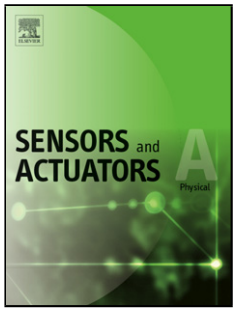

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PII: S0924-4247(17)31521-2
DOI: https://doi.org/10.1016/j.sna.2018.01.061
Reference: SNA 10616

To appear in: *Sensors and Actuators A*

Received date: 1-9-2017
Revised date: 28-1-2018
Accepted date: 29-1-2018

Please cite this article as: Liu M, Nie L, Zhang G, Zhang W, Zou J, Realization of a Composite MEMS Hydrophone Without Left-right Ambiguity, *Sensors and Actuators: A Physical* (2010), https://doi.org/10.1016/j.sna.2018.01.061

Realization of a Composite MEMS Hydrophone Without Left-right Ambiguity

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Highlights:

(1)The composite MEMS hydrophone can eliminate the left-right ambiguity problem of MEMS vector hydrophone.

(2)The volume of the composite MEMS hydrophone is smaller than the traditional composite hydrophone.

(3)The new designed MEMS processing technology can improve the sensitivity of the capacitance.

(4)The oil hole of capacitance microstructure can improve the pressure-resisting ability of the traditional capacitance sensor.

Abstract: A sound-pressure sound-pressure-gradient composite MEMS vector hydrophone has been proposed and demonstrated to solve the problem of left-right ambiguity that is intrinsic to existing MEMS hydrophones measuring the pressure gradient of a vector sound field. A newly-designed capacitance scalar microstructure is added into a MEMS vector hydrophone that otherwise consists of only a regular cilium-four-beam microstructure. Theoretical model shows that the left-right ambiguity problem can be artfully solved by synthesizing the output signals from the vector and scalar structures. The hydrophone's ability of azimuth measurement is tested with a standing-wave tube and the error of direction of arrival (DOA) estimation is within 1 degree. Moreover, the composite hydrophone remains the frequency response trend of the cilium MEMS vector hydrophone. We believe that this work is a significant advance in the development of MEMS hydrophone and should place a solid base for relevant engineering applications.

Key word: MEMS, Composite hydrophone, Left-right ambiguity, Capacitance microstructure