


# Sound Design for Industry





# give your products a new

## AUTOMOTIVE



- Engine sound design
- Active sound generation
- Mechanical sound refinement
- Sound for driving simulators
- Sound refinement for locks, seats, windows, air conditioning and windshield wipers

LEA is the premier software solution for sound design, sound analysis, sound quality and sound synthesis, and it is able to link sound to driving simulators, flight simulators and virtual reality platforms.

LEA paves the way to target sound definition, brand sound creation, subjective and objective testing, component separation, troubleshooting and sound data-set preparation.




## AUDIO & TELECOM


- Telephones
- Audio systems
- Loudspeakers
- Speech intelligibility



## CONSUMER & LUXURY GOODS



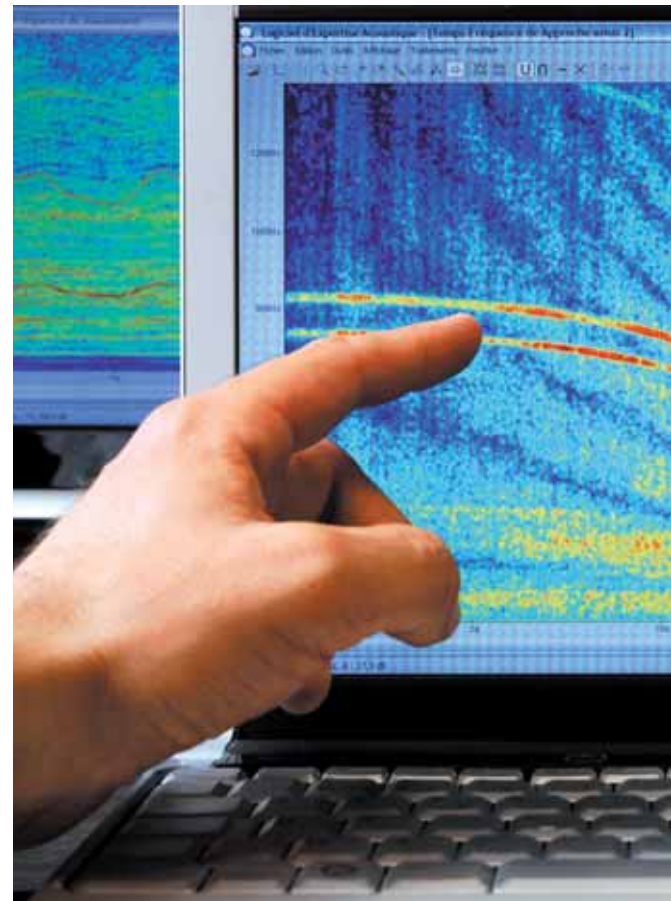
- Home appliances: washing machines, refrigerators and vacuum cleaners
- DIY and garden tools
- Watches, alarm clocks, lighters, packaging



*For consumers, the sound of a product triggers a sensorial and emotional response, which has a direct impact on their buying decisions.*

*A product's sound provides information about the quality of the materials used and its craftsmanship.*

***This is a selling point for your product and it is crucial to be able to control its impact.***



*Sound level is just one parameter for maximizing sound comfort.*

*Measuring and controlling it is a step further.*

***It is more effective to refine a sound rather than simply trying to reduce it.***

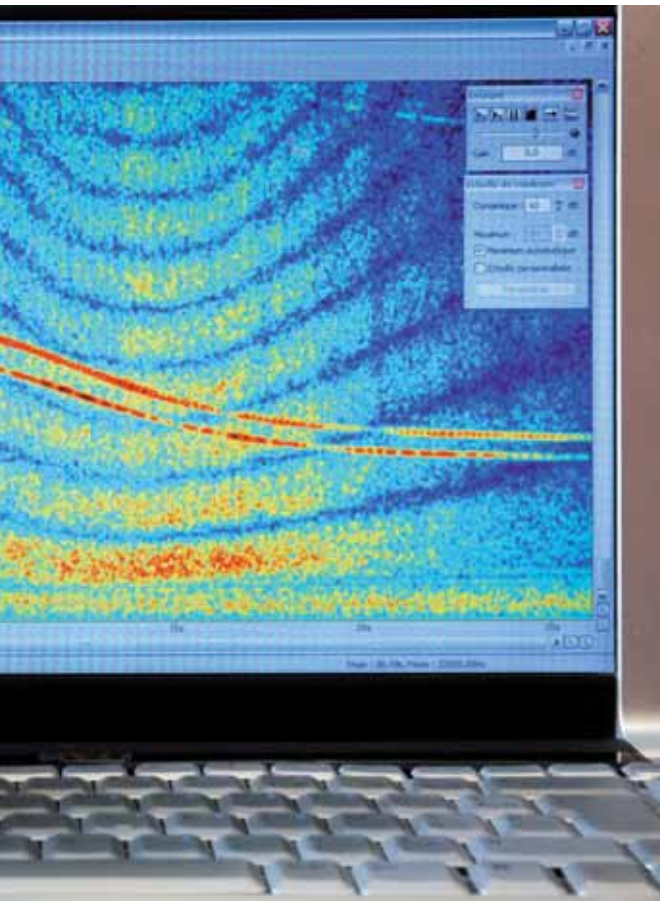


# sound dimension

## Better sound, better life!

*Sound is everywhere, bringing us information and emotion, alerting us to potential threats and giving us the feeling of quality and comfort.*

GENESIS's mission is to help companies to give their products a better sound. To provide a better customer experience, a distinctive sound signature, or for reducing the annoyance of air, rail or road transportation systems, sound matters for various reasons. Rather than simply reducing the noise level, it is more effective to investigate the components of the sound and analyze precisely the influence each component has on human perception.



### Genesis contributes to a better world

Through collaborating on projects aimed at reducing transportation noise and developing energy efficient technologies, Genesis demonstrates its commitment to a cleaner environment and quieter communities.

## AEROSPACE

Engine noise  
Cabin noise  
Fly-over noise  
Sound rendering in the cockpit



## RAILWAYS

Passenger audio comfort  
Pass-by noise  
Train driver cabin noise



## INDUSTRIAL

Diesel engines, turbo machines, wind turbines, pumps, electric motors and other applications: noise control, noise reduction, fault diagnosis

Quality control, end of line tests, objective metrics for the pass/fail test



## DEFENSE

Quietness evaluation  
Noise source identification  
Sound for sonar operator training simulator  
Sound for flying, driving and mission simulators  
Sound database



## Sound design

Target sound design

Psychoacoustic research

Troubleshooting

Separation of sound sources

Acoustic analysis

3D Sound playback

Order analysis

Annoyance assessment

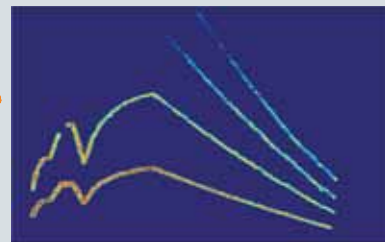
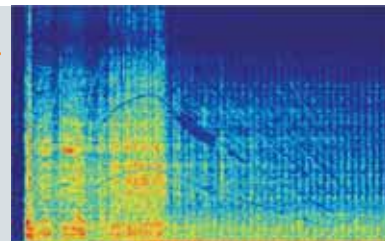
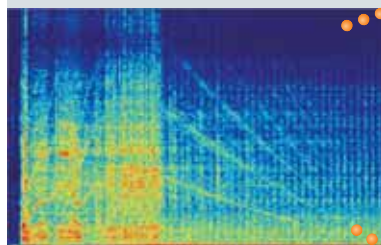
## SOUND SOURCE SEPARATION



The acoustic signal from a car's electric starter allows for an in-depth analysis of the engine starting sequence.

With just a few clicks, LEA **separates the components of the sound**, plays them and **extracts the harmonics**. The rotating speed profile is also extracted, and the behavior of the freewheel can be analyzed.

### Car electric starter



*"I use LEA to analyze transient electric starter signals, which are short and random. I also use the tool to do signal post processing, quantification of acoustic signals, vibration, voltage, temperature, etc.. I also do sound quality work... In fact, I use LEA for 90% of my work. The same tasks that used to take me half an hour using two or three programs now takes me only two minutes to do with LEA."*

**NVH Manager, Automotive supplier**

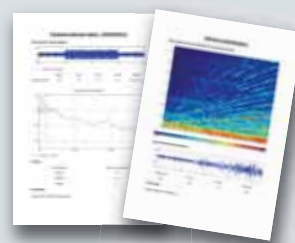
## PSYCHOACOUSTICS

LEA is able to calculate crucial metrics concerning noise perception inside and out of an aircraft. For example, to analyze the comfort level inside the cabin of a helicopter, LEA calculates standard indicators like Loudness (Zwicker - ISO532B), Sharpness, Roughness, Fluctuation strength and others.

LEA offers the possibility to calculate a user-defined Comfort Index, based on Zwicker or polynomial form, to obtain an overall measurement of the comfort inside the cabin using only a single indicator.

Additional indexes are provided for evaluating intelligibility and calculating the EPNL (required for aircraft and helicopter certification).

### Cabin noise design



*"We use LEA everyday, mainly for target sound design, psychoacoustic indicator calculations, time-frequency sculptures and playback. We record the signals and sculpt the sounds in the time-frequency diagram, which then allows us to modify certain signal components. Then we analyze the results using psychoacoustic indicators and listening tests."*

*LEA also allows us to create new signals to share with the decision makers to validate comfort modifications. In addition, GENESIS has equipped our studio with a playback system that perfectly reproduces the 3D Sound environment inside the cabin."*

**Acoustics Engineer, Internal Noise Dept, Helicopter manufacturer**



## Engine Sound Design

### Jury testing

Audio dataset preparation for driving and flight simulators  
Signal denoising

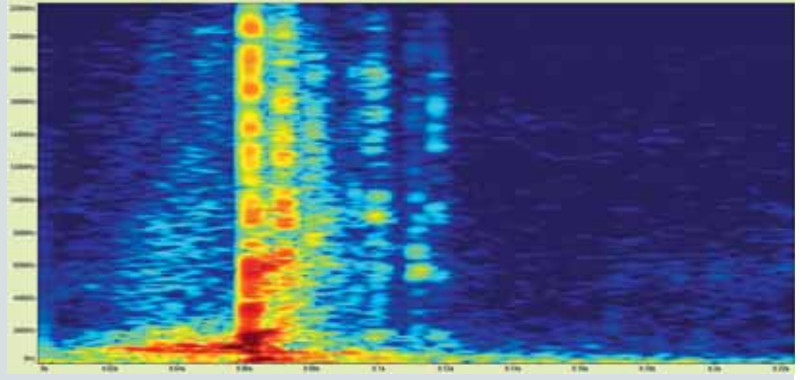
## SOUND DESIGN

There are many applications for transient and impulsive sounds. Beyond the classic car door slam, LEA can also be used to analyze and improve the sound of locks, windshield wipers, switches and alarms.

Sensorial marketing and expectations of quality make it also important to control the sound of watches, pen caps, lighters, packaging and chocolate bars (to name a few).



### Golf club



*Golf enthusiasts look for the perfect touch, the perfect sound. After using LEA to analyze the sound of their golf club, a famous golf club manufacturer was able to identify what sound was produced and how to control the various parameters. "With LEA we can define precisely our target sound and then 'sculpt' it. It is the secret our engineers use to modify the product accordingly."*

*Now, the greater sound precision of their clubs is widely appreciated by their customers.*

**Sound Designer, Consulting Company**

## ENGINE SOUND SYNTHESIS

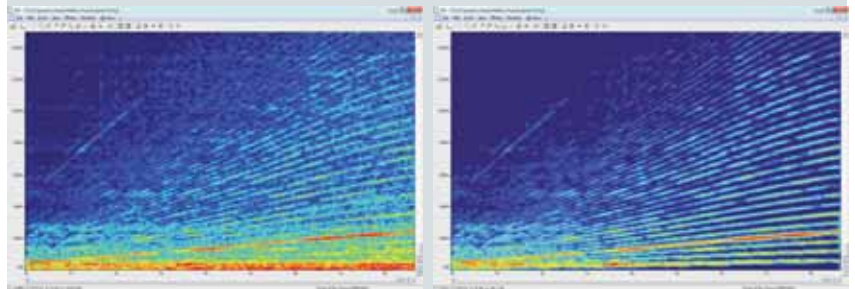
LEA provides an intermediary between sound synthesis, simulators and virtual reality platforms.

With GeneCARS, the sound prepared with LEA can be tested in a Desktop Sound Simulator with a steering wheel, gears, a brake and a throttle. This sound can be loaded into a Driving Simulator with 3D sound capability for high-quality sound rendering.

With GeneBOX, the target sound designed with LEA can be tested on the road in a vehicle. The driving parameters are acquired from the CAN bus and the sound is delivered through the audio system or headphones.



### Engine target sound determination



*"With LEA, creating time-frequency sculptures allows us to produce accurate sound databases without defects so much simpler and faster, and avoids re-recordings that are costly in both time and money."*

*In addition, LEA brings us knowledge and practices that allow us to be more fluid in the way we work with sounds. We can highlight the characteristics of a sound and communicate by creating 'sound cartoons' for our customers, or internally, to talk to engineers who will work on the development of the object, making the link between the perception of sound and its time and/or frequency representation."*

**Team manager, Sound Perception and Sound Quality Dept,  
Car manufacturer**

# Unique architecture for performance and flexibility

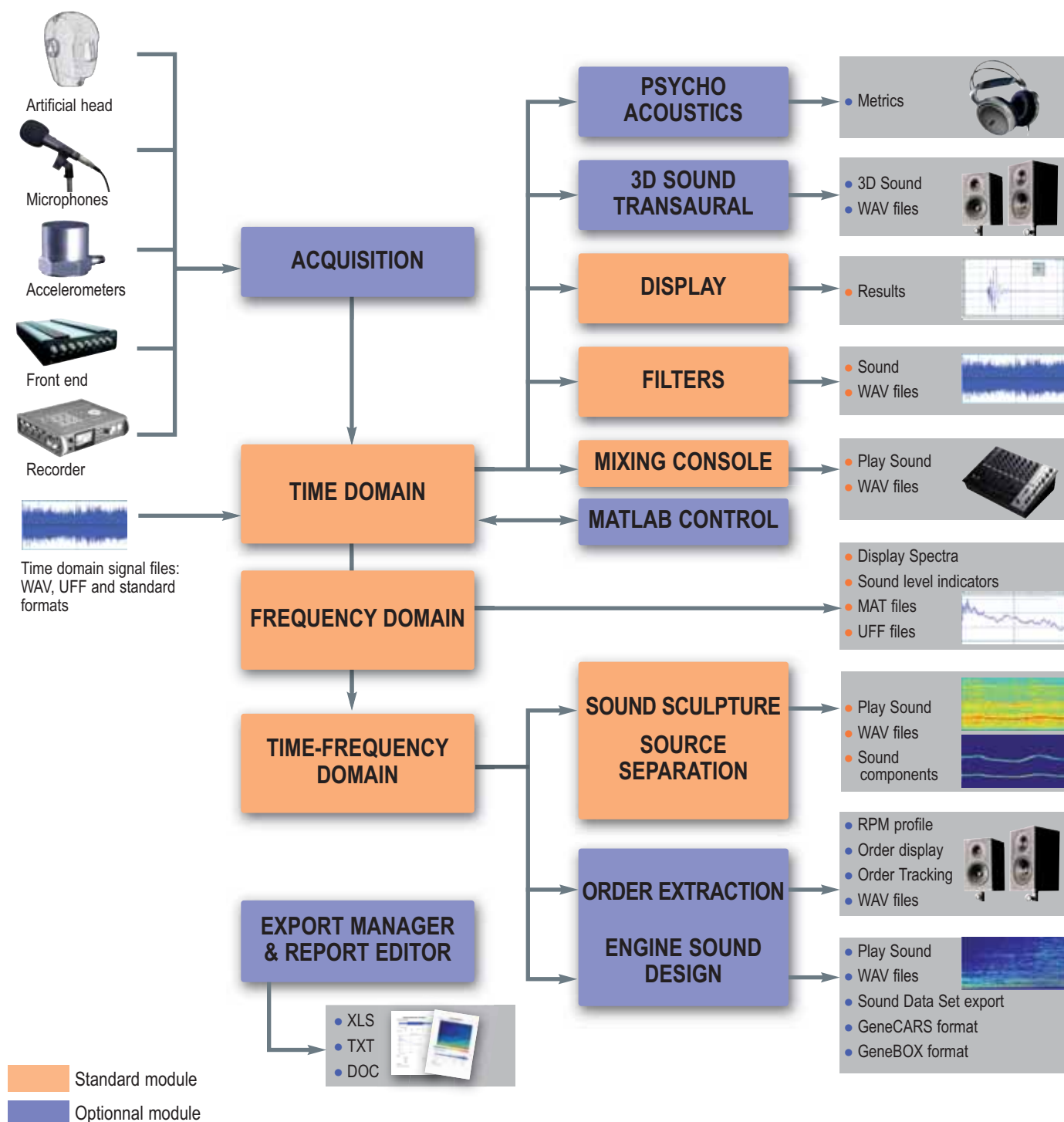
LEA can be adapted to fit your needs and applications. The standard package offers features for sound design and sound analysis. A series of optional modules provide access to dedicated functions, including order analysis, psychoacoustics, sound synthesis, 3D sound and sound simulation. LEA offers a set of exceptional features in a straightforward format that allows you to zero in on your critical tasks. While capable of performing advanced analytics and processes, LEA's intuitive interface is easy to use and does not require a background in signal processing.

LEA's **Time-frequency** diagram is manipulated through the use of **graphic Autosize FFT, Autoscale, zoom and slice display tools**.

The **Magic Wand tool** is a unique and efficient way to visually select a sound component. Other easy-to-use selection tools, like the **line**, **rectangle**, and **freehand** options, allow you to extract or modify any area in the time-frequency diagram. Any extracted component can be listened to, amplified, attenuated, combined with others and saved.

The **harmonic detector** easily extracts the fundamental and any number of harmonics. It is also used to extract the RPM signal from a simple microphone signal, for order analysis or engine sound refinement.

Sync Playback makes it easy to compare the original sound to the modified sound and instantaneously switch between the two during playback.



## STANDARD MODULES

### TIME DOMAIN

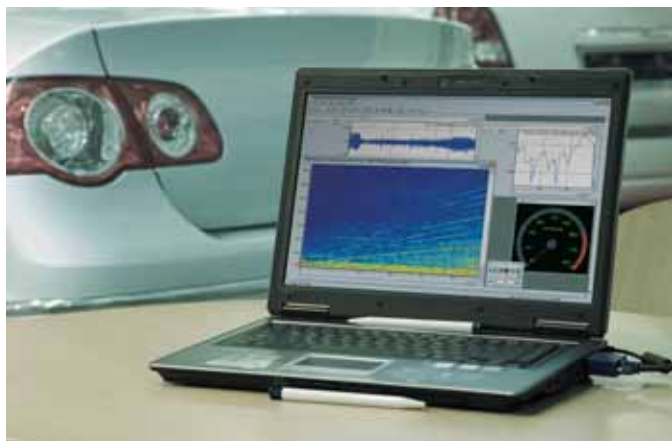
- File format : wav (multichannel), xrc , uff (ascii)
- Sampling frequency : any up to 192kHz
- Resolution: 8, 16, 32 bits integer & float
- Number of channels : 1 to 8 inputs, 1or 2 outputs
- Display: Lin vs time, zoom, auto or fixed scaling
- dB(A), dB(B), dB(C), dB(G) and time history
- Unit, reference, sensitivity: selectable
- H&V Zoom, markers
- Resampling: adjustable frequency up to 192 kHz
- Equalizer: 1/3 octave, octave and Bark
- Play controls: Start, Stop, Pause, Repeat, full or between markers, output level 1 or 2 channels
- Playlist: unlimited number of signals, play simultaneously

### FREQUENCY DOMAIN

- Window : Hanning, Hamming, Gauss, Flattop, Blackman, Rectangular, Triangular
- FFT: from 16 to 131072 lines
- Overlap: 0 to 99%, step 1%
- Average: Lin or Peak
- Scale: lin, log, dB(A), dB(B), dB(C), H&V zoom, fixed or auto
- Markers, harmonic cursors
- Add, remove, overlay signal traces, reference trace
- Overall level in frequency bands

### TIME-FREQUENCY DOMAIN

- 1 or 2 channels simultaneously
- FFT settings: automatic or manual
- Color scale: automatic, manual, customized
- Selection tools: magic wand, line, rectangular, free hand, point
- Expand / shrink selection
- Harmonic detection
- Isolate, delete, adjust gain of selected components
- Save selected components as wav files
- Synchronized playback of original and modified sounds



## OPTIONAL MODULES

### ACQUISITION

- Direct recording from any professional sound card and supported front ends
- Supports binaural recording from artificial head or in-ear microphones
- Vu meters
- Direct display of time domain signals and one click frequency or time-frequency analysis

### ORDER

- Self extraction of RPM signal when not recorded
- Orders extraction : adjustable resolution in frequency, resolution in order down to 0.01 order
- Order listening and individual tuning and mixing
- Order tracking vs Time or RPM + overall
- Display Orders/Time, RPM/Frequency, RPM/Orders
- Engine Sound Design: sound synthesis test and adjustment
- Generation of synthesis data sets for real-time Sound Simulators : GeneBox and GeneCars formats

### PSYCHOACOUSTICS

- Metrics for Stationary, Non-stationary and Impulsive sounds
- Loudness ISO532B, Sharpness, Fluctuation strength, Roughness
- Specific Loudness, Spectral Centroid, Impulsive Loudness
- Time history of Loudness, Sharpness
- N5 and N10 for non-stationary sounds
- EPNL, Effective Perceived Noise Level, requested for aircrafts and helicopters certification
- dB SIL3 & 4, Speech Interference Level, for Aircraft Interior Noise Level Measurements, dB PSIL, Preferred Speech Interference Level
- TNR and PR for pure tones hearing assessment
- Loudness equalization: normalization of sound files in preparation of jury testing
- Comfort equation (polynomial or Zwicker): user defined coefficients for the definition of a custom metric

### 3D SOUND - TRANSAURAL

- Calibrated process from recording to playback
- Extends the effect of 3D binaural audio for use with 2 loudspeakers
- Provides highly realistic, natural perception and immersion feeling
- Real-time operation from any binaural recording
- Recommended for subjective tests

### MATLAB

- A bridge between LEA and Matlab
- Passage for importing your own specific or any Matlab function into LEA
- Results can be displayed in LEA's graphic interface
- Input data: string, scalar or signal
- Output data: string, scalar or signal

### EXPORT and REPORT

- Time domain, frequency domain, time-frequency diagram, psychoacoustic metrics, orders, order spectra
- ASCII format, .txt file
- Compatible with Microsoft Word and Excel,
- Automatic report in 1 click
- Formatted for Microsoft Word with traces, settings, markers, comments

**GENESIS** is a world leader in the field of **Sound Design and Acoustic Simulators**. We specialize in consulting and software products in psychoacoustics, acoustic signal processing, sound design and soundscape simulation. As a pioneer in perception analysis, 3D playback and simulation, **GENESIS** is involved in many research projects with major companies and world-class research institutes.

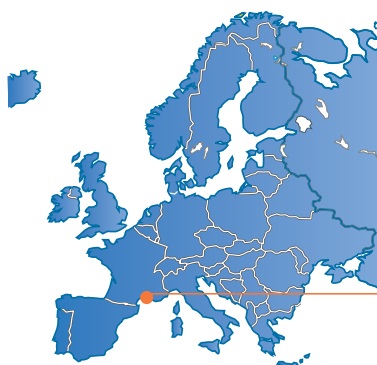
LEA software is fully developed by **GENESIS**, in cooperation with renowned research labs in acoustics, and established as a market standard for sound design applications since its first release in 2003. It is used every day by experts in the automobile industry as well as aeronautic, railway, defense, audio, consumer and telecom industries.

In the creation of **LEA**, **GENESIS** invented the intuitive and powerful technique of **Sound Sculpture in the Time-Frequency domain**, which was quickly adopted by professionals in need of preparing target sounds and creating databases of expressive sound files.

**GENESIS** provides high quality and highly realistic real-time sound generation for driving and flight simulators. **LEA** allows for the preparation of sound data sets for simulators that will be produced in 3D sound in real-time.

In the automobile industry, **GENESIS** proposes state-of-the-art solutions for engine **Sound design, active sound generation** (for internal combustion engines as well as electric and hybrid vehicles) and sound generation for dynamic driving simulators. GeneCARS offers a range of sound generation solutions for desktop target sound testing, **on-road target sound testing** and sound generation for driving simulators. GeneBOX is an embedded sound generator that can be connected to CAN bus for in-vehicle target sound testing as well as prototyping active **sound generation for gasoline and electric vehicles**.

At **GENESIS**, we provide tools and techniques to make the sounds in our environment better, more comfortable and more significant. We offer our competencies in the form of products, consulting and research works.



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