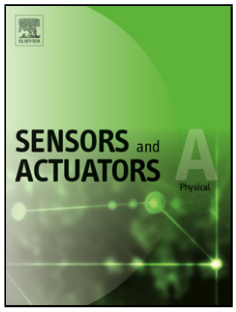

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Design and implementation of two-component cilia cylinder MEMS vector hydrophone

Qingda Xu[1,a)], Guojun Zhang[1,a)], Junwen Ding[1], Renxin Wang[1], Yu Pei[1], Ziming Ren[1], Zhenzhen Shang[1], Chenyang Xue[1], Wendong Zhang[1]

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Highlights:

- A novel MEMS vector hydrophone was developed for applying based on piezoresistive effect and fish bionics in the range of 20-1000Hz.
- The two-component cilia cylinder structure can greatly improve the sensitivity of MEMS vector hydrophone. Compared with previous studies, the structure can improve the sensitivity of MEMS vector hydrophone on the condition of same load on cantilever beam which has never been achieved in other researches.
- By using multi-parameters optimization function of ANSYS17.0 software, the optimum solution of the highest sensitivity was obtained with the restrictions of bandwidth.
- The MEMS vector hydrophone not only had a simple fabrication but also had a good performance for engineering application, such as the high sensitivity, wide working bandwidth and 8-shape directivity.

Abstract

In previous studies of MEMS vector hydrophone, the ideas of increasing the sound signal reception area were only considered for improving the sensitivity of cilium MEMS vector hydrophone (CVH), which lead to a problem of increasing the load of cantilever beam. In order to solve the problem, a two-component cilia cylinder MEMS vector hydrophone (TCVH) is developed in this paper. TCVH can improve the sensitivity of MEMS vector hydrophone with the same load of cantilever beam as CVH. Firstly, device structure parameters of the two-component cilia cylinder and cross-beam are determined based on the theoretical analysis and simulation analysis. Compared with the modal shapes of CVH, the overall structure of TCVH is more stable. And in terms of fabrication, the secondary integration process become more simple than that of previous works due to the consistency of the upper and lower cilia materials as well as the feature of no mould. Then,

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