Course 320 - Sound System Design - Direct Field

320-10 Listen - Measure - Predict

The human auditory system is the most powerful tool in existence for evaluating the performance of a sound system or the room. As powerful as it is, it has two major short comings. It is neither calibrated nor consistent. Acoustic measurements add an objective element to the subjective process of listening. In addition to measuring and listening, sound system designers must be able to predict the performance of the system at the drawing board. This is possibly the most challenging task of all. In this lesson, I will do a fly over of the entire process before we drill down into the details.

Three videos covering the following topics

1. Introduction
2. A System Design Process
3. On-site Evaluation
4. The Room Impulse Response - RIR
5. Sculpting the RIR
6. Listening by Convolution
7. Classical Methods vs. Room Modeling
8. The Most Important Tool is You!
9. Conclusion

320-20 Sound Fields

All rooms produce reflections of the sound made in them. In the lesson, I will cover the various sound fields that are produced when a source excites a room. This is the core information for working in the field of acoustics.

Three videos covering the following topics

1. It’s About Time
2. Room Acoustics
3. The Impulse Response
4. Post-Processing the RIR
5. Sound Absorption
6. Sound Scattering
7. Wave Behavior
8. The Direct Field
9. Very Early Reflections
10. Early Reflections
11. Late Reflections

12. Reverberation
13. Conclusion

320-25 Acoustic Measures

Now that I presented the various sound fields that occur in rooms. It's time to put some numbers to it. By quantifying parts of the room response with numbers we can manipulate their interactions mathematically.

Three videos covering the following topics

1. Introduction
2. The Schroeder Curve
3. Reverberation Time - T30
4. Reverberation Characteristics
5. Early-Decay Time - EDT
6. Clarity
7. Measurement Software
8. Conclusion

320-30 Small Room Acoustics

When discussing room size, physical dimensions naturally comes to mind. In the field of acoustics, the physical dimension determine the behavior of reflected sound. In this lesson, I will present and differentiate between the two types of sound wave behavior and show you how to determine which is the dominate behavior base on the physical size of the room.

Three videos covering the following topics

1. "Acoustic" Size
2. Room Mode Detection
3. Mode Anatomy
4. Acoustic Zones
5. A Matter of Scale
6. A Simpler Approach
7. Room Mode Calculation
8. Observations
9. General Workflow for Small Rooms

320-40 Large Room Acoustics

From an acoustical perspective, sound behavior in physically large spaces is actually easier to qualified than in physically small environments. Most rooms that need sound systems are acoustically large. In this lesson, I will treat the sound as a ray applying optical principles to it prorogation.

Three videos covering the following topics

1. Overview
2. Distance Variables and Initial Assumptions
3. What is a "Large" Room?
4. Hopkins-Stryker
5. N-Factor
6. A More Useful Form
7. Examining the Variables
8. Additional Modifiers
9. The Equation in Motion - L_D
10. The Equation in Motion - L_R
11. Critical Distance - D_C
12. Intelligent Compromise

320-50 Speech Intelligibility

It's easy to produce sound in a room, just interconnect some audio gear and turn it on. What is not easy is exciting the room in such a way, that the information carried by the sound waves is preserved at all listener positions. In this lessons, I will present some mathematical tools for estimating how well the information is preserved by the room sound system combination.

Six videos covering the following topics

1. Introduction
2. Speech Intelligibility
3. The Signal Chain
4. The Talkbox
5. Speech System Requirements
6. Level-Dependent Masking
7. Speech Intelligibility Measures
8. Speech Signal Characteristics
9. A Modulation Example
10. Speech Transmission Index
11. Direct vs. Indirect Method
12. Conclusion

320-55 RIR Collection and Processing

You've been asked to measure the acoustics of the room. What do you measure? Where do you measure? Fortunately, most of the information that we seek is contained in the Room Impulse Response (RIR). There are various ways to collect and analyze it. I will present the ones I use most in this lesson.

2 videos

320-60 Merging Measurement and Modeling

Everything we have learned about acoustic measurements can be executed in room modeling software. You can think of a modeling program as a virtual measurement system. Mastering these programs is not trivial. You have to start with a basic knowledge of acoustics which you now have if you have completed the lessons. Now, I will show you how to merge measuring and modeling into a powerful sound system design process.

Three videos covering the following topics

1. Introduction
2. Sources
3. Microphones
4. A Backup Plan
5. Site Overview
6. Direct-to-Reverberant Demo
7. Measurement Position Selection
8. Placing the Microphone
9. The Data
10. STIPA Measurements
11. Advanced Techniques
12. Balloon Pop

One video covering the follow topics - Merging Measurement and Modeling

1. Overview
2. 3D Room Model
3. Place Source and Listeners
4. Refine the Model
5. Design the System
6. Conclusion

320-70 Case Studies

Congratulations for making it this far in the course. You may think you are nearly finish but now the real learning begins. Practice and repetition will make used of the tools I presented logical, fluent and intuitive. I have provided three case studies for your exploration. You can open the RIRs and process them yourself. Be sure to place them and the included studies in your learning library. They will a valuable asset as you continue horning your measurement, listening and prediction skills.