AQUABAND

WHISPER
White Spectral Reformation

www.aqua-band.com

Technical Note

Shortcomings of Acoustic Transducers

Frequency Selective Response

Underwater acoustic transducers have frequency-selective Transmit Voltage Responses (TVRs) that typically have bell-shaped curves. Therefore, an underwater transducer has a large gain at frequencies close to the resonant but the gain rolls of quickly moving away from the resonant frequency.

This forces the sonar and acoustic communication systems designers to use only small fractions of bandwidth on and near the resonant, so that their signals are not distorted by the frequency-selectivity of their transducers.

It would be ideal, however, to be able to use much larger bandwidths without distortion in sonar systems for much higher resolution&accuracy. Likewise, for underwater communications, using a larger bandwidth enables higher connection speeds.

Our Solution

WHISPER: Digital Transducer Control

We addressed this fundamental limitation of acoustic transducers by developing WHISPER.
WHISPER turns acoustic transducers into broadband projectors with a perfectly flat TVR. WHISPER differentiates itself in its ability NOT to rely on a parameterized fixed digital filter. WHISPER optimizes itself based on the transducer TVR and the bandwidth and the pulse type&duration the user needs.

Therefore WHISPER produces a unique, optimum result for each transducer/bandwidth/pulse/waveform combination.

Thanks to its low computational cost, WHISPER app can be installed on any computer (*including Single Board Computers as Raspberry Pi*), under WINDOWS or Linux,

Users can also take advantage of the built-in waveform library for most commonly used sonar waveforms.

Demo

Instructions/Explanation

A demo of the WHISPER app is available on https://www.aqua-band.com/?name=Whisper
In this demo, the user chooses to send a chirp waveform under the water either for sonar or communications by selecting a waveform type from the drop down menu.

Then they manually set the transmission bandwidth between 9KHz and 25KHz. They can also adjust the Source Pressure, Burst Duration, the Number of Bursts and Inter-Burst Pauses (if any).

Thereafter they choose a transducer from the built-in transducer library, and the generate and play a pre-whitened wavefile.

On the top-left image, the inverse of the transducer TVR is displayed. On the top-right, the spectrum of the waveform after transducer correction is displayed. As you can see, the waveform played under the water has now a perfectly flat spectrum rather than a bell-shaped one.

On the bottom figure, a sampled version of the waveform is displayed.

Customization

Tailored to Your Transducers

We build a transducer library customized for each user, based on the users' TVR measurements.
The TVR measurements can be sparsely sampled, as our software has a built-in optimum extrapolation feature.