

A new type of vector sensor and its application in ambient noise measurements

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The vector hydrophone is one kind of sensor for ambient noise measurement in underwater acoustics. Because the frequency response of vector sensor can extend to a very low band, and have almost frequency-independent directivity, it finds applications in many areas: ambient noise measurement, low-frequency signal beamforming using short arrays, left/right ambiguity resolution of towed array sonars, etc.

The traditional vector sensor usually consists of one pressure sensor and two (X and Y axis) velocity sensors. The information of Z axis is neglected when the sensors are used in a deep water environment. A new type of 4-D vector sensor is described in this paper, which consists of one pressure hydrophone and three (X , Y , and Z axis) velocity sensors. The combined application of the data received from these four sensors show some advantage compared to a single hydrophone.

A 24-m long experimental array with four vector sensors and some auxiliary sensors was designed. Some research results from at-sea and lake experiments of ambient noise measurements and underwater acoustic channel modeling are illustrated in this paper. The experimental results are also compared with two, 32-element horizontal and vertical arrays. Some problems with using vector sensors are also presented.