3:35

1pSP5. Time variation characterization of a nonstationary time series. Nai-chyuan Yen (CLY Assoc., 2109 Rampart Dr., Alexandria, VA 22308-1537)

The Fourier transform of a nonstationary time series has the difficulty of providing a proper physical interpretation of the signal as the physical attributes and dynamics associated with the time series may consist of several transients that are different in their nature. The time series analysis method developed by NASA [N. Huang *et al.*, ''The Empirical Mode Decomposition and The Hilbert Spectrum for Nonlinear and Nonstationary Time Series Analysis'' (to be published)] has a unique approach to adaptively break down the nonstationary time series into the sum of several simple mode functions. Each single mode function can then be expressed in terms of an analytical signal whose amplitude and phase can both be varied with time. Those time variations can be related to the abrupt changes associated with dynamic systems. Such a time variation characteristic can be used to observe the occurrence of a transient event even in a nonstationary process. Applications of this technique to observe various types of acoustic signals in noisy environments are discussed.

3:55

1pSP6. Comparison of methods for analysis of cyclostationary noise. Karel Vokurka (Tech. Univ. of Liberec, Dept. of Phys., Halkova 6, CZ-461 17 Liberec, Czech Republic, karel.vokurka@vslib.cz)

A great number of machines work cyclically. Hence the noise they generate is cyclostationary. A traditional approach to this noise analysis is based on an assumption of its stationarity. This assumption implies continuous time averaging. Unfortunately in this way a certain amount of information concerning, e.g., time-frequency distribution, is lost. Methods have been looked for to preserve this information. They all are based on periodic time averaging and the resulting statistical characteristics are known as gated spectrum, cyclic correlation, cyclic autospectrum, double autocorrelation, double autospectrum, etc. Each of the methods has its advantages and disadvantages. These may concern processing time, hardware requirements, frequency resolution, occurrence of artifacts (cross terms), and others. In this paper the methods are analyzed and compared and possible improvements in their performance are suggested. [Work supported by the Grant Agency of the Czech Republic and by the European Commission.]

MONDAY AFTERNOON, 22 JUNE 1998 GRAND BALLROOM B (S), 1:00 TO 4:20 P.M.

Session 1pUW

Underwater Acoustics: Sources, Arrays, Tracking, and Localization

Stanley E. Dosso, Chair
School of Earth and Ocean Sciences, University of Victoria, P.O. Box 1700, Victoria, BC V8W 3P6, Canada

Chair's Introduction—1:00

Contributed Papers

1:05

1pUW1. Localized wave pulses in the Keyport experiment. David H. Chambers and D. Kent Lewis (Lawrence Livermore Natl. Lab., P.O. Box 808 L-372, Livermore, CA 94551, chambers2@llnl.gov)

Localized wave (LW) pulses were produced using a standard Navy array in the anechoic tank at NUWC Keyport. The LW pulses used were the MPS pulse first derived by Ziolkowski, and a new type of pulse based on a superposition of Gaussian beam modes. This new type is motivated by a desire to make a comparison of the MPS pulse with another broadband pulse built from solutions to the wave equation. The superposed Gaussian pulse can be described by parameters which are analogous to those describing the MPS pulse. The directivity patterns and the axial energy decay between the pulses are compared. The behavior of the pulses are found to be similar so that the superposed Gaussian could be another candidate in the class of low diffractive pulses known as localized waves.

1:20

1pUW2. Localized wave generation with a standard underwater array. D. Kent Lewis, David H. Chambers (Lawrence Livermore Natl. Lab., 7000 East Ave., L-372, Livermore, CA 94550), and Richard W. Ziolkowski (Univ. of Arizona)

Recent work at the NUWC Keyport has generated localized waves using Navy field equipment. The array, a rectangular arrangement of tonpiltz elements, was driven with precompensated signals to generate sound covering a decade of usable bandwidth. The elements were grouped by radius from the center and excited by signals designed specifically for each radius, for a total of 7 radii. Results of the angular scans show a narrowed beam pattern and lowered side lobes relative to design signals. Results of axial range scans show an increase in directivity of more than an order of magnitude over array specific tone bursts. Frequency analysis shows that the main beam is an octave wide while the surviving side lobes are narrow bandwidth.

1:35

1pUW3. An inexpensive light-weight ocean acoustic research array. Garry J. Heard (Defence Res. Establishment Atlantic, P.O. Box 1012, Dartmouth, NS B2Y 3Z7, Canada, heard@drea.dnd.ca)

Current and past research arrays built at the Defence Research Establishment Atlantic (DREA) have been intended for indefinite and repeated use. Building, maintaining, and using these arrays has been expensive in terms of both money and labor due to the rugged construction practices, complicated electronics, and materials. With the reduced resources available in most laboratories today, there is considerable need for cheaper research array systems that are easily maintained and deployable from a variety of platforms: from Zodiacs to full-sized AGOR vessels. This paper describes the initial development of a light-weight research array that is expected to meet the requirements of the Ocean Acoustics Group at DREA. The array uses epoxy resins for most of the structural components, has a serial-digital bus, has low-power requirements, is easily reconfigured, and is essentially disposable, although the intention is to reuse the array in whole or in part as long as it remains serviceable. The prototype array, which is scheduled for sea testing in July 1998, will be a bottom-deployed 500-m aperture horizontal line array with 16 channels sampled at 2048 Hz.