

EXPERIMENTAL STUDIES OF SCALAR-VECTOR SOUND RECEIVER OPERATION IN THE MODES OF UNDERWATER NOISE SOURCE DETECTION AND DIRECTION FINDING

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An experiment in shallow water area for receiving signals of a moving underwater source of noise signals by a scalar-vector receiver placed on board of a stationary bottom station is described. Signal-to-noise ratios in vector and scalar channels of the receiver at different source ranges are analyzed. Significantly different levels of anisotropic noise in the receiver channels and the possibility of achieving a 6-10 dB advantage in the signal-to-noise ratio by the vector channel over the scalar channel at minimum values of active anisotropic noise are noted. The angular arrival of noise emission energy from the source during its movement was analyzed, additional noise emitting objects in the controlled water area were detected and the possibility of differentiation between noise sources based on the composition of the emitted spectrum was shown.

Keywords: scalar vector sound receiver, signal-to-noise ratio, detection and direction finding of underwater noise source.

References

1. Gordienko V.A., Il'ichev V.I., Zakharov L.N. Vector-phase methods in acoustics. Moscow: Nauka, 1989. 223 p.
2. Matvienko Yu.V., Khvorostov Yu.A., Kuleshov V.P. Features of the use of scalar-vector sound receivers in systems for monitoring the underwater environment of local areas // Underwater Research and Robotics. 2022. No. 4 (42). Pp. 4–15. DOI: 10.37102/1992-4429_2022_42_04_01. EDN: CAMOFW.
3. Skrebnev G.K. Combined hydroacoustic receivers. St. Petersburg: Elmor, 1997. 200 p.
4. Shchurov V.A. et al. Mobile acoustic combined receiving systems based on autonomous unmanned underwater vehicles. Underwater Research and Robotics. 2012. No. 2 (14). Pp. 4–12.
5. Seleznev I.A., Yasnikov A.I. Prospects for the use of underwater gliders for oceanography and underwater environment monitoring. Review based on foreign literature. Underwater Research and Robotics. 2023. No. 1 (43). Pp. 4–13. DOI: 10.37102/1992-4429_2023_43_01_01. EDN: HPVCMN.
6. Smaryshev M.D. On the noise immunity of a combined acoustic receiver. Acoustical Journal. 2005. Vol. 51, No. 4. Pp. 558–559.
7. Dzyuba V.P. Scalar-vector methods in theoretical acoustics. Vladivostok: Dalnauka, 2006. 194 p.
8. Gordienko V.A., Gordienko E.L., Krasnopistsev N.A., Nekrasov V.N. Noise immunity of hydroacoustic receiving systems registering the flow of acoustic power. Acoustical Journal. 2008. Vol. 54, No. 5. Pp. 774–785.
9. Seleznev I.A., Glebova G.M., Zhabankov G.A., Maltsev A.M., Kharakhashyan A.M. Probabilistic characteristics of signal detection by a single scalar-vector module. Underwater Research and Robotics. 2016. No. 2 (22). Pp. 44–49.
10. Zakharov K.L. Frequency-angular characteristics of a hydroacoustic signal using the vector-phase method. Electronic scientific publication "Sustainable Innovative Development: Design and Management," www.rpravlenie.ru, 2014. Vol. 10, No. 3 (24). Art. 7.
11. Matvienko Yu.V., Kamornyi A.V., Khvorostov Yu.A. On one approach to solving the problem of detecting an underwater source of noise signals. Underwater Research and Robotics. 2018. No. 2 (26). Pp. 37–43.

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