
Calibration and characterization of the ELVIS hydrophones

Andreas Blixt & Patrik Öhlin

Department of Measurement Technology and Industrial Electrical Engineering, LTH

When using a measurement system it is of great importance to know that the measured data is correct. Many types of sensors will respond differently for different frequencies and this is why calibration is needed.

Calibration today

Calibration is fundamental for accurate measurements and to eliminate systematic errors. Systematic errors may occur during fabrication or over time, more commonly it is caused by damage or interference from the environment, for example temperature. This makes continuous calibration necessary with the industrial standards being once a year, it is a balance of cost and accuracy. Most of the time, a calibration requires an already calibrated reference. To calibrate an already operating system, some modifications usually has to be made. A system like this is ELVIS.

What is ELVIS?

ELVIS is an abbreviation for EchoLocation Visualization and Interface System. It is a measurement system used to study the echolocation beam of marine animals, such as dolphins. To do this, ELVIS uses an array of 47 hydrophones. Every single hydrophone measures one million times each second which results in huge amounts of data. This is necessary to make the measurements accurate. The hydrophones used by ELVIS were not calibrated and because of this, the data can not be fully trusted.

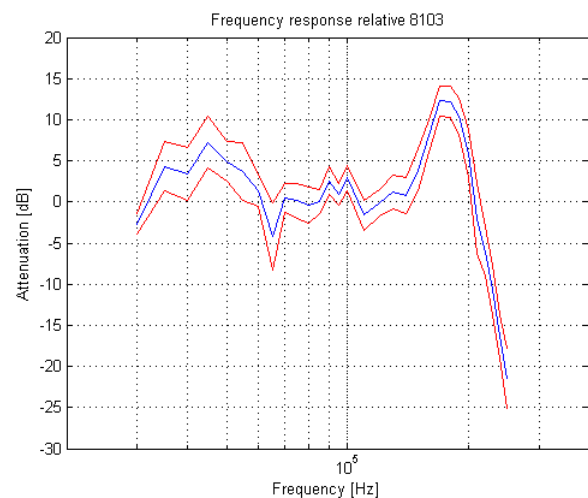
Calibrating the hydrophones

The method chosen is called calibration by comparison. The idea is to measure the same signal with

both the hydrophone you want calibrated and with an already calibrated hydrophone. By using a calibrated hydrophone you can know what signal the uncalibrated one picked up and by comparing this to the actual response you can determine the frequency behaviour. The hydrophone chosen as reference is Brüel & Kjær type 8103.

Conclusion

The graph below shows the results of the calibration. The blue line is the mean value from all the hydrophones and the red lines shows the standard deviation of the measurements.



The conclusion is that they perform very well compared to each other. There are two resonances present, one around 45 kHz and one at 170 kHz. After 200 kHz the performance drops drastically and around 65 kHz there is a slight performance drop as well. This method demands a lot from the reference and this is the largest error in our results and therefore no absolute results can be presented.
