Archivox Room Impulse Response Software 1.0

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1 Introduction

The first step to understanding the acoustic condition in a room is to measure an acoustic impulse response. This user interface for MATLAB™ allows for simple impulse response measurements with multiple channels of input and output through any sound interface with ASIO drivers on PC or Core Audio on Mac. The polar scan feature can also be used to measure loudspeaker directivity or diffusion coefficients of architectural wall panels.

2 Installation

Once all prerequisites are in place, installation is as simple as unzipping the package and placing the .m and .fig files in your MATLAB™ path.

3 Setup Options

Sample Freq. The sampling frequency is the rate at which audio data is collected. Higher sample frequencies facilitate more detailed time resolution, therefore higher frequencies can be resolved. Some sound cards only operate at specific sampling frequencies. e.g. 44100, 48000, 96000, 192000. Please check sound card documentation for compatibility.

Bit Depth This is the bit depth the output file will be saved in. Higher bit depths allow for greater dynamic range. 8, 16, 24, and 32 are common options. The default of 16 bits should be suitable for most purposes.

Signal Length This option controls the length of the output sine sweep. At a minimum this length must be longer than the reverberation time of the room. Increasing the length further will improve the signal to noise ratio of the recorded impulse response.

Low Frequency Limit This is the starting point of the output sine sweep. If your loudspeaker source is distorting at low frequencies these frequencies may be excluded to prevent damage to the loudspeaker.

High Frequency Limit This is the ending point of the output sine sweep. The maximum possible is equal to half of the sampling frequencies.

Averages This is the number of times the sine sweep will be repeated. Increasing the number of averages will increase the signal to noise ratio of the measurement but also increases the time required to collect it.

Device All of the properly installed audio devices on your system should show up in this drop down menu. Select the one that you would like to use and the maximum number of input and output channels will be displayed below. For some default sound devices the maximum channels will display as 0, this is a known bug to be corrected in a future release.

Out Channels Specify the number of channels you would like to output here. At this time the output channels will be the first consecutive channels up the the number specified. It is not currently possible to play only channel 3, for example. Multi-channel output is useful for testing speaker placement and coordination.

In Channels Specify the number of channels you would like to input here. At this time the output channels will be the first consecutive channels up the the number specified. It is not currently possible to record only channel 3, for example. Multi-channel input is useful for omni, figure-8, binaural measurements or for measuring multiple listening positions at once.

External Trigger An external trigger allows for precise timing of the arrival of the direct sound from the time the signal leaves the loudspeaker until the time it arrives at the microphone. Enabling the external trigger adds one more input channel and one more output channel. Placing a patch cable to loop the extra output to the extra input provides a timing queue to calculate the direct sound delay. Check sound card documentation to ensure that this procedure will not damage your sound card.

Polar Scan This option is used to measure speaker directivity or diffusion coefficients. See instructions below for more information.

Resolution Set the degree resolution of the polar scan measurements here. See instructions below for more information.

Go! Begins the measurement.

Save Writes a .wav file to the location of your choice.

4 Room Impulse Response Measurements

Room impulse response measurements can be conducted by placing a loudspeaker and microphone in positions appropriate to the use of the room. Preferably, the source should be the actual loudspeaker that will be employed when the room is in use or a source that emulates the actual source. Omni-directional sources, like dodecahedral loudspeakers are often used to simulate music ensembles or other natural sources. The receiver should be placed at a representative listening position, or in the case of large seating areas, many measurements throughout the listener area should be taken. Impulses collected with this software can be saved for future analysis or for making auralizations of the space. See ISO standard 3382 for more information.

5 Polar Scan Measurements

Polar scan measurements are initiated by placing the microphone in the first position on a measurement arc and pressing "Go!." When the first measurement is complete the microphone is moved the number of degrees specified in the "Resolution" box and the next measurement is taken by pressing go until the arc is complete. To measure loudspeaker directivity the loudspeaker must be placed in the center of a large empty room such that the first reflection from any surface arrives substantially after the direct sound. The signal can then be cropped to include only the direct sound. The relative magnitude of the direct sound in each direction composes the directivity of the loudspeaker. If a measurement is interrupted or fails for any reason the "Go back" button allows repeating previous positions. When all measurements have been collected the "Save" button will write a multi-channel .wav file to the location of your choice. See AES standard AES-4id-2001 for more information on diffusion coefficient measurements.