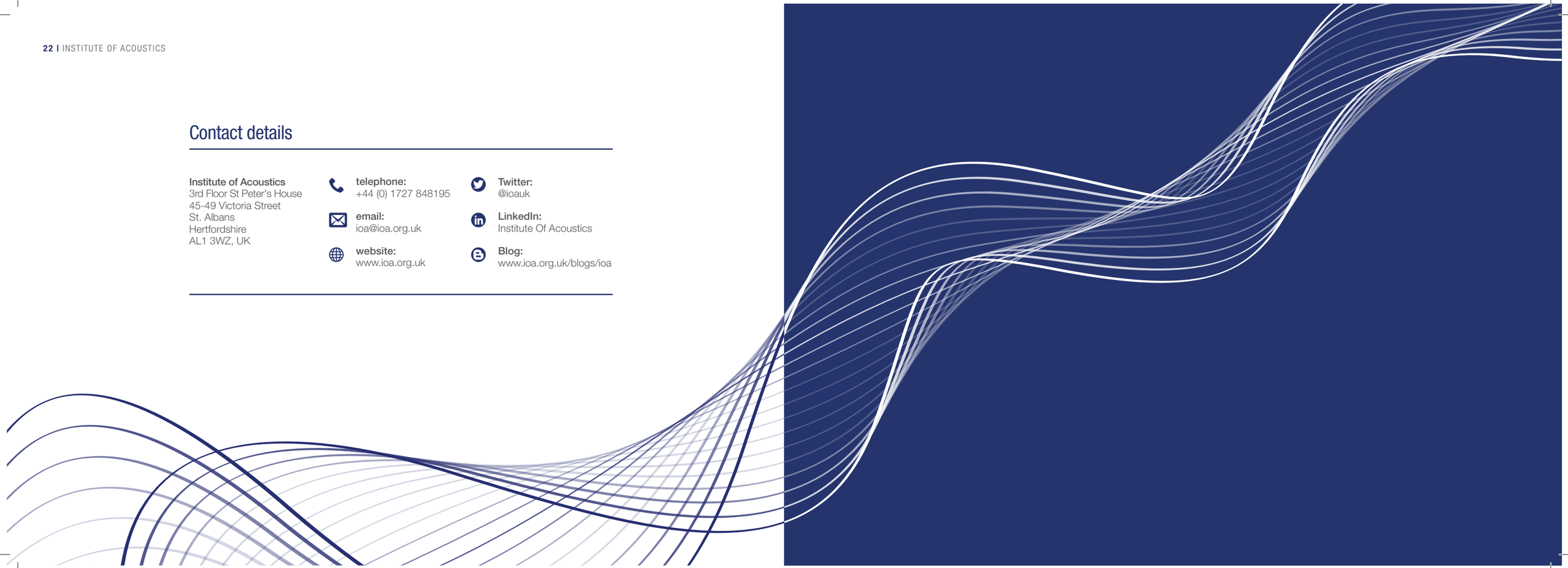

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