# Optimizing Sound Quality in Consumer Electronic Devices
Improve Design and Sound Performance

Sound Quality Improvement for Audio Devices

Numerical acoustics simulation is helping product engineers to improve sound quality for many audio device applications

- Loudspeakers
- Microphones
- Headsets
- Televisions
- Cell Phones
- Car Sound Packages
- Hearing-Aid Devices
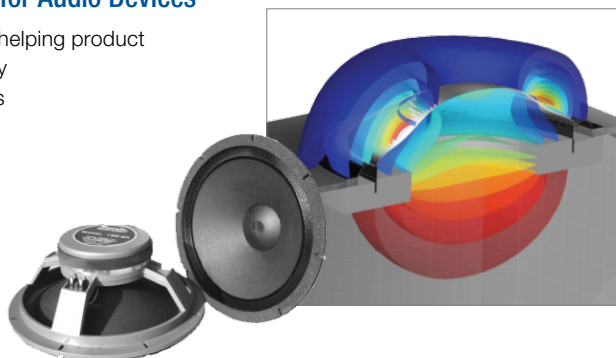
Actran Simulates Audio Device Acoustic Performance with Accuracy

- Rich library of components:
- Acoustic
- Visco-elastic
- Porous material
- Membrane
- Visco-thermal acoustic damping
- Piezo-electric
- Exterior sound radiation by Infinite Elements or Adaptive Perfectly Matched Layers (APML)
- 3D and 2D axi-symmetric modeling
- Rich post-processing: color maps, frequency response curves, sound directivity, directional microphones, animations, etc.
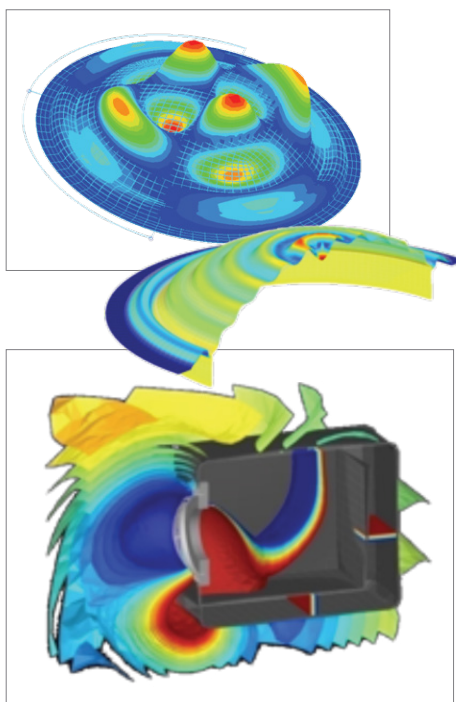

Key Software Features

- Acoustic Finite Elements for cavity and exterior acoustics modeling
- Acoustic Infinite Elements or Adaptive Perfectly Match Layers (APML) for modeling the far field anechoic condition
- Full structure element library: solids, shells, membranes, beams, springs, rigid connections, etc.
- Dissipation mechanisms such as visco-thermal losses, acoustic absorption...
- Poro-elastic element library based on the BIOT theory for modeling bulk reacting materials
- Piezo-electric element libraries for modeling active structures
- Full support of non-congruent meshes
- Use vibration results from most FEA structural analysis solvers for acoustic radiation modeling
- Plane, spherical and cylindrical wave sources
- Acoustic pressure, velocity and admittance boundary conditions
- Mechanical and kinematic excitations
- Fast direct and iterative solvers for reduced CPU times
- MUMPS and Krylov solvers for fast frequency response analysis
- Rich post-processing capabilities: frequency response plots, maps, sound directivity, directive microphones, animations and more...

FFT
MSC Software Company

Case Study: Loudspeaker Simulation with Actran

Actran model of a transmission line box loudspeaker

- A loudspeaker and enclosure model shows the vibration of the diaphragm, the acoustic propagation through the transmission line, and the resulting sound field due to radiation from both the diaphragm and the transmission line exit
- Actran is used for the design of the transmission line enclosure
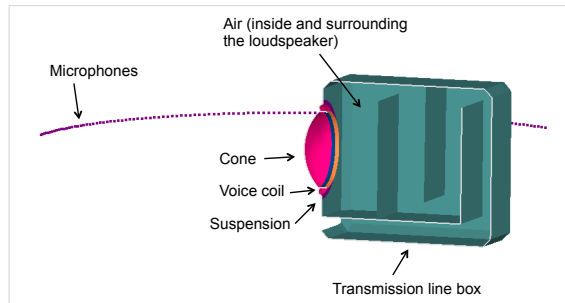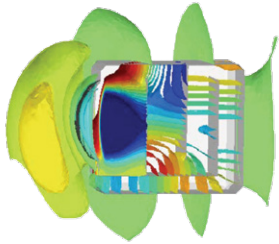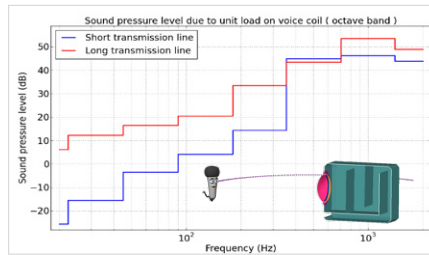
Case Study: Microphone Simulation with Actran

Actran can be used to model frequency response and directivity of a microphone

- The model shows that exterior sound waves propagate towards the microphone, producing the vibration of the microphone diaphragm.
- Actran can include all necessary materials to accurately model a microphone
  - Diaphragm under initial tension
  - Porous material (filter, damper)
  - Air material including visco-thermal dissipation
- Actran finite element models can easily be created and post-processed using the Actran/VI Graphical user Interface
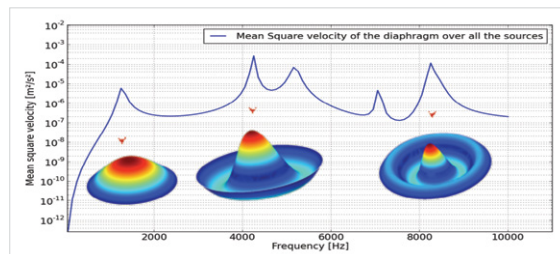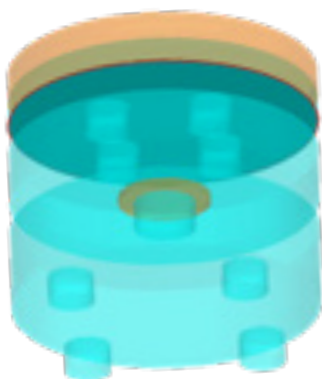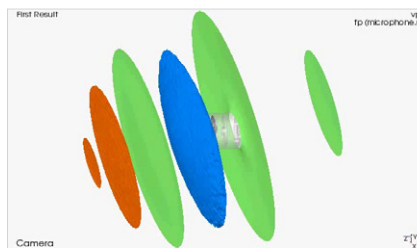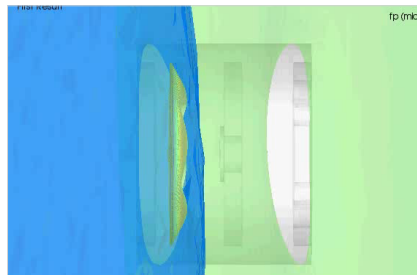
Actran™

Software Suite

Actran is a complete acoustic, vibro-acoustic and aero-acoustic CAE software suite. Empowered by the technologies of finite/infinite element methods (FE/IFE), as well as the Discontinuous Galerkin Method (DGM), Actran provides a rich library of materials, elements, boundary conditions, solution schemes and solvers. Actran is a high accuracy, high performance and high productivity modeling tool suiting the needs of the most demanding engineers, researchers, teachers and students for solving the most challenging acoustic problems.

Free Field Technologies (FFT)

Free Field Technologies is focused on three main areas:
- Developing Actran software for acoustic, aero-acoustic and vibro-acoustic simulation;
- Providing technical services, support, training and delivering acoustic engineering projects;
- Researching innovative technologies and methods of acoustic analysis in order to remain the leader in acoustic modeling.

Free Field Technologies has more than 250 customers around the world active in the Automotive, Aerospace, Shipbuilding, Electronic and Heavy Equipment industries as well as in the Educational and Research sectors.

FFT is a wholly owned subsidiary of MSC Software Corporation.