Summer school on Noise control in urban areas

May 7–9, 2014

– Lecture content

Technical acoustics basics

Wolfgang Kropp, Professor, Applied Acoustics, Chalmers, Sweden

In many applications the understanding of sound propagation on structures is the key to further understanding of sound radiation and sound insulation. Key issues will be radiations efficiency of structures and air-borne sound insulation of partitions such as walls and windows. The function of single walls and double walls are explained together with typical examples from practice.

References: Own lecture notes published on our home page. For further reading I recommend a very well written book by Tor Erik Vigran, Building Acoustics (not compulsory for the course).

Noise control design – general principles

Wolfgang Kropp, Professor, Applied Acoustics, Chalmers, Sweden

Often in our education we forget to talk about the sources of sound and vibrations. In this lecture we will look on some of the main principles of sound generation. From this we can derive a fundamental understanding how to design quieter products at the source itself.

References: Lecture notes published on our home page.

Absorbers

Krister Larsson, Senior researcher, SP Technical Research Institute of Sweden

The lecture will give an introduction to sound absorption mechanisms and how they can be realized in different practical sound absorbers Sound absorption will be defined and the standardized methods for measuring and quantifying sound absorption will be described, such as the impedance tube and the reverberation room methods. Additionally, the evaluation and classification of absorbers will be introduced. Finally, an overview of noise control using absorbers will be given, where the influence of parameters such as thickness and mounting conditions will be described.

References

Standards: EN-ISO 354, EN-ISO 11654, EN-ISO 10534

Prediction of Aircraft Noise

Kurt Heutschi, Dr., Empa, Swiss Federal Laboratories for Materials Science & Technology

The talk will start with an exploration of a modern aircraft as a sound source. The most important sub sources are identified and discussed with respect to their relevance under different operating conditions. In a second part, acoustic measurements are described that are currently performed around Zurich airport in the context of the newly developed Empa aircraft noise model sonAIR. The third part finally deals with the prediction of aircraft noise. The calculation model ECAC Doc. 29, as recommended by CNOSSOS (Common Noise Assessment Methods in Europe), is presented.

References

E.-L. Bertsch, Noise Prediction within Conceptual Aircraft Design, DLR 2013.

Noise action work/experience from field

Beate Altreuther, Müller-BBM

The lecture will present a catalogue of state-of-the-art noise abatement measures that are usually applied in the consultancy for urban planning / land use planning as well as for single projects. Examples will be shown and the benefits as well as the disadvantages of the measures will be discussed.

Diffraction and screens

Jens Forssén, Associate professor, Applied Acoustics, Chalmers, Sweden

Noise shielding using barriers, buildings and other obstacles is common within environmental noise planning. In this lecture, a derivation of an expression for the sound field behind a thin barrier is shown, valid for small diffraction angles. Further, expressions for general cases are reviewed as well as diffraction models used in noise mapping software.

For literature, the students are referred to Chapter 3.3 in ["Lecture notes, VTA 125, Building acoustics and community noise (BAC)", Jens Forssén, 2013]

Building design related to urban acoustics

Dr. Maarten Hornikx, Eindhoven University of Technology

The acoustics of urban environments is highly dependent on the configuration of building (blocks), their façade and roof properties. This lecture presents the state-of-art in this field and addresses the influence of the following aspects on urban acoustics: absorption and diffusion of façades, the roof shape and absorption, the building layout and the urban density.

Road and rail sources

Wolfgang Kropp, Professor, Applied Acoustics, Chalmers, Sweden

Road and rail traffic are major sources of noise in urban environment. An overview is given on the different source mechanisms as well on the possibilities to reduce noise from road and rail. A strong focus is given to design of low noise road surfaces and silent tracks.

References: One lecture notes published on the web page. For further reading I recommend Tyre,Road noise reference book by Sandberg and Ejsmont and Railway Noise and Vibration by David Thompson.

Noise control experiments

Dr. Maarten Hornikx and Remy Wenmaekers M.Sc., Eindhoven University of Technology

The effect of a noise barrier as a noise control measure will experimentally be quantified. Firstly, the insertion loss of a noise barrier will be measured for various source and receive positions. A small noise barrier is erected for this purpose at the campus of Eindhoven University of Technology (TU/e). Secondly, the sound insulation of the material of the barrier is determined by measuring its sound insulation in the acoustic laboratory facilities of TU/e.

Harmonoise/Imagine/Cnossos-EU source models

Jens Forssén, Associate professor, Applied Acoustics, Chalmers, Sweden

In noise mapping prediction models, as in linear outdoor acoustics in general, the propagation effects can be split from the source strength. In this lecture, the commonly used source models for road and rail traffic are briefly reviewed and the source models for road traffic are investigated more in detail, as coming from projects Harmonoise/Imagine and Cnossos-EU. Abatement effects are studied in terms of reduced speed, reduced engine and/or tyre noise, as well as traffic rerouting.

For literature, the students are referred to the following reports.

R. Nota, R. Barelds, and D. van Maercke. "Engineering method for road traffic and railway noise after validation and fine-tuning.", Technical Report HAR32TR-040922-DGMR20, Harmonoise WP 3, 2005.

Kephalopoulos, S., Paviotti, M., Anfosso-Lédée, F. Common Noise Assessment Methods in Europe (CNOSSOS-EU). Publications Office of the European Union 2012.

BUILDING ACOUSTICS: predicting building performance with EN 12354

prof. ir. Eddy Gerretsen, Level Acoustics BV

The acoustic performance of buildings is an important aspect for the health and comfort of people. It concerns the reduction of airborne sound (TV, music), impact sound (walking), outdoor sound (traffic) and sound levels due to technical service equipment (heating, water supply etc.). Most countries specify minimum requirements for the acoustic performance as defined by measurement methods. To achieve acoustic quality for newly built and retrofit houses it is essential to be able to simulate the acoustic performance beforehand. The European standard EN 12354 provides the tools to do so. The background for this standard and the possibilities to use it will be highlighted and illustrated for the parts on airborne and impact sound transmission.

Literature

[1] Gerretsen, E., '*European developments in prediction models for building acoustics*', acta acustica 2 (1994), 205-214

[2] Gerretsen, E., 'The development of the EN 12354 series: 1989-2009', Euronoise 2009, Edinburgh 2009.

[3] COST Action FP 0702, 'Net-Acoustics for timber based lightweight buildings and elements', eBook: http://extranet.cstb.fr/sites/cost/ebook