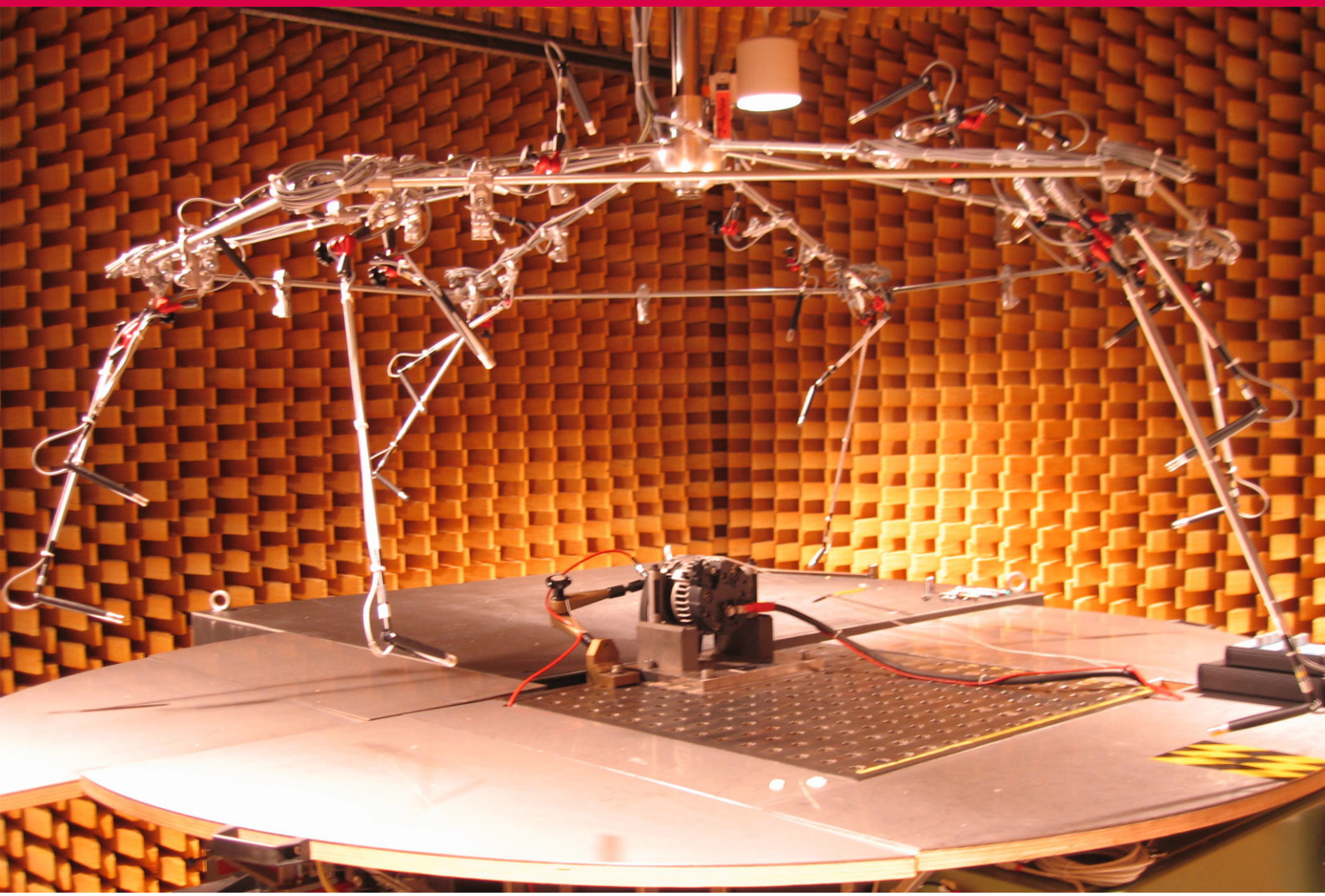
How do you ensure that it’s not too loud in the vehicle?

Acoustical power analysis on automotive alternators



For acoustical testing of automobile alternators, imc has developed an acoustical power analysis test stand that automatically tests and evaluates emitted noise pollution.

The test stand solution is based on the imc CRONOS-PL modular measurement system and a customized software based on the imc STUDIO software platform. The test results are saved in a connected database.

What produces noise in an automobile?

For quite some time now, interior noise in cars has been getting quieter. The once dominant sound of the internal-combustion engine is now in the background, and other noise sources have moved to the forefront. Due to their high RPM, alternators contribute up to 40% of this total noise inside the vehicle.

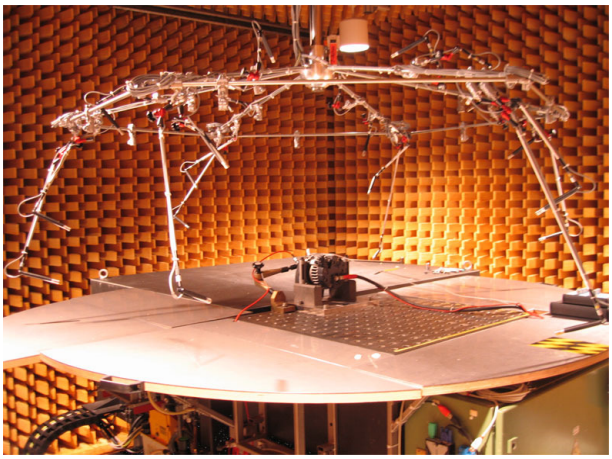


Figure 1: Acoustical power test stand with alternator under test.

In order that this noise doesn't become to dominant or disturbing, the alternator is subjected to an acoustical emission test. During the examination, random accoustical samples are collected by the test stand over a microphone portal. The subsequent signals are analyzed and evaluated, and the results are classified on a PASS/FAIL basis and stored in the database.

To make the testing as simple, accurate and fast as possible, imc automated the entire test sequence. The system consists of a modular imc measurement system and customized software based on the imc STUDIO software platform.

Requirements and procedures

Testing must meet the following criteria:

- Automatically-positioned microphone portal
- Can be moved in X-, Y-, Z- and W-directions (W → rotary axis)
- Simulation of real loads with load machine, belt drive and PLC
- Adjustable load and RPM
- Acoustical power measurements in accordance with **DIN EN ISO 3745**.

The entire measurement is divided into the areas of testing and evaluation. Both areas are automated in this system.

The automated test sequence is comprised of the following steps:

1. Load test parameters
2. Initialization of all test components (microphone portal servo drives, DC motor for driving simulation, measurement devices and other interfaces)
3. Positioning of microphones
4. Implementation of measurement

Results are automatically evaluated. The following analyses are performed:

- Aggregate acoustical power level
- Weighted acoustic level,
- Thirds / octaves
- FFT spectrum over RPM

Results are stored in a database.

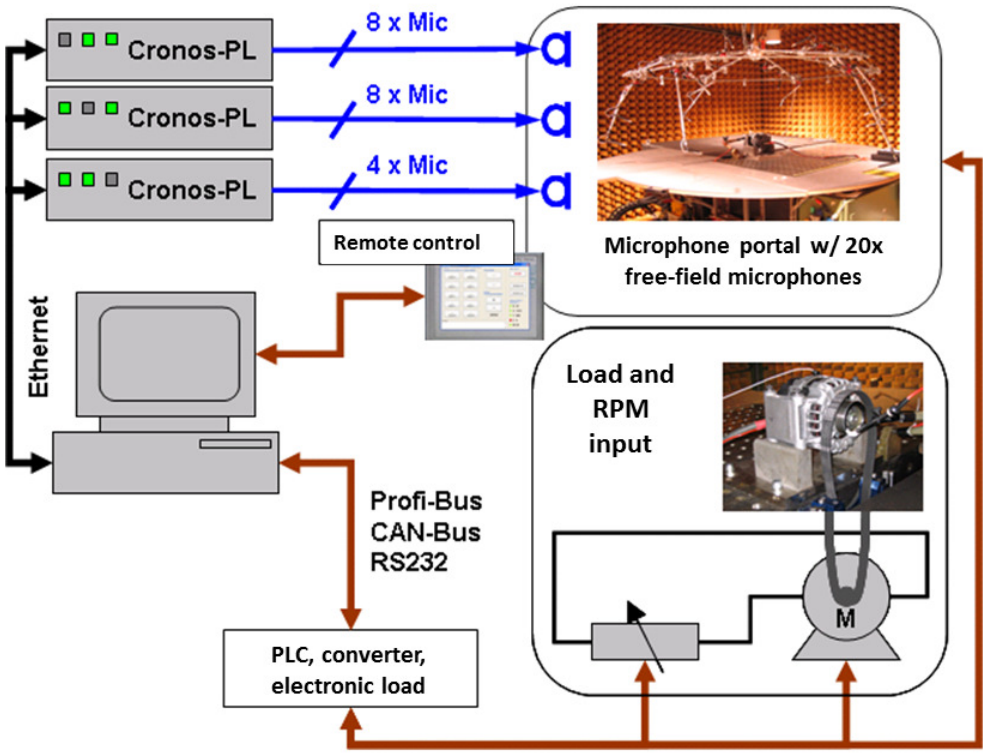


Figure 2: Schematic illustration of acoustical power test stand design

Analysis examples

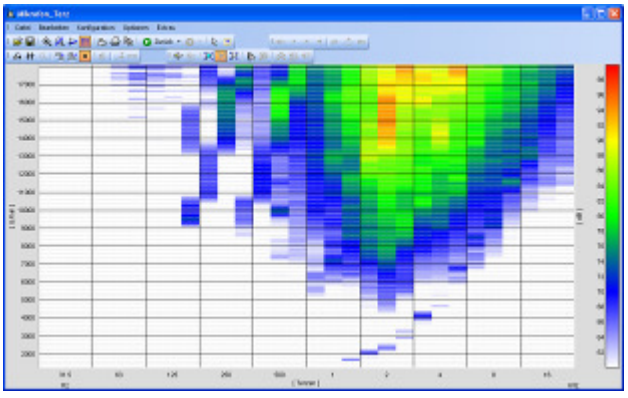


Figure 3: third-octave spectrum

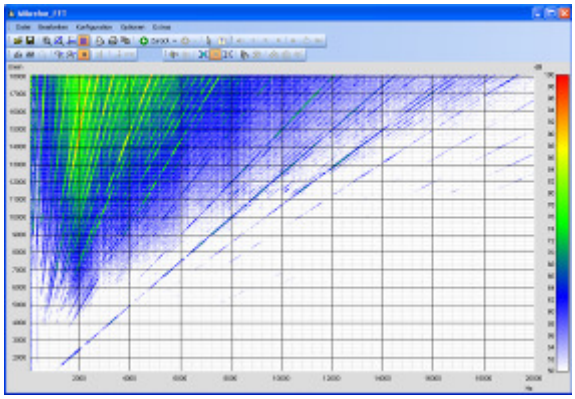


Figure 4: FFT spectrum

Conclusion

To assess the amount of sound emitted by a vehicle alternator according to DIN EN ISO 3745, imc has developed an acoustical power test stand. The result is a combination of a standard imc measurement system with testing software that enables automatic measurement and evaluation of acoustical power.

Implementation

Measurement principle

To determine the acoustical power, the enveloping surface method is used according to ISO 3741, 3744, 3745. The analysis is based on the measurement of the average acoustical pressure level over a measuring surface (enveloping surface dimension), which surrounds the sound source.

Technical Details

Measurement system:

- Modular imc measurement system

Software:

- Software solution based on customized imc STUDIO software platform
- Integration of database

System features

- Automated test procedure
- Automated evaluation
- A-, B-, C- and unweighted acoustical level, third-octave and octave spectrum
- Aggregate acoustical power level
- Various microphone arrays supported
- Indoor and background noise correction
- Sensor and calibrator database, TEDS sensor recognition
- Automatic calibration
- Presentation of acoustical power over any additional channels
- Automatic measurement data reports
- Several measurement cycles for statistics (minimum, maximum, mean, standard deviation)

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