Australian Acoustical Society
Queensland Division

ACOUSTICS BURSARY

QUEENSLAND SCIENCE CONTEST 2016

The Bursary

The Australian Acoustical Society, Queensland Division will present a **$600** bursary for the best project in the field of acoustics; open to students in all Divisions. At the discretion of the judges, this bursary may be split among a number of deserving entries (maximum of five).

The Society

The Australian Acoustical Society is a learned society formed in 1971 to advance the science and practice of acoustics. Members practise or study acoustics in areas such as architectural acoustics, underwater acoustics, engineering noise and vibration, ultrasonics, environmental and occupational noise management, bioacoustics, hearing and speech physiology, audiology and music acoustics.

Project Areas

Acoustics is the study of sound (and hearing) in air, water and other fluids and the interactions of sound with solid materials. It is a broad field and impinges on many aspects of the physical and biological sciences.

Project areas include:

- Architectural acoustics
- Acoustical and vibration transducers
- Bioacoustics
- Engineering noise and vibration control
- Environmental noise and vibration
- Hearing and speech physiology
- Music acoustics
- Occupational noise and vibration
- Physical acoustics
- Seismology
- Ultrasonics
- Underwater acoustics

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Architectural acoustics: the study and design of rooms and other building spaces to determine those attributes which make them acoustically “fit for purpose”. For example, to be “fit for purpose” an auditorium, lecture theatre or classroom must provide an environment which allows a person standing in front of the audience to be heard clearly. A bedroom must be quiet enough for sleep. A music venue must provide satisfactory acoustical conditions for musicians and audience while limiting the emission of “music noise” to the environment.

Acoustical and vibration transducers: Transducers convert energy from one form to another. Mechanical, electromagnetic, optical and hydraulic components are used to receive or generate sound and vibration. “Pick-up” transducers include microphones, hydrophones, geophones and accelerometers. A loudspeaker is a familiar example of a transducer which converts an electrical signal into sound.

Bioacoustics: Animals use sound (and vibration) to explore their environment and to communicate. Bioacoustics involves the study of the uses and mechanisms of hearing and vocalisation in mammals, birds, reptiles, amphibians, fish, insects, crustaceans, molluscs and other animals. It includes the study of other effects of sound on biological systems. Acoustical techniques are used to identify and track individuals or groups of animals and to study their interactions with other species and the environment in which they live and move.

Engineering noise and vibration control: applies acoustical science to the control of unwanted sound (noise) and mechanical vibration. Mufflers employ a series of passages and chambers to attenuate engine noise. Building materials are used to encompass a noise source within a “box”, more or less opaque to the sound produced within. Sound absorptive materials are used to damp reverberation and control resonance. Springs and dampers are used to isolate vibration from areas sensitive to its effects. “Active” noise and vibration control seeks to cancel noise or vibration by introducing a signal which is equal in amplitude and frequency but opposite in phase to one or more of the major components comprising the disturbance.

Environmental noise and vibration: Industry, mining, construction, road, rail and air transport, sporting and musical venues and home appliances such as air-conditioners, lawnmowers, vacuum cleaners and food blenders, produce noise. While such noise (and vibration) is often little noticed by those involved in the activity or using the appliance, it can cause intense annoyance to “the neighbours”. There are many techniques available to ameliorate this, from good land use planning, which separates residential areas from industry and transportation, to expensive “after-the-fact” treatments to reduce noise and vibration at source, at the receiver or in between.

Hearing and speech physiology: The physiology behind hearing and speech has been investigated since ancient times. From the 1500’s onwards increasingly detailed knowledge has been acquired as to the mechanisms involved. Today, with the many tools available to science and medicine, knowledge of hearing and speech, the diseases which affect them and interventions which can assist them, has greatly advanced and is applied in many devices used to protect and assist hearing and speech. This includes most recently, the “cochlear implant” to provide a partial restoration of hearing in the profoundly deaf.

Music acoustics: is the study of the physical, physiological and psychological mechanisms behind music and musical instruments. Vibrating strings, membranes, plates and columns of air are used in different ways in the various families of musical instruments. Similar mechanisms apply in the anatomy which supports the human voice. Music acoustics began with Pythagoras and continues to be investigated and applied today.

Occupational noise and vibration: Exposure to loud noise can cause hearing loss. If the noise is loud enough and persists long enough, the person is rendered deaf. Thus in any occupation where high sound levels are involved, workers must be protected from its effects. Similarly, high levels of vibration over long periods can cause injury, for example to the hands when manipulating vibrating tools. Occupational noise and vibration is concerned with managing and minimising such exposure so that the deleterious effects of loud noise and excessive vibration can be avoided.

Physical acoustics: concerns the fundamental properties of sound. Phenomena such as sound transmission, absorption, reflection, refraction, diffraction, interference, scattering and dispersion and the mechanisms of sound propagation through gases, liquids and solids and through the fluid filled pores of rocks and other materials are relevant to the area. Physical acoustics also includes the interactions of sound with light and other electromagnetic radiation (for example, sonoluminesence), the use of sound to investigate the structural properties of materials and to modify those properties (for example, through the methods of sonochemistry).

Seismology: uses ground vibrations to “sound-out” structures within the earth. Seismic techniques are used to investigate the processes behind earthquakes and to prospect for oil and gas. In ancient times, groundborne noise was used to detect tunnelling activities in siege warfare. Today directional seismic arrays are used to detect artillery emplacements. Groundborne noise and vibration from underground trains, other transport and construction activities, is a topic of current interest in many cities around the globe.

Ultrasonics: Sound at frequencies above 16 to 20 kHz is “ultrasonic” and unheard by people. Animals such as bats and dolphins use ultrasound, to detect prey and avoid obstacles. Prey animals such as moths have evolved the ability to hear these frequencies (and sometimes, to produce them). Ultrasonic imaging is used in medicine. Ultrasound is used to detect flaws in large mining machines, in prestressed concrete structures and in the lightweight composites used in racing cars, aircraft and wind-turbines. Intense ultrasound can be used to clean and sterilise, induce chemical reactions and drill through materials which are too hard for mechanical tools to process efficiently.

Underwater acoustics: Underwater, sound is everywhere. Most fishes, aquatic mammals, reptiles and invertebrates have a well developed sense of hearing and many communicate by vocalisation. Whales and dolphins are known for their “singing” and echolocation abilities. Sonar was developed to track submarines and similar methods are used to find fish finding, depth-sound and to investigate submerged sediments. Underwater acoustic arrays have been deployed to detect nuclear explosions. Similar systems detect earthquakes and warn of tsunamis.