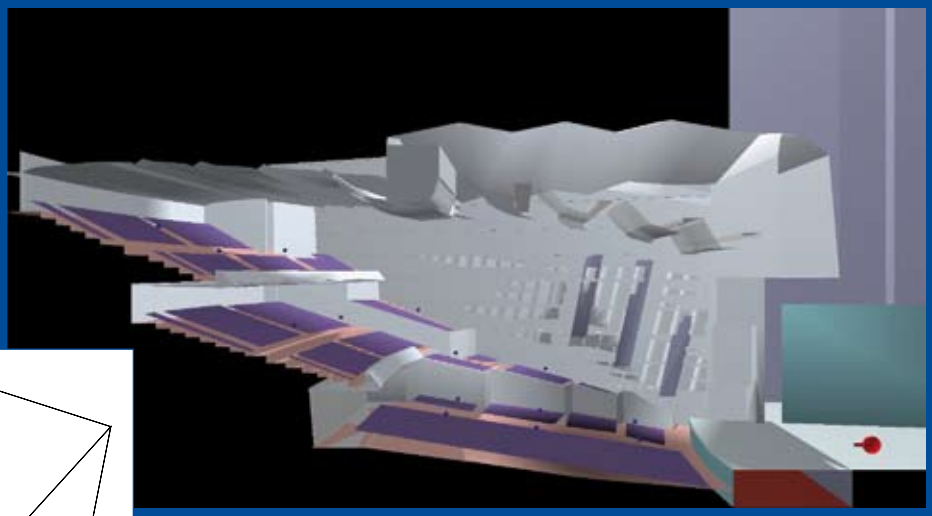
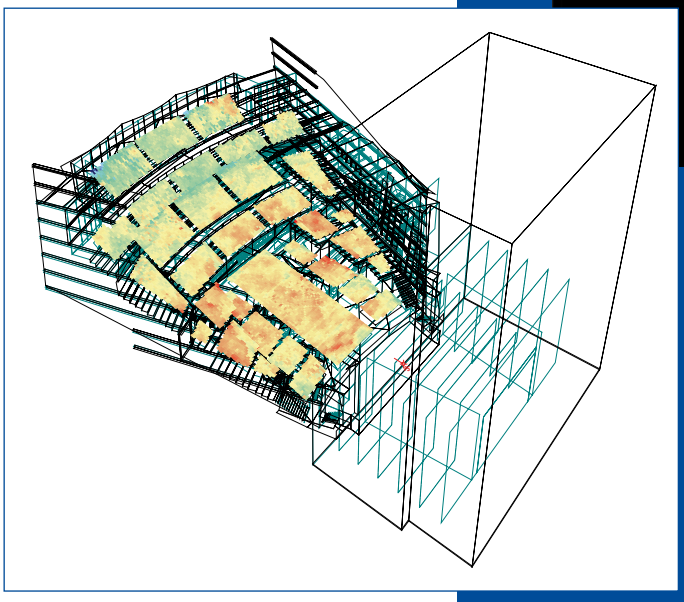
ROOM ACOUSTICS MODELLING SOFTWARE





Room acoustic modelling with Odeon

means

- Speed of calculation
- Reliability of results
- Ease and flexibility in use
- Efficient import of 3D models
- Interactive visualisation of results
- Quality of auralisation

Odeon is the state-of-the-art tool for room acoustic design and investigations from the smallest to the largest projects. Odeon is used for design of performance spaces like theatres, concert halls, and opera halls, sound reinforcement in concert halls and public areas, for noise control in industrial halls, for acoustical predictions in open plan offices, museums, and a wealth of other cases. The high quality auralisation is useful for demonstration purposes and for creating listening tests in research projects.

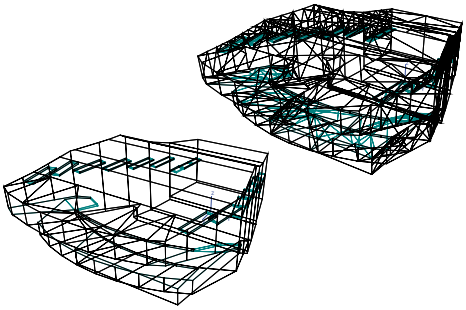
Odeon

is available in three editions for different applications: Industrial, Auditorium, and Combined edition. For further information and demo version, visit www.odeon.dk.

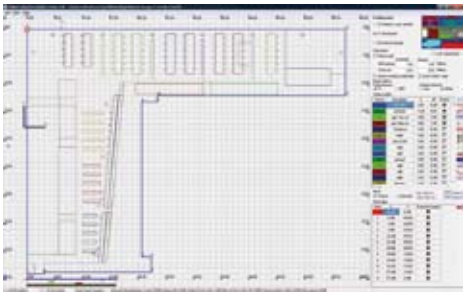
Auditorium acoustics · Sound reinforcement · Noise control in industrial halls

Open Room

Room geometries can be imported from CAD systems e.g. AutoCAD®, Google-Sketchup, IntelliCAD®, Rhino, etc. if in the DXF or 3DS format.



In order to optimise the models for room acoustic simulations, connected surfaces in the same plane are automatically combined into polygons.



The Odeon Extrusion modeller is used for creating a 3D model by sketching in 2D.

Odeon Editor

A text editor for parametric modeling is integrated in Odeon to ensure quick and smooth modeling and editing of the room geometry. The parametric language allows high level script modeling using constants, variables mathematical expressions and programmatic constructions. The editor may also be used for access to details in calculation results.

Printer

Results, graphic displays and calculation properties can be printed in high quality from within Odeon. Graphics can be exchanged via the Windows clipboard or via files in various formats. Calculated results may be exported to a text file.

Graphs and tables can be printed or exported via clipboard or file in several formats (.wmf, .emf., .bmp, .gif, .jpg, .pcx, .png). Results, including parameters, reflection data, curves, etc., can be exported in ASCII (text) format for further processing in other programs.

GIF Animation

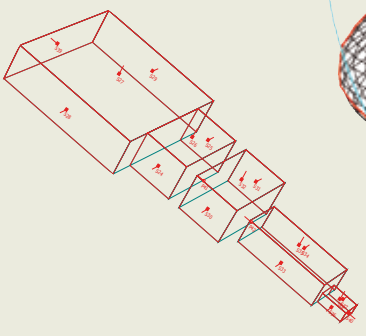
The GIF facilities make it possible to capture small films of ODEON's animations for inclusion in PowerPoint presentations or for use on the Web. The application has been developed in order to allow editing of GIF animations created in Odeon.

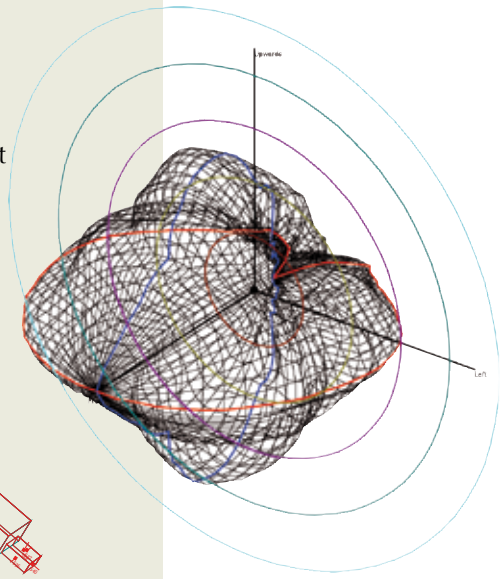
Geometry Debugger

To ensure that calculation results are reliable it is essential that the geometries are consistent. Odeon includes a number of tools for geometry verification, e.g. a check for duplicate or overlapping surfaces.

Sound Sources

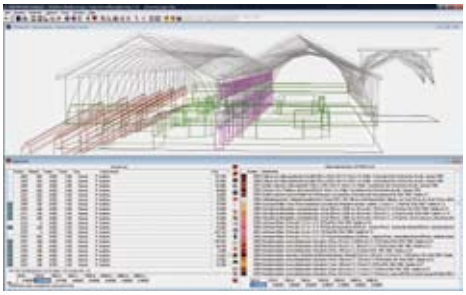
Point sources can be defined from a directivity pattern, gain, equalisation and a delay, allowing the definition of natural sound sources as well as loudspeaker systems. The Common Loudspeaker Format is supported, visit www.clfgroup.org for further info. The Industrial and Combined editions also allow the definition of line and surface sources that are particular useful for calculations in industrial environments. Source positions, orientations, direct sound mapping etc. are visualized in 3D displays.



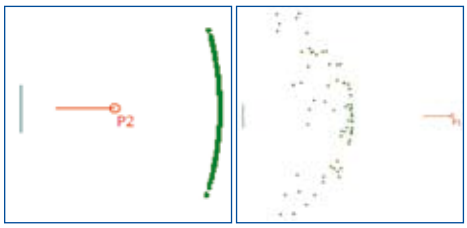


Materials

Materials are defined by the absorption coefficients from 63 to 8000 Hz, scattering coefficient and transparency coefficient. Materials are from an extendable library of materials. The surface list is linked to a 3D display showing the selected surface. In larger room models the use of layers can facilitate the material assignment.



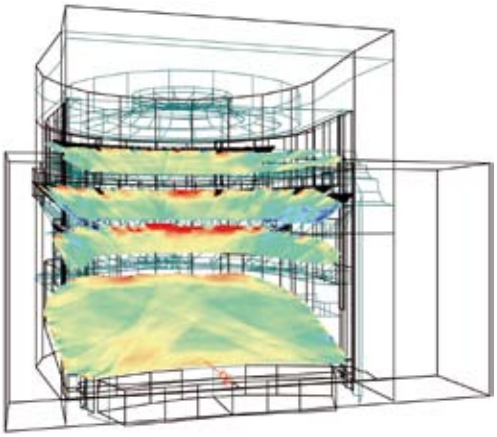
Example of Odeon's user-friendly interface, here for assignment of materials (right) to surfaces (left).



In order to calculate the influence of scattering from surface roughness and from edge diffraction, Odeon has developed the Reflection Based Scattering method. Diffraction depends on the area of the surface and distance from the source, see the two examples above; near source (left) and remote source (right).

Grid Maps

Maps of calculated energy parameters can be calculated for any number of selected receiver surfaces. The example shows the calculated distribution of clarity C80 at 1 kHz in a model of a new opera house.



Auralisation

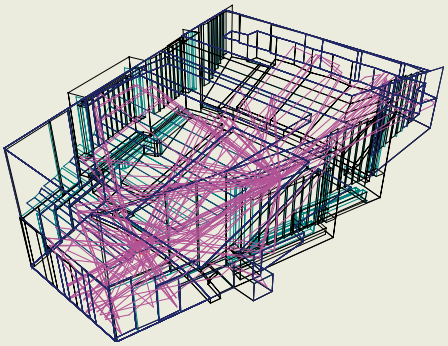
Auralisation tools allow presenting predicted acoustics as it will sound – a priceless tool when complex acoustic solutions are to be presented to clients. Presentations can be done from within Odeon, in Power Point Presentation or on the WEB.

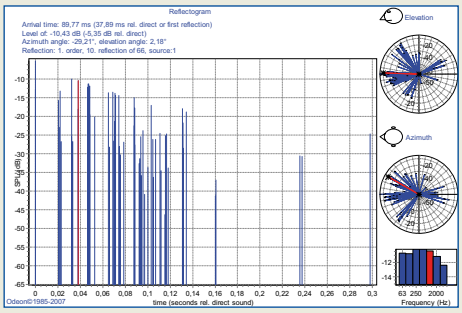
The auralisation options available in Odeon are based on binaural technology allowing three-dimensional presentation of the predicted acoustics over headphones. All calculations including the ray tracing, received reflections at a receiver point, binaural filtering and convolution are carried out by Odeon in a one-step process.

In addition to the binaural auralisation using headphones, Odeon offers auralisation through loudspeakers, e.g. in a surround setup.

Job List

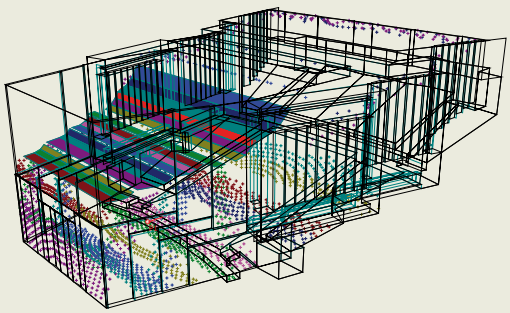
The job list is the central in calculation of point response results and auralisation results. Jobs to be carried out can be organised and displayed when calculated.





Reflector Coverage

The reflector coverage display allows fast evaluation of the receiver area covered by a number of reflectors for a selected source position.

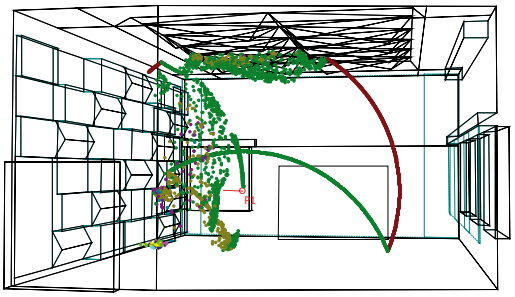


Ray Tracing Display

The ray tracing display may be used for verification of the room geometry.

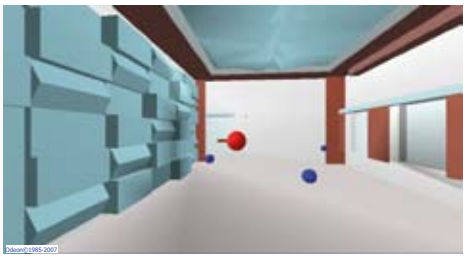
3D Billard

The 3D Billiard display is a tool that can be used for investigating or demonstrating effects such as scattering from surfaces, flutter echoes, focusing or coupling effects. A burst of balls are emitted from the source and bounce off the surfaces in the room. The emission of balls can be either 2D or 3D.



3D OpenGL

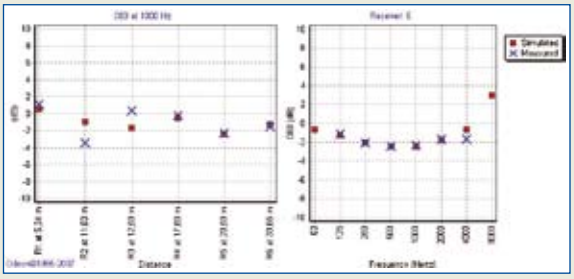
The OpenGL renders geometry, materials, and source and receiver positions. It is useful when checking the validity of room geometries or the locations of sources and receivers.



A special Odeon feature is the use of acoustic colours in OpenGL to identify the frequence-dependent absorption coefficient of each material - very useful when checking that correct materials are assigned to the surfaces in complicated models, and also useful for presentation.

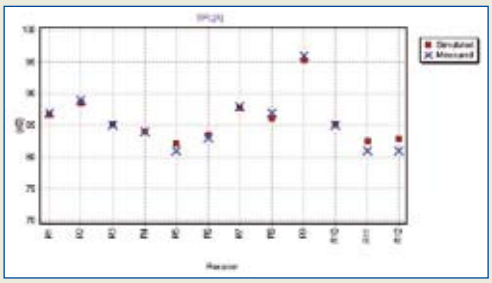
Reliable results

The advanced frequency-dependent scattering method developed within Odeon is one of the reasons for excellent agreement with measurement results that is achieved. The example shows measured and simulated clarity C80 at 500 Hz in the Elmia concert hall (3rd international Round Robin on room acoustic prediction models). Left: variation with position, right: variation with frequency.



Prediction of noise in industrial environments

The prediction accuracy provided by Odeon has been verified in a turbine hall at a power plant. The A-weighted sound pressure level was measured in twelve receiving points and compared to the levels estimated by Odeon. The room and its machinery were modelled by 54 surfaces. Each of the two turbines were modelled by 17 surface sources and two point sources (ball bearings). Relevant data for radiated sound power were measured with the intensity method. Test results show very high correlation between measured and estimated results, the average deviation being less than 1 dB.



Speed of calculations

Odeon calculations are optimised to be very fast. For the Elmia concert hall (470 surfaces) a typical point response including the ray tracing and BRIR (Binaural Room Impulse Response) takes 10 seconds, a multipoint calculation with six receivers comes in 12 seconds, and a complete grid with 1109 points covering all seats takes only 12 minutes (Intel® Core™2 DUO CPU E6850@3.00GHz). These times refer to Engineering quality, Survey calculations can be made even faster. The convolution for auralisation is made within a few seconds, or almost in real time using the special streaming convolution option.

Project management

Thorough project management is an important part of Odeon. Odeon will always ensure that results stored with a project are consistent with the specified geometry, materials, sources etc. A project stored in the Odeon-Zip-Archive contains all the information needed for full documentation in one single file.

Background

Odeon has been developed at the Technical University of Denmark from 1984. The Odeon Company is owned by a group of Danish consulting companies and since 2001 the Odeon software is also registered as a Brüel & Kjær product.

Odeon
Room Acoustics Software

Ordering information

For further information and ordering see the Odeon homepage or contact the Odeon office:

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