

Innovations in Acoustics and Vibration

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These reports summarize global activities of S&T Associate Directors of the Office of Naval Research International Field Offices (ONRIFO).

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Keywords

Acoustics, Underwater acoustics, architectural acoustics, Bio-acoustics

1. Abstract

About 100 people attended this three day meeting. Almost all the attendees were from Australia with a few Americans and Canadians and one Swiss attendee. A total of 51 papers, 2 workshops and a wind noise forum were presented in three simultaneous sessions. Session topics included: active noise control, underwater acoustics, environmental noise, musical acoustics, aero-acoustics, marine bioacoustics, electro-acoustics, architectural acoustics, acoustic inversion techniques, audio engineering, and structural acoustics and vibration. Underwater acoustics had the largest number of papers.

2. Discussion

Dr. David Chapman, the acting Technical Director of the Defense R&D Organization Canada, gave the keynote address titled “Uncertainty and Variability in Ocean Acoustics: How do we cope?” He stepped through the definition of the shallow water problem and discussed the efficacy of noise surveys, environmental assessments, through the sensor environmental probing and environmentally adaptive sonars. He discussed normal mode theory, adiabatic mode theory, inverse techniques and closed by noting that the complexity of the problem make it very difficult to separate the effects of parameter uncertainty from each other. That is, uncertainty in a particular parameter, for example water depth, can have an effect on transmission loss as a function of range that is indistinguishable from uncertainty in another parameter such as depth of the thermocline. In general there was nothing new in this talk but it was a good scene setter for the rest of the meeting.

2. Underwater Acoustics

Underwater acoustics papers included:

1. Scott Foster of DSTO discussed the difficulty in acoustically isolating conformal flank arrays from platform noise.
2. Marshall Hall of DSTO discussed predicting nearfield sound pressure level from a surface ship at some location A based on a measurement at a different location B. He used an empirical method wherein he towed a projector at both the A and B sites and used the measured differences to adjust the ship signature measured at B.
3. Adrian Jones et al of DSTO and researchers from Thales Underwaters Systems (TUS) reported on work to improve sonar prediction models for shallow water applications. DSTO measurements were compared to TUS model predictions. This work is ongoing.
4. Kam Lo, DSTO, Multi-ping Integration of High Frequency sector scan sonar images. The method was applied to a forward looking sonar and used multi-ping integration in the spatial frequency domain using FFTs. Both coherent and incoherent methods were discussed. The problem with this work is the familiar one of knowing with adequate accuracy the inter-ping motion of the platform. Only model data was presented.
5. Bryan Martin, University of Adelaide, Background Noise in the Great barrier reef (Heron Island). This paper presented a set of simple one hydrophone omnidirectional noise measurements in shallow water.
6. Graham Pulford, TUS, Relative performance of single scan algorithms for passive sonar tracking. Five tracking algorithms were compared for

- tracking performance. The nearest neighbor Kalman filter performed best in this test.
7. Alex Zinoviev, Application of multi-modal integral method to sound wave scattering in a three-dimensional fluid layer. This paper was a complex mathematical approach typical of Russian deterministic mathematics.
 8. Chris King, MOD, Acoustic processing workstation. The Australian Joint Acoustic Analysis Centre (AJAAC) is the Australian counterpart of ONI's acoustic analysis division. AJAAC has developed OSPREY, an acoustic analysis workstation. Canada and New Zealand use variants of this workstation. OSPREY is a software-based capability that runs on a variety of open architecture hardware. The only innovation that I detected was the use of color in waterfall displays to indicate signal bearing.

4. Bioacoustics

There were three papers on marine bioacoustics:

1. Adrian Jone et al, Observation and explanation of low frequency clicks in blue whale calls. These clicks are at about 20 hz and have SPLs of up to 190 Db. The clicks appear to be made by the excitation of the fundamental lung resonance in the animal.
2. Robert McCauley et al , Predicting biological noise in Australian Waters. Work in progress at selected areas to categorize the impact of sea life on sonar performance.
3. Douglas Cato et al , Australian research in Marine mammal Acoustics. This paper was a survey of ongoing Australian work in cataloging marine mammal acoustics. The recent shift of East coast Humpback whales to the West coast song was discussed.

5. Assessment

In general, the work presented at this meeting contained no surprises and was not ahead of similar work in the US or the UK. The range of papers was limited. For example there was no time reversal work or any biomedical acoustic work reported. Additionally, the use of acoustics for non-destructive evaluation was not mentioned. DSTO is clearly the major funder of acoustics research with civil sector work in architectural acoustics and environmental noise evaluation and remediation the next largest sector.

6. Contacts

The meeting was organized by Prof. Anthony Zander
The University of Adelaide Mechanical Engineering Department.

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