

LECTURE INVITATION

Sound Quality of Audio Systems – Modelling, Measurement and Control

The University course will be presented as a block seminar

Presented by:	Prof. Dr. Wolfgang Klippel Institute of Acoustics and Speech Communication, Dresden University of Technology, Germany
Date:	March 23th to 25th, 2015 9:00 a.m. – 5:00 p.m.
Location:	Dresden University of Technology Barkhausenbau, Room 205 Helmholtzstraße 18 01069 Dresden, Germany
Language:	English

ABSTRACT:

The lecture addresses the evaluation of sound reproduction systems using physical and perceptual measurement techniques. The generation of signal distortion is modelled by linear, nonlinear and time-variant systems with lumped and distributed parameters. New measurement techniques based on those models are presented using test signals and music as well. The course makes the relationship between symptoms and physical causes of the distortion more transparent and discusses the impact on the perceived sound quality by combining listening tests, auralization techniques with physical methods. This knowledge is important for defining target performance, designing small, light and cost-effective loudspeakers reproducing the sound at high efficiency and sufficient sound quality and for quality control in manufacturing. The new methods and diagnostic tools are illustrated on loudspeakers used in telecommunication, automotive, multi-media and professional applications. The lecture is supplemented by practical sections giving each participant further opportunities for learning by doing.



CONTENT:

NEW TOPICS ADDRESSED THIS YEAR:

- Nonlinear distortion generated by break-up modes
- Physical causes rocking modes and remedies
- Comprehensive evaluation of active loudspeaker systems
- Designing green speakers providing more output with higher efficiency and lower cost

TUTORIALS:

Tutorials will be offered every day (duration about 2 hours). Notifications of subscription will be sent out at the beginning of March.

- Control Theory (attendance every day recommended)
 - Short history on loudspeaker control
 - · Volterra Series generic control strategies
 - · Mirror filter transducer oriented control structures
 - · Adaptive control on-line monitoring with music
 - · Active Protection driving to mechanical and thermal limits
 - · Implementation Hardware contra software
 - Green speaker new freedom for passive transducer design
- Detection of Irregular Distortion and Defects using R&D and QC System
 - How to check tiny defects?
 - Can audible defects be tolerated?
 - How to cope with production noise?
 - Interaction between QC and R&D
 - · Diagnosis of defects (localisation, classification, root cause analysis)
- Tutorial on Nonlinear Loudspeaker Parameter Interpretation
 - · Linear & nonlinear parameter determination
 - · Relation between parameters and symptoms
 - · Nonlinear parameter based simulation
 - · Auralisation of measured and simulated loudspeakers
- Directivity Measurement under Non-anechoic conditions
 - Near field scanning theory
 - Far field directivity analysis
 - Near field sound pressure analysis
 - · Fast on-axis measurement
 - · Practical aspects for setting up a measurement
- Tutorial on Practical Loudspeaker Diagnostics based on Laser Scanning
 - How to work with a laser scanner
 - Root causes of excessive rocking modes (mass unbalances, stiffness asymmetries or B-field inhomogeneities)
 - Finite element simulation by using accurate and relevant material parameters (valid in the audio band)

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ELECTRO-ACOUSTICAL MODELLING:

- Fundamentals transduction, vibration, radiation
- Abstraction models with lumped and distributed parameters
- · Small Signal Performance linear approximation and transfer function
- Large Signal Performance thermal dynamics and nonlinearities
- Time-varying properties influence of climate and aging

MEASUREMENTS AND ANALYSIS:

- · Persistent excitation artificial and natural stimuli
- Monitored signals electrical, mechanical and acoustical sensors
- · Complex structures digital and analogue components
- · Sound field measurements in the near and far field
- · Interaction with the room direct and diffuse sound part
- · Measurement time ultra-fast and long-term (power) testing
- · Distortion analysis linear and nonlinear components
- · System identification optimal fitting and parameter estimation
- Transformations Fourier, wavelet and perceptual modelling
- · Data compression separation of unique and redundant information

INTERPRETATION AND DIAGNOSTICS:

- · Interpretation measured symptoms and physical causes
- · Perception audibility and impact on perceived sound quality
- Evaluation selection of optimal drive units for system design
- Specification minimal but comprehensive set of data
- Tolerances variation of parameters and influences

For further information please contact Stefanie at s.weichelt@klippel.de