

# Accurate Sound Reproduction Using DSP Addendum

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## Title

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Accurate Sound Reproduction Using DSP Addendum

## Copyright

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Addendum to [Accurate Sound Reproduction using DSP](#)  
ISBN 9781520977904

## Note to Readers

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This addendum is for readers who have purchased the paperback edition and wish to have an electronic copy of the hyperlinks. With over 200 hyperlinks, there is no easy way to include the link addresses in the paperback edition. Some hyperlink addresses are long, and with the number of links, typing them out manually is not practical.

I can be reached through a variety of user groups and forums. The two I most frequent are:

[Computer Audiophile](#)

[diyAudio](#)

I hope you enjoy the link content.

Kind regards,

Mitch

## Acknowledgements

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[Acourate software](#)

[Acourate user group](#)

[Acoustic and Psychoacoustic Issues in Room Correction](#)

[Archimago](#)

## Hardware and Software Requirements

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[Finite Impulse Response \(FIR\)](#)

[convolution](#)

[Acourate](#)

[ASIO](#)

[ASIO4ALL](#)

[JRiver Media Center](#)

[convolution engine](#)

[digital volume control](#)

[Room Eq Wizard](#)

[setup and interconnects for the measurement chain](#)

[Calibrated measurement microphone](#)

[Cross Spectrum Labs](#)

[Earthworks](#)

[phantom power](#)

[Lynx Hilo](#)

[Virtual Audio Cable](#)

[noise exposure limits](#)

[CM-170 sound level meter](#)

[Sound System Interconnection guide](#)

## 1. Introduction to Accurate Sound Reproduction

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[Finite Impulse Response \(FIR\)](#)

[convolution](#)

[Finite Impulse Response](#)

[loudspeaker design](#)

[room acoustics](#)

[psychoacoustics](#)

[audio DSP](#)

[\*The Scientist and Engineer's Guide to Digital Signal Processing\*](#)

### a. Accurate Sound Reproduction

[linear response](#)

[transfer function](#)

[Step Response](#)

[Step Response](#)

[LEDE recording studios](#)

[The LEDE- Concept for the Control of Acoustic and Psychoacoustic Parameters in Recording Control Rooms](#)

[Haas effect or Precedence effect or law of the first wavefront](#)

[time aligned](#)

[Mixing down](#)

[stereo microphone techniques](#)

[mastering](#)

[stereo enhancement](#)

[Sabine](#)

[TEF computer](#)

[The Best Room Kits](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[ears frequency response changes with sound pressure level](#)

[ears' overall frequency response is the flattest \(i.e. 80 to 90 dB SPL\)](#)

## **b. Recommended Target Responses**

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[Relevant loudspeaker tests in studios in Hi-Fi dealers' demo rooms in the home etc. using 1/3 octave, pink-weighted, random noise](#)

[Recommendation ITU-R BS.1116-3 \(02/2015\) Methods for the subjective assessment of small impairments in audio systems](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[The Subjective and Objective Evaluation of Room Correction Products](#)

[Presentation download](#)

[The Measurement and Calibration of Sound Reproducing Systems](#)

[Bob Katz](#)

[Few consumer loudspeakers are time aligned](#)

[Blauert & Laws](#)

[Directivity in Loudspeaker Systems](#)

[timbre](#)

[masked by the noise level itself](#)

## **2. Quick Start Guide - Basic Loudspeaker and Room Correction**

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[Figure 4, Typical layout of stereo listening arrangement](#)

[Dolby's 5.1 Channel Production Guidelines](#)

[Recommendation ITU-R BS.775-1 Multichannel stereophonic sound system with and without accompanying picture](#)

### **a. Importing Microphone Calibration File**

### **b. Setting up Microphone at Listening Position**

### **c. LogSweep Measurement**

### **d. Amplitude Preparation**

### **e. Target Curve Design**

### **f. Inversion**

### **g. Filter Generation**

### **h. Test Convolution**

### **i. FilterGen TestConvo Iteration**

[see this article](#)

### **j. Filter Installation**

[Convolution Engine](#)

[Config Files](#)

[config examples](#)

[Section 2](#)

## **k. Listening Impressions**

[AudioCheck.net](#)

[Bob Katz's](#)

[\*Mastering Audio: The Art and the Science\*](#)

[Volume Leveling](#)

[Loudness Range: A Measure To Supplement EBU R 128 Loudness Normalization](#)

[few loudspeakers on the market that are actually time coherent](#)

[Listening Environment Diagnostic Recording \(LEDR\)](#)

[JRiver's WDM driver](#)

[Stereo Perception and Sound Localization](#)

[Stereo Perception and Sound Localization](#)

[commercial test recordings](#)

[Audacity](#)

[timbre](#)

[fairly acute](#)

## **3. Understanding Acoustic Measurements and Target Responses**

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### **a. Acoustics and Psychoacoustics of Room Correction**

[Acoustic and Psychoacoustic Issues in Room Correction](#)

[Power Point presentation](#)

[directivity](#)

[Directivity in Loudspeaker Systems](#)

[the law of the first wavefront or first arrival or the Haas effect](#)

[The HAAS Effect! Demonstration \(use headphones\)](#)

[Lexicon unit](#)

[David Griesinger](#)

[a DSP processor](#)

[A 20 Hz frequency has a time period or cycle time of 50 ms](#)

## **b. Frequency Response**

[Relevant loudspeaker tests in studios in Hi-Fi dealers' demo rooms in the home etc. using 1/3 octave, pink-weighted, random noise](#)

[Recommendation ITU-R BS.1116-3 \(02/2015\) Methods for the subjective assessment of small impairments in audio systems](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[The Subjective and Objective Evaluation of Room Correction Products](#)

[Presentation download](#)

[The Measurement and Calibration of Sound Reproducing Systems](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[Fun with Digital Audio - Bit Perfect Audibility Testing](#)

## **c. Step Response**

[timbre](#)

[stereo imaging](#)

[heavily weighted towards high frequencies](#)

[Figure 12](#)

[this PDF document](#)

[demonstrated in the video](#)

## **d. Group Delay**

[Minimum Phase and Time Delay](#)

[Blauert, J.; Laws, P. \(May 1978\), "Group Delay Distortions in Electroacoustical Systems", Journal of the Acoustical Society of America 63 \(5\): 1478–1483](#)

[Some observations on Group Delay and how to minimize it's effects in a vented design](#)



## **e. Energy Time Curve (ETC)**

[precedence effect](#)

[Haas effect demo](#)

[Acoustics and Psychoacoustics Applied - Part 1: Listening room design](#)

[close-up view of the chart](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[the law of the first wavefront](#)

## **f. Reverberation Time**

[Reverberation](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[JohnM's post here](#)

[STC and sound absorption results](#)

[Sabine equations](#)

## **g. Polar Response (Loudspeaker Directivity)**

[loudspeaker's directivity](#)

[Speaker directivity / off-axis response: theory and measurement techniques](#)

[Linkwitz Riley Crossovers: A Primer](#)

[Loudspeaker Measurements Polar Response/Dispersion](#)

[Danley Sound Labs](#)

[consumer loudspeakers](#)

[diyAudio aficionados](#)

[home theater monsters](#)

[studio monitors](#)

[Bruno Putzeys' kii III](#)

[B&O's BeoLab 90](#)

[Dr. Earl Geddes](#)

[Directivity in Loudspeaker Systems](#)

[Summa loudspeaker](#)

[Listening conditions for the assessment of sound programme material: monophonic and two-channel stereophonic](#)

[How to do PolarMap measurements](#)

## **h. Interaural Coherence Coefficient (IACC)**

[Blauert](#)

[Braasch](#)

[Griesinger](#)

## **i. Revisiting Quick Start Guide**

# **4. Advanced Digital Loudspeaker and Room Correction**

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[bi-amping](#)

[tri-amping](#)

## **a. Digital Crossover (XO)**

[Thoughts on Crossovers](#)

[Minimum phase](#)

[Horbach-Keele](#)

[Parts Express](#)

[speaker crimp connectors](#)

[diyAudio](#)

[Dirac](#)

[PDF document](#)

[Stereophile](#)

[diyAudio](#)

## **b. Loudspeaker Driver Linearization**

[BMS 4540ND](#)

[QSC waveguide](#)

[Advanced Accurate Digital XO Time Alignment Driver Linearization Walkthrough](#)  
[requires](#)

### **c. Time Alignment**

[Accurate Forum](#)

### **d. Fine-Tuning Techniques**

## **5. Acoustic Measurement Techniques**

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### **a. Measuring Room Noise Floor**

[Download](#)

[Checking Levels](#)

[Calibrating the Soundcard](#)

[Calibrating the SPL Reading](#)

[NC level is a standard](#)

### **b. Performing Loopback Measurements**

[JRiver is transparent](#)

[Virtual Audio Cable](#)

[VB Audio Cable](#)

[REW's Signal Generator](#)

[JRiver's 64-bit internal volume control](#)

[my own measurements and listening tests](#)

[convolver text configuration file](#)

[example configurations](#)

[REW's pink noise generator](#)

[RTL Utility](#)

[JRiver](#)

[Acourate](#)

[REW](#)

## **c. Beamforming Measurement Technique**

[Quasi-Anechoic Measurement of Loudspeakers Using Beamforming Method](#)

## **d. Filter Design Verification**

[Acoustics and Psychoacoustics Issues with Room Correction](#)

[REW's On-line Help](#)

## **6. Conclusion**

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## **About the Author**

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[DIY today](#)

[sometimes produced](#)

[Computer Audiophile](#)

[Acourate user group](#)

[JRiver Interact](#)

[REW forum](#)

[diyAudio](#)

[hydrogenaudio](#)