

Press Release

Darmstadt, April 10th, 2008

Reducing noise actively – exhibits of EU project InMAR at darmstadtium

How noise can be reduced with smart materials has been shown by representatives from the areas of research, industry as well as small- and medium-sized enterprises at the final conference of the EU project InMAR at the conference center darmstadtium on April 10th. For the first time, the research results were presented, which can be achieved using "intelligent" materials systems for noise and vibration reduction of technical products in automobiles, rail vehicles and infrastructures like veneers and bridges,. Among other things, noise reduced exhibits such as a gearbox mounting, a compressor of an air conditioner and a sound insulation window have been shown. The four-year research and development work of the 41 partners from 13 countries was coordinated by the Fraunhofer LBF in Darmstadt. With 23 sub-projects and a 27-million euros total budget, InMAR belongs to one of the most extensive research projects on noise abatement in Europe.

For the people in Germany, noise remains one of the most intensively perceived environmental impairments. Europe-wide, more than 100 million people are affected by noise exposure. The nationwide "Tag gegen Lärm" (International Noise Awareness Day), on April 16th, 2008 will inform about the harmful effects of noise.

In this context the scientists from the European project InMAR - Intelligent Materials for Active Noise Reduction – researched the suitability of functional materials and the performance of active structural systems to reduce noise and vibrations. In order to reduce the vibrations, the researchers linked the sensor and actuator functions of materials with electronic controllers. Sensors and actuators can be used specifically to respond to variable operating conditions: depending on the oscillation, frequency countercurrent sound waves are introduced into the structure. This reduces the expansion of sound waves and the noise source is actively subdued. This way the mechanical properties, such as the damping behavior or the stiffness, can be adapted by software. Also, vibrations can be decreased by functional materials, noise can be reduced or the shape of components can be controlled. They are frequently called "intelligent", because these components can adapt specifically to their environment as needed.

"With most of the active solutions developed for cars, trains and infrastructure elements, the noise pollution can be reduced by up to 10 dB", says InMAR project coordinator, Dr.Thilo Bein of Fraunhofer LBF.



"Sound waves must be decreased exactly in the frequency ranges, which are perceived as very stressful. Noise consists of many overlapping sound waves in different frequency ranges. Due to the adaptability of active structure systems, the vibration behaviour can be changed in those areas where they are most effective", explains Bein.

In the wake of the European Environmental Noise Directive (2002/49/EC), it is necessary to "avoid the harmful effects, including harassment by ambient noise, or prevent or decrease them." In this context, several demonstrations with smart materials were developed by scientists from the InMAR project. As examples of the 23 sub-projects in the area of automobiles, railway vehicles and infrastructure may be mentioned:

- a **gearbox mounting** of a car which actively reduces vibration transmission in the body with intelligent materials. By means of structural-dynamic measurements significant transmission paths and directions for the sound in the frequency range from 0 to 250 Hz were identified. Based on measured data and using simulation tools, different approaches of active intervention were investigated.

- a **compressor of an air conditioner**, of which oscillations are reduced with an active vibration absorber. A passive spiral-spring-system is used to decrease the vibrations of the compressor in a specific frequency range. With attached piezoelectric patches additional oscillations in the actually passive vibration absorber can be induced, which actively change the natural frequency of the damper in the range of -12 to + 3 Hz.

- a **sound-proof window** for low frequencies, to prevent aircraft noise or bass sound from discos. "The window can reduce test signals in the frequency range between 50 Hz and 1000 to six decibels in average - the sound behind the window is only half as loud," says Dr. Joachim Bös of the Technical University of Darmstadt, Department of System Reliability and Machine Acoustics. "The volume of individual test signals can be reduced even up to 15 decibels." Regarding the motor noisiness of passenger aircrafts, the experts expect noise reduction below 1000 Hz of up to 10 dB in the future.

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The members of the InMAR research consortium: Fraunhofer LBF, Fraunhofer IBP, Fraunhofer IKTS, Fraunhofer ITWM, AVL, LMS, Micromega, D2S, KUL, ULB, VW, Ford, Siemens, FEV, EADS, IGAM, ERAS, Smart Materials, DLR, UniBW HH, TU Darmstadt, Rieter, Schindler, EMPA, Renault, Saint-Gobain Glass, TechnoFirst, CNAM, C.R.F., Lucchini, CIRA, PoliMi, PanPhonics, VTT, TNO, Uni Twente, TU Delft, Bombardier, Volvo, KTH, ISVR, INASMET, IMMG, Bute.



EU project InMAR: active vibration absorber reducing noise of a compressor of an air conditioner. (Photo Fraunhofer LBF)

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