Acoustics - Structure Interaction Studies of Fiber Optic Mandrel Hydrophne Using COMSOL Multiphysics®

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Abstract

Hydrophones are acoustic receivers, which can be used to listen to the sound propagating underwater for the purposes of monitoring marine life, or other sound producing activities in the sea. Commonly used hydrophones are based on piezoelectric transducers. With the introduction of fiber optic mandrel hydrophones, many drawbacks seen in piezoelectric hydrophones has been eliminated.

It is essential to design a fiber optic hydrophone with required performance parameters like sensitivity, acoustic receiving bandwidth and minimum vibration response. Minimizing the acceleration sensitivity and maximizing acoustic sensitivity are the major aims of the research work. To achieve an optimum design, FEM analysis using COMSOL Multiphysics® was used. This project requires acoustic and structural mechanics modules. At first the hydrophone geometry was created using structural mechanics module, both the Eigen frequency and frequency domain analysis were done. The materials and the dimensions are optimized using different analyses. Finally, hydrophone with the optimized design is studied using the acoustic module and the performance parameters are calculated with acoustic - structure interaction study. An acoustic sensitivity of -155 dB re V/µPa was achieved with the present study. With the help of COMSOL®, we were able to analyze the performance of hydrophones for different dimensions and materials before fabricating the structure.

Figures used in the abstract

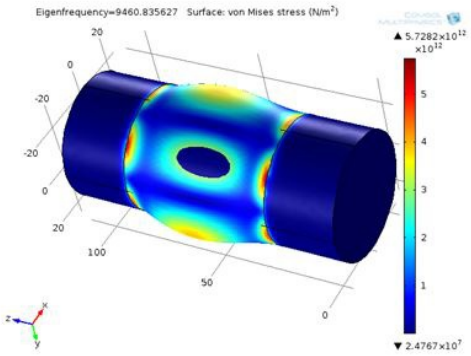

Figure 1: Fig.1 Shows first resonance mode when the two ends of the hydrophones are fixed