



## **Electroacoustic Measurements**

**April 24, 2017, Santa Clara, CA**

This course focuses on the fundamentals of electroacoustic measurements, including principles of acoustics, instrumentation, and data interpretation as well as practical information on how to perform appropriate tests. This course is intended for technical persons who are responsible for the acoustical performance of audio and electroacoustic products and audio, either in R&D or in Production. The course is appropriate for both novices and persons with some test and measurement experience. This training enables participants to perform accurate audio and electroacoustic tests and provides them with the necessary tools to understand and correctly interpret the results.

### **Class Outline**

#### **Introduction**

- Transducers & Reciprocity
- Subjective & Objective Tests
- Loudspeaker and Microphone Test Systems

#### **Basic Acoustics and Measuring Sound**

- Sound Pressure & Sound Pressure Level
- Wavelength & Frequency
- The Decibel and Working with Decibels
- Weighting Networks
- Detectors, and Time Constants

#### **Sound Sources and Sound Fields**

- Ideal Sources, Sound Radiation, and Sound Fields
- Transmission, Reflection and Diffraction
- Elementary Room Acoustics
- Anechoic Chambers and Reverb Rooms

#### **Psychoacoustics & Hearing**

- Frequency and Dynamic Range
- Masking & Critical Bands
- Directional Effects
- Anatomy of the Ear
- Detection and Signal Processing within the Ear
- Loudness & Hearing Loss

#### **Measurement Microphones**

- Principles of Operation
- Frequency & Dynamic Range
- Microphone Types, Selection and Applications
- Field Calibration

#### **Frequency Analysis**

- Signal Types
- Filters and Filter Analysis
- Confidence Limits, and Averaging Time
- The FFT
- Time Windows, Overlap & "Real Time" Analysis



### **System Analysis**

- Time & Frequency Domains
- Causal Linear Time-Invariant Systems
- Analysis Methods: Dual Channel FFT, MLS, TDS
- Stimulus Signals

### **Simulated Free Field Measurements**

- Sound Paths, Correlated and Uncorrelated Noise
- Quasi-Anechoic Test Methods
- Near Field Measurements
- Time Selective Techniques

### **Distortion & Non-Linearity**

- Non-Linear Systems & Distortion Order
- Distortion Audibility
- Transducer Defect Detection
- Harmonic, Intermodulation & Difference Frequency Distortion Tests
- Measurements of Band-Limited Systems
- Multi-Tone Distortion
- THD + N
- Signal-to-Noise Ratio and Non-Coherent Power
- Time Variance and Linearity Measures

**Instructor:** Christopher J. Struck, CEO & Chief Scientist – CJS Labs

**Cost:** \$495 (\$350 with Listen support contract)

### **Registration:**

Registration closes two weeks before the course. Late registration will be accepted based on available space. The seminar fee includes lunch, coffee breaks, and a complete materials package. Payment in U.S. Dollars only. Checks should be made out to Listen, Inc; Visa, Mastercard and AMEX are also accepted. A space is guaranteed once full payment has been received. Full refunds will be made for cancellations received no later than two weeks prior to the seminar. Listen, Inc. reserves the right to substitute instructors and to cancel this course in the event of insufficient registration.

### **Location:**

The training course will be held at The Embassy Suites, 2885 Lakeside Drive, Santa Clara, CA 95054. Course registration starts at 8:00 AM and the training course is 8:30 AM to 5:00 PM each day. Please contact the hotel directly at 408-496-6400 to reserve a room.