

## EASE Seminar – November 20<sup>th</sup> to 24<sup>th</sup> 2017, Berlin, Germany

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Language: English  
Hours: 09:00 - 17:00 (please be there at 08:45)

AFMG EASE Seminars are split into two levels with Level 1 (entry level) being aimed at users of EASE JR and engineers beginning modeling with EASE. The course covers all important elements of the main program. Basic general information on acoustics and sound system design are given during the course as well but are not the main focus. Level 2 continues seamlessly from Level 1, taking modeling with EASE to the advanced level. It is intended for EASE users with some experience or for the ones who want to start immediately with higher level projects including AURA and EARS modules.

### Agenda

#### Level 1, Day 1:

1. Introduction and overview
  - a. Class objectives *Establishing an understanding of theory, capabilities, limits and efficient use*
  - b. History and background of EASE
2. Concept of and need for acoustical simulation
  - a. What is simulation?
  - b. Why do we need simulation? *Feasible approach to predict rooms/systems behavior -vs- analytical methods*
  - c. Simulation techniques *Statistical, wave-based and ray-tracing*
3. Basic program modules and general settings
  - a. Main module
  - b. Room editor *Items, perspectives and data checking*
  - c. Database *Materials and speakers*
  - d. Eyes *Rendering, performing calculations and viewing results*
  - e. EARS *Auralization*
  - f. Room data settings *Statistics, reverberation, noise and power settings*
4. Constructing and closing room models *Hands-on Model*
  - a. EASE model items
    - i. Vertices *Coordinates*
    - ii. Faces *Boundary vertices, material, folds, coating*
    - iii. Audience areas *Boundary nodes, shift*
    - iv. Listener's seats *Coordinates, orientation*
  - b. Fast Entry methods
    - i. Prototypes
    - ii. Three-dimensional shapes *Cuboid, cylinder, cupola, pyramid, cone*
  - c. Potential causes and remedy of holes
5. Material database
  - a. Format of material data
    - i. Absorption coefficients
  - b. Adding new materials *Interpolation*
  - c. Using Excel
6. Reverberation time formulae and their limits
7. RT optimization *Employing EASE to find the right acoustical treatment Hands-on Model*

## Level 1, Day 2:

8. Adding loudspeakers *Hands-on Model*
  - a. Position
  - b. Aiming angles and convention
  - c. Model
  - d. Power settings and alternatives *Broadband pink noise or multi-tone signal*
9. Looking at the rendered model and first calculations in Standard Mapping *Hands-on Model*
  - a. Eyes settings and options
  - b. Views
    - i. Dyes *White, material, face, alpha, random*
    - ii. External
    - iii. Item
    - iv. Walker *Jumping/wandering inside the model*
  - c. Standard mapping
    - i. Settings *Patch, shadow, interference*
    - ii. Limits
  - d. Viewing Standard Mapping results
    - i. Map types *SPL, energy ratios, intelligibility*
    - ii. Frequency perspective
    - iii. Distribution
    - iv. STI options *Standard, male/female, STIPA, with/without noise and masking*
    - v. Exporting Standard Mapping results *Pictures and values*
10. Speaker database
  - a. Format of speaker data
    - i. Types of speaker data files *SPK, DLL and GLL*
    - ii. Attenuation table *Horizontal/vertical planes and interpolation*
  - b. Polar plots
  - c. Balloons
    - i. Interpretation of balloons
    - ii. Rendering balloons *Colored globes and shaped balloons*
    - iii. Phase balloons
  - d. Graphical representation of speaker data
    - i. Sensitivity
    - ii. Directivity index
    - iii. Frequency response
  - e. Speaker cases
11. GLL Modeled Speakers
  - a. Shortcomings of other methods *Configurable arrays, multi-way loudspeakers, ...*
  - b. Advantages of the GLL solution
12. Line array simulation in EASE
  - a. What are line arrays?
    - i. Concept *Cylindrical radiation*
    - ii. Advantages versus conventional loudspeakers *Coverage, spreading loss, steerability...*
  - b. Modeling line arrays in EASE
    - i. Near/far field considerations
    - ii. Balloons of line arrays *Disc-shaped balloons*
    - iii. Use of DLL files *Embedded programs for configuring arrays*
13. Demonstration – Loudspeaker behavior outdoors and in a room – interference and acoustic coupling.
14. Auralisation of direct sound from Standard Mapping *Hands-on Model*

Level 1, Day 3:

15. Auralisation of direct sound from Standard Mapping Hands-on Model
  - a. Probe with direct sound Arrivals level and delay
  - b. Using auralization of direct arrivals to check echoes
16. Advanced functions for faster and more efficient room modeling *Hands-on Model*
  - a. Objects
    - i. Definition *Items, reference point and angle*
    - ii. Advantages of using Objects *Group actions*
  - b. Tables
    - i. Different types of Tables
    - ii. Advantages of using Tables *Group actions*
17. Import/export functions
  - a. Advantages of using AutoCad *Using architectural drawings, curved and non- uniform surfaces*
  - b. 3D polylines and 3D faces
  - c. Examples
18. Presentation utilizing Vision *Hands-on Model*
  - a. Face texture
  - b. Lamps
  - c. Methods of rendering in EASE Vision
    - i. Ray tracing
    - ii. Scanline
    - iii. OpenGL Texture Map
    - iv. OpenGL Simple Map
  - d. 16.04 Perspective views
    - i. External
    - ii. Item
    - iii. Walker
19. Case study – typical problems in modeling and optimizing a sound system in a room

Level 2, Day 1:

20. Overview *Highlights on basic topics for advanced users starting with Level 2*
  - a. Room entry
  - b. Materials and speakers
  - c. Mapping
21. Scattering coefficients
22. GLL modeled speakers
  - a. Shortcomings of other methods *Configurable arrays, multi-way loudspeakers ...*
  - b. Advantages of the GLL solution
23. Loudspeaker clusters and arrays
  - a. Clusters
    - i. Building clusters *Reference point/angle and calculation method*
    - ii. Using clusters *Individual components embedded in the cluster*
  - b. Arrays
    - i. Building arrays
    - ii. Using Arrays *Individual components still accessible*
  - c. Clusters versus arrays
24. Ray tracing fundamentals
  - a. Motives and limits of ray tracing
  - b. Sound particles *Separability principle*
  - c. Concept
    - i. Classical ray tracing
    - ii. Mirror image method
    - iii. Hybrid method
  - d. Modeling of sources
    - i. Frequency dependence
    - ii. Space-angle dependence
  - e. Modeling of boundaries
    - i. Geometry
    - ii. Absorption
    - iii. Scattering
  - f. Modeling of medium
    - i. Spreading loss
    - ii. Air absorption
  - g. Modeling of receivers
25. Raytracing impacts *Hands-on Model*
  - a. Concept and limits
  - b. Cut-off settings
    - i. Number of rays
    - ii. Travelling time
    - iii. Order
    - iv. Loss
  - c. Analysis in probe
    - i. Reflectogram
    - ii. Impulse response and ETC
    - iii. Waterfall view
    - iv. Hedgehog view
    - v. Reverberation time
    - vi. Energy ratios

- 26. AURA mapping / AURA response *Hands-on Model*
  - a. AURA versus classical ray tracing impacts
  - b. Calculation settings
    - i. Patch size
    - ii. Number of particles
    - iii. Length
    - iv. Maximum diameter after 1s
    - v. Diffuse rain
  - c. AURA Mapping results
    - i. Histogram and validity of calculations
    - ii. Maps
    - iii. Frequency and distribution perspectives
    - iv. STI options
    - v. File info
    - vi. Exporting results
  - d. Echograms versus reflectograms

Level 2, Day 2:

- 27. Auralization theory and procedure
  - a. Binaural hearing and HRTF
  - b. Impulse response and convolution
- 28. EARS Hands-on Model
  - a. File formats
    - i. RSP files
    - ii. BIR files
    - iii. WAV files
  - b. HRTF balloons
  - c. Auralization
    - i. Convolver type
    - ii. FIR
    - iii. Input and output
  - d. Auralization of stereo systems
- 29. Accuracy/calculation-time trade-off for different calculation methods *Hands-on Model*
  - a. Discussion of the hands-on example results
- 30. Exporting results from EASE to measurement programs (EASERA) for direct comparison of measurement and simulation
- 31. Case study – typical problems in modeling and optimizing a sound system in a room