Invited Talk

Effects of the Channel on Acoustic Modem Performance in the Ocean

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Abstract

The U.S. Navy has used underwater acoustic modems for many decades for a variety of applications. As usual, the first interest is simply to get the modem to work and then to work better (increasing ranges, data rates, and robustness). However, as the technology matures, interest turns to performance modeling. This is critical in designing network lay-downs for fixed systems; in dynamically configuring the topology where mobile nodes are in play; and finally in making Smart Modems smarter by enabling them to search the parameter space more efficiently.

It is important to note that the ocean environment does have dramatic effects on modem performance. For instance, a developing storm breaks up the acoustic mirror formed by the ocean surface while also generating lots of noise due to breaking waves. Volumetric features such as internal tides cause dramatic refractive changes with equally interesting effects on the scattering function.

Interestingly our ability to properly simulate the important effects for acoustic modems has been surprising limited. Coherent modems using equalizers respond on a time scale that is not quite short enough to freeze the ocean surface in a flash of an acoustic strobe pulse, nor long enough to allow one to think of averaged properties. New channel models have been needed to simulate the important effects of a rough, moving, 3D surface. The challenges have expanded further with recent interests in MIMO systems where space-time coherence issues are in play.

This talk will provide a perspective on these environmental effects and their incorporation into a channel simulator.

Categories & Subject Descriptors: H.5.5 Sound and Music computing; Methodologies and techniques,; Modeling, signal analysis, synthesis, and processing; Systems.

General Terms: Algorithms, Measurement, Performance, Design, Reliability, Experimentation, Theory.

Bio

The speaker received the B.S. And Ph.D. degrees in applied mathematics from Caltech and Northwestern in 1979 and 1984 respectively. He has worked in a variety of areas in ocean acoustics in government labs (Naval Ocean Systems Center, Naval Research Laboratory, SACLANT Undersea Research Centre), academia (New Jersey Institute of Technology, University of Algarve, and Scripps Institute of Oceanography), and in the private sector (Science Applications International and HLS Research). His research has included effects of oceanographic features (internal tides, surface ducts), marine mammals (dolphin sonar, mammal tracking, environmental effects), mine counter measures, matched-field processing, computational acoustics, geoacoustic inversion, and target scattering. Over the last 8 years, underwater acoustic communications has been a major interest.

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