Acoustic - Structure Interaction Studies of Fiber Optic Mandrel Hydrophone using COMSOL Multiphysics®

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INTRODUCTION

- Optical fiber sensors (OFS) operate by modifying one or more properties of light.

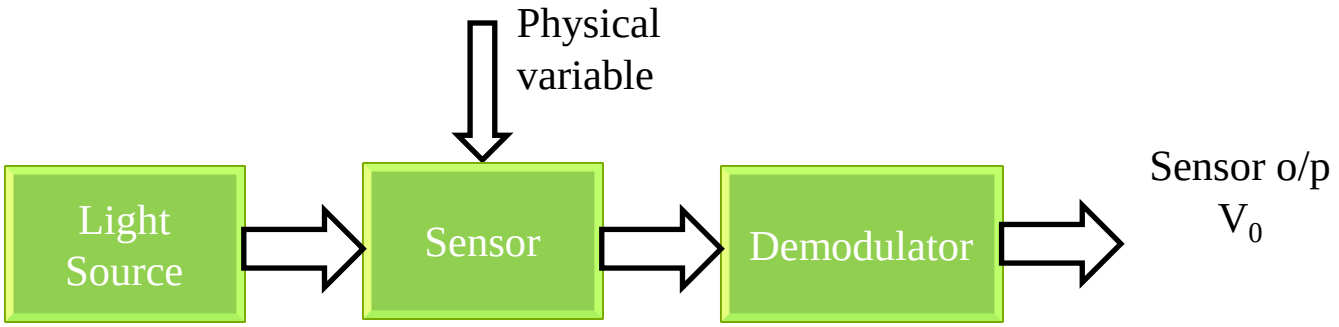

Fig. 1 Basic scheme of fiber optic sensors

HYDROPHONE

- A **hydrophone** is a microphone designed to be used underwater for recording or listening to underwater sound.
- Fiber Mandrel Sensor consists of a single mode fiber wound over a drum or hollow shell as mandrel.

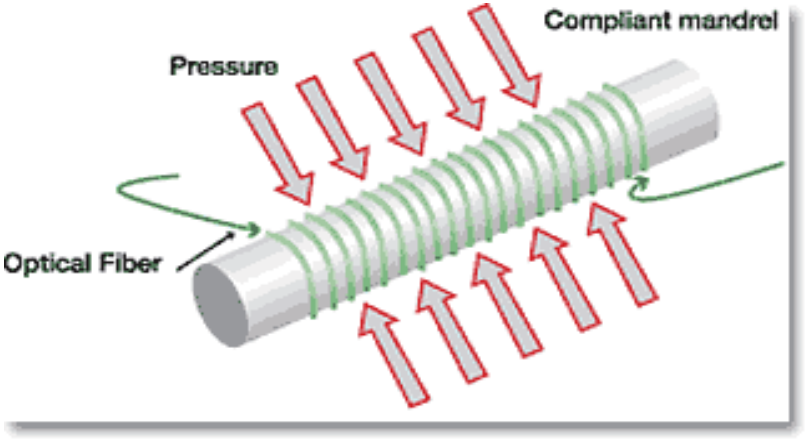

Fig. 2 A typical passive underwater fiber sensor

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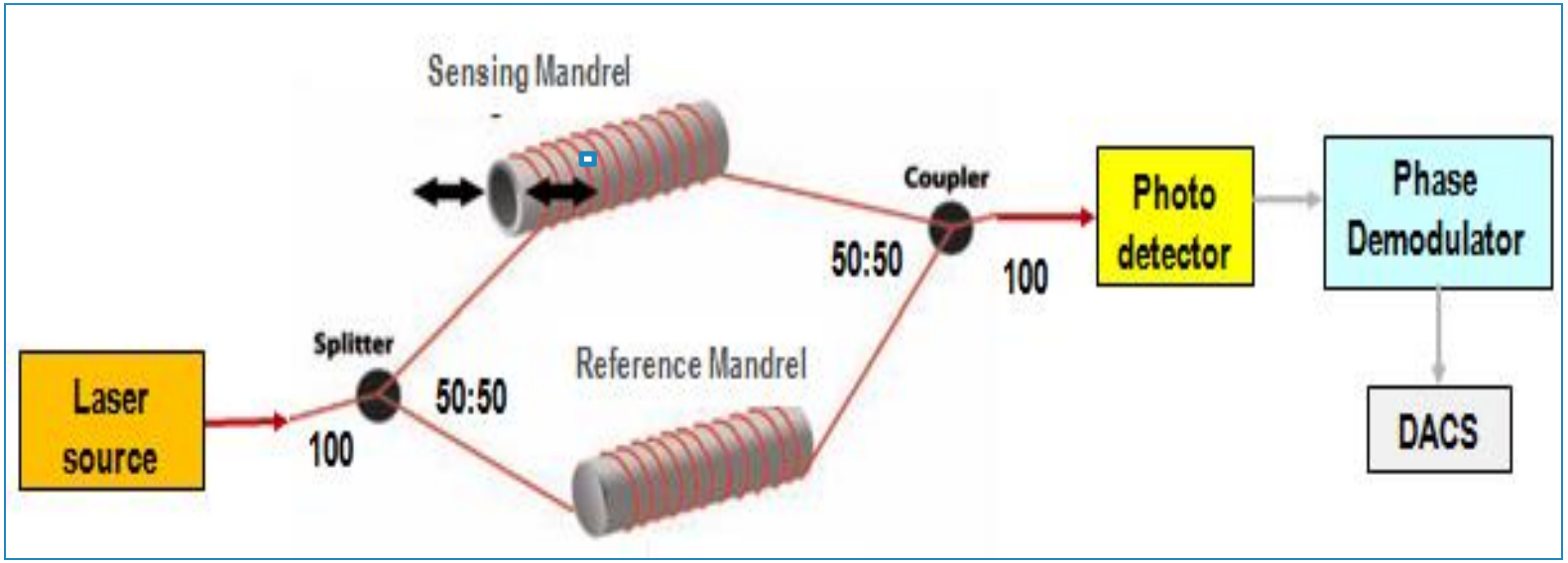


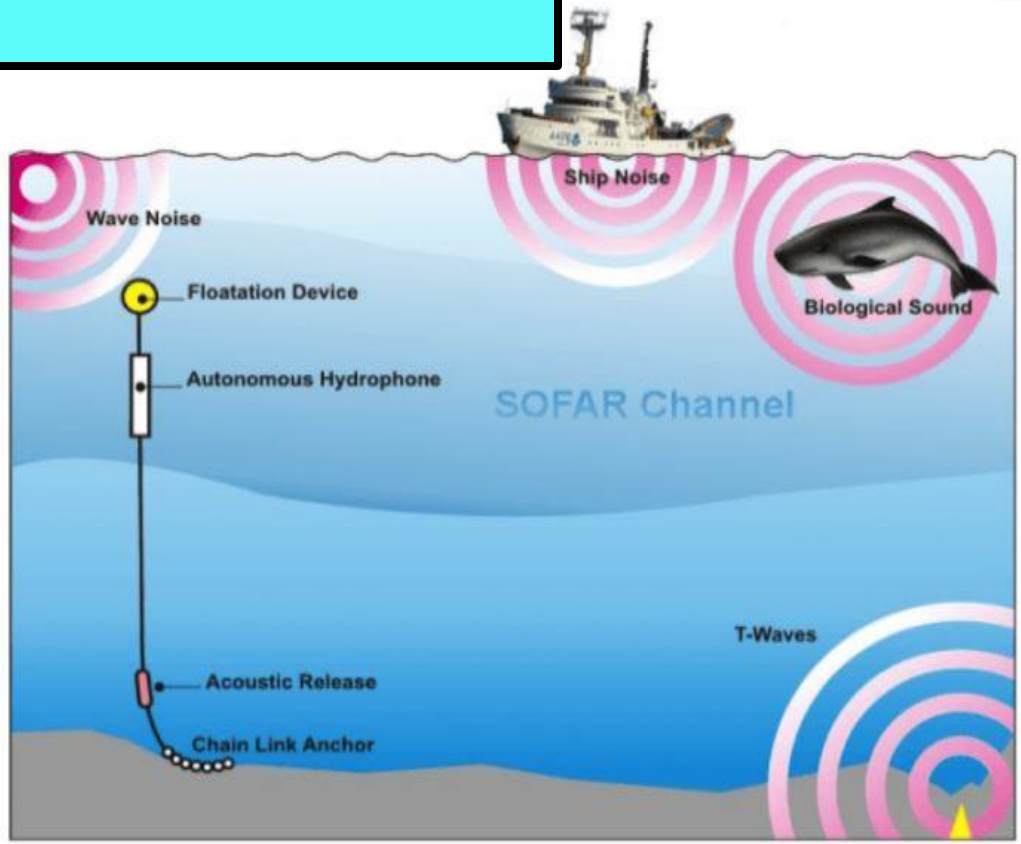
Fig. 3 Working of fiber mandrel hydrophone

Applications

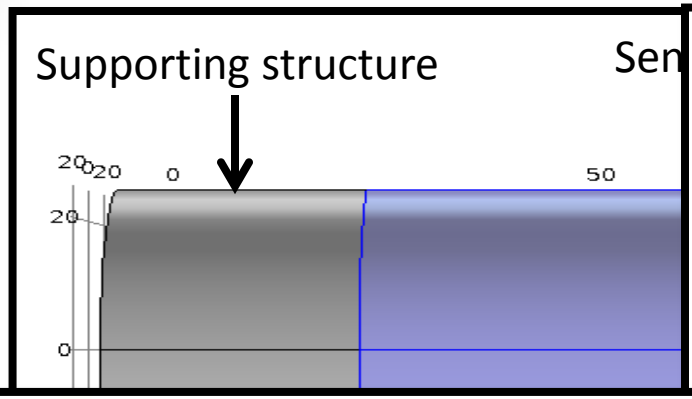
- Military
- Tracking of mammals
- Detection of shock waves reflected by the sea bed
- Detection of hadronic shower
- Seismic sensing

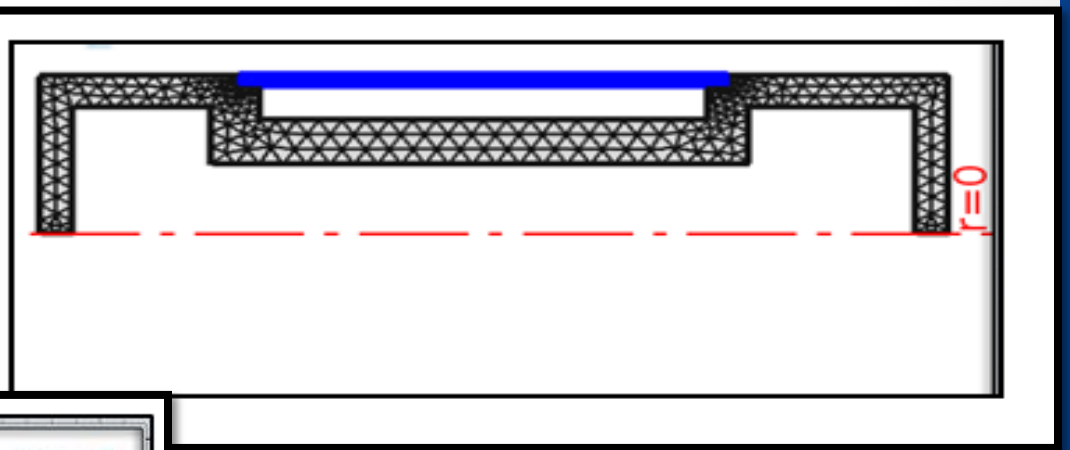
Current interest

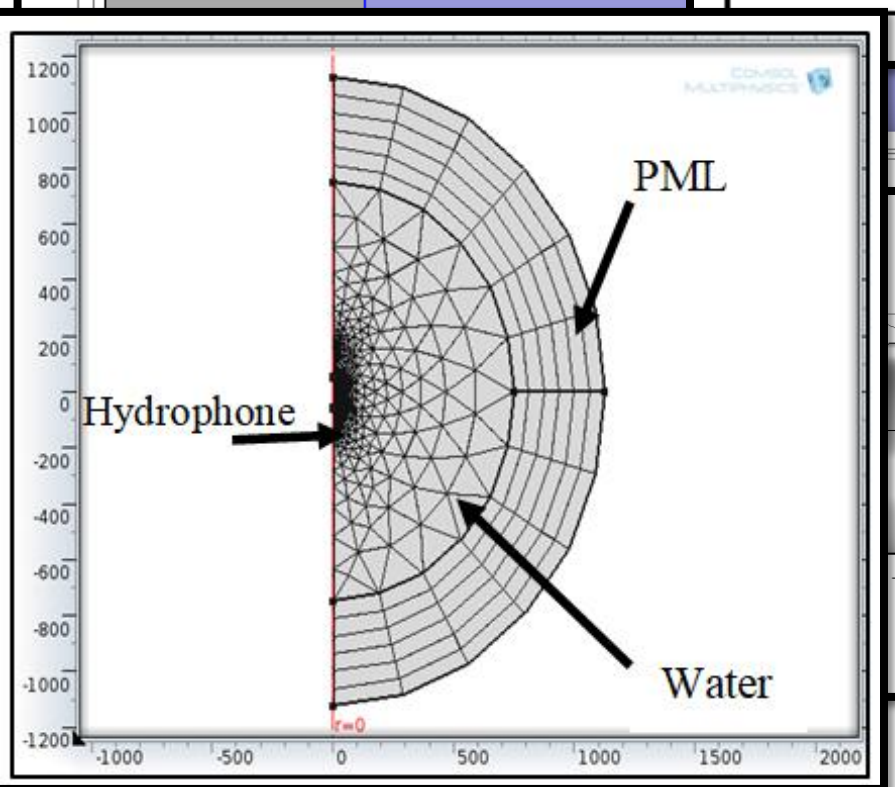
- Fiber Optic Hydrophone with bandwidth (5 kHz)
- Pressure Detection (a few hundreds of µPa)

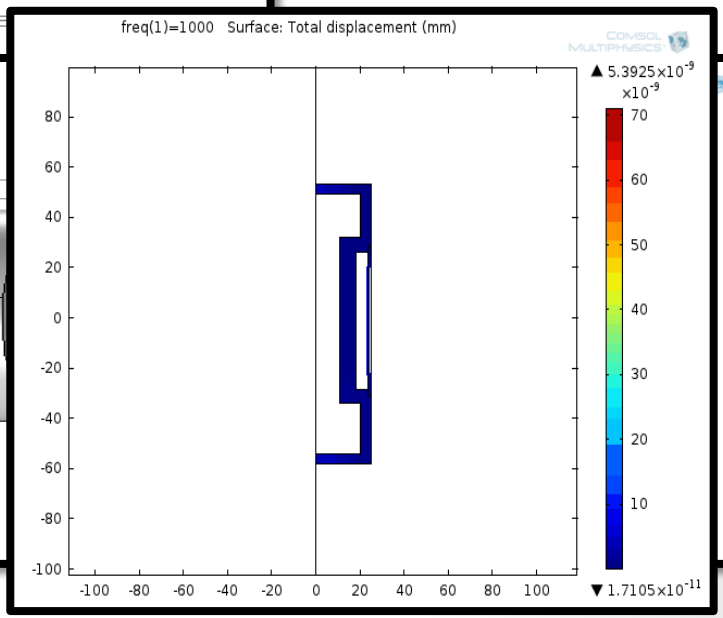


FEM Analysis of Hydrophone









FEM Results

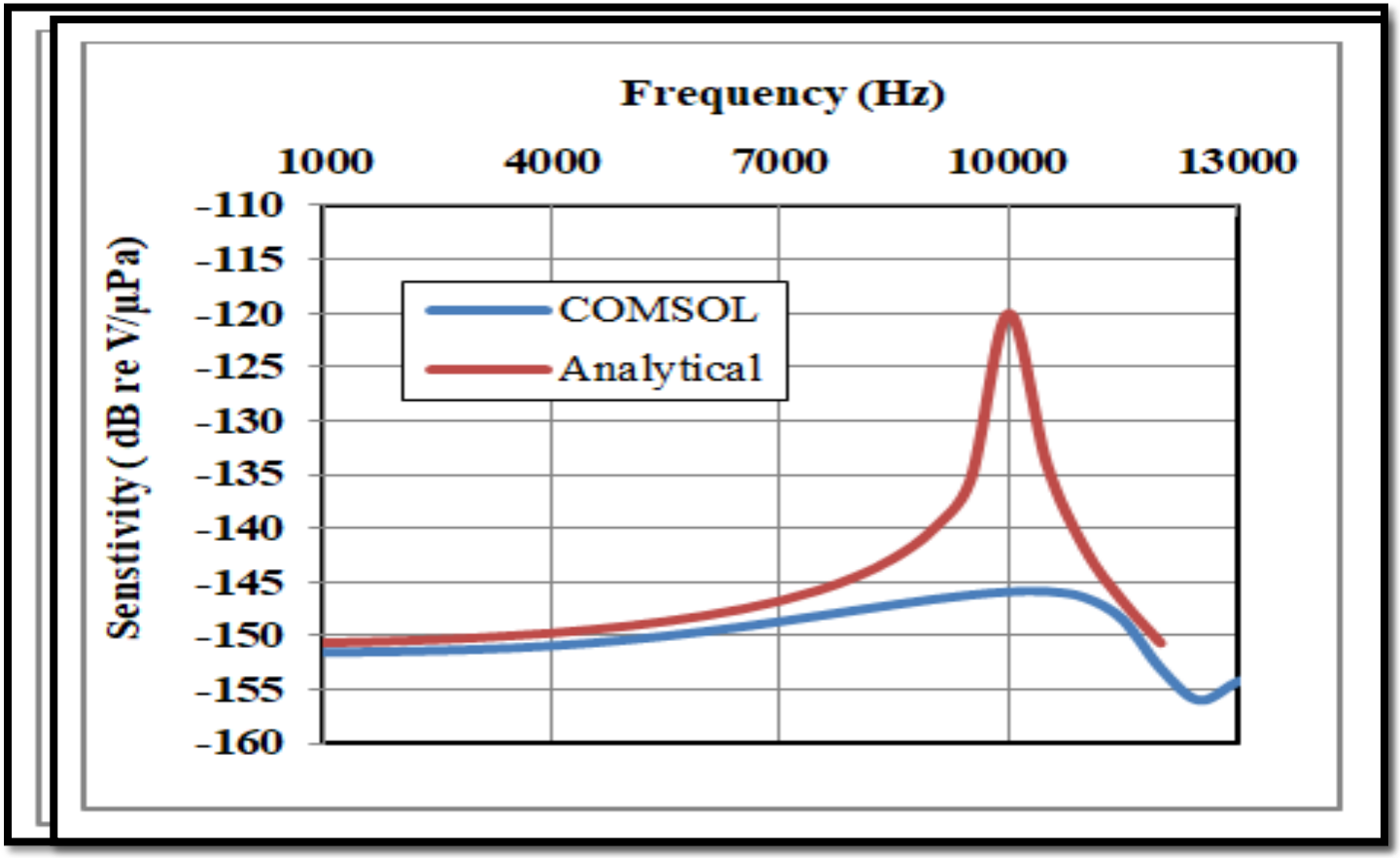


Fig. 5 Comparison of Analytical and COMSOL results

Fig. 4 Radial displacement of the hydrophone

CONCLUSION

- Analytical model result agrees with the numerical solution from COMSOL Multiphysics within a frequency range of 1 - 13 kHz.
- Radial displacement of 4 pm was obtained which corresponds to an acoustic sensitivity of -151.5 dB re 1V/µPa (1 kHz).

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THANK YOU