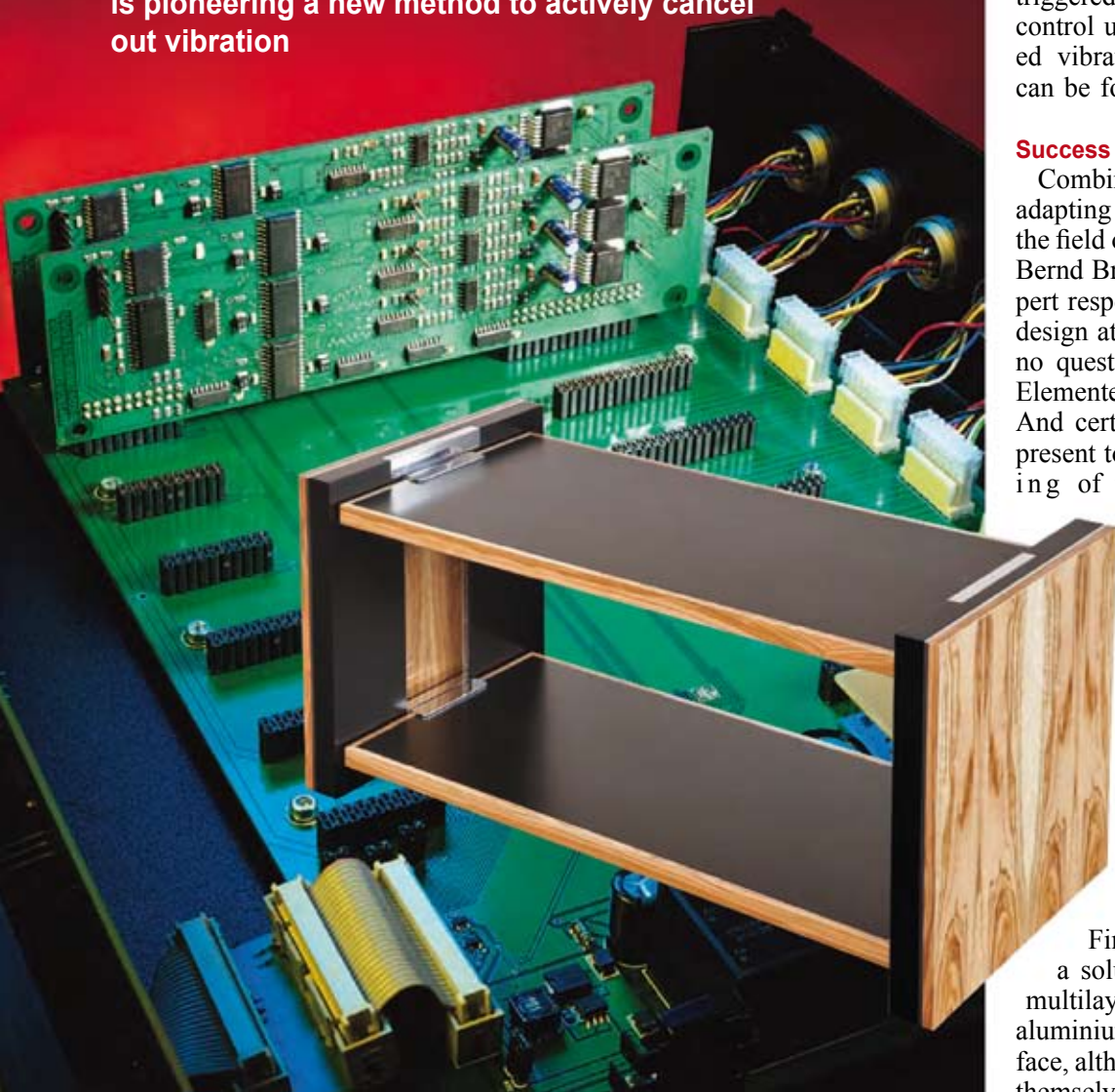


# Stop signal !

With the new "Emperor" rack Finite Elemente is pioneering a new method to actively cancel out vibration



Literally the backbone of just about every single component test review here at STEREO are the complexly designed Pagode Master Reference racks by the German company Finite Elemente. In our listening rooms and also for comparison tests at workshops at hi-fi dealers, these racks have proved their worth as top-class stands time and again. The racks allow every type of component to demonstrate its strengths to the full, in contrast to simpler rack systems which tend to be restrictive, making the component's performance seem more compact, less dynamic, discoloured or less relaxed. The Master Reference is the rack we use as the basis for reliable sound evaluations and is one of the finest pieces of audio furniture you can find.

This remains true today, although Finite Elemente has been working for

some time on topping even the Master Reference, which has been on the market since 1999. It quickly became clear that no real progress would be made using conventional technology. The top-of-the-range model already uses horizontal spikes for permanently tensioned component levels with specially tuned passive resonators as well as subtle ceramic ball coupling feet, which either prevent vibrations occurring in the first place or, where they do occur, eliminating them effectively.

The breakthrough came with a patented innovation by the renowned LBF Fraunhofer Institute in Darmstadt, Germany, where a process of active vibration control was developed to increase material strength and operational reliability, and it is exactly this process that Finite Elemente is licensed to

use exclusively in the sector of audio furniture. In addition to the mechanical approaches the „ActiveVibeControl“, abbreviated to AVC, uses for the first time in the world elements triggered by electric signals from a control unit to achieve active, targeted vibration reduction (Explanation can be found in the text box below).

## Success using „Active Vibe Control“

Combining these two areas and adapting the Fraunhofer innovation for the field of audio racks was the task of Bernd Brockhoff, the engineering expert responsible for development and design at Finite Elemente. There was no question of using AVC in Finite Elemente's existing Pagode system. And certain preconditions had to be present to guarantee perfect functioning of the active vibration control system. For example, the mechanical environment of the piezoceramic actuators countering the vibration interference had to meet certain conditions. The Pagode design using MDF boards, wood and aluminium struts was not suited for this purpose.

For the component shelves of the new sophisticated „Emperor“ audio rack Finite Elemente finally found a solution using „ALPORAS“ in multilayer sandwich design. This aluminium foam has a porous surface, although the individual pores are themselves enclosed. This high-tech material offers high specific rigidity coupled with outstanding energy absorption, excellent homogeneity and extreme low weight. ALPORAS panels are used to form the sturdy backbone of the Emperor.

In addition to selecting the material it was also necessary to develop and implement the electronic correction system. This task was the responsibility of the Trigon company in Kassel, Germany, in close cooperation with Finite Elemente. Trigon is renowned as a manufacturer of top-of-the-range hi-fi and high-end components and certainly had the required qualifications for the task. However it wasn't always easy to achieve the real-time correction signals required for effective vibration control.

**Control unit from Trigon**

The black „Control“ unit contains a high-speed computer to regulate the control electronics, which are spread across a number of circuit boards (see large photo on the left), whereby each component level is assigned its own plug-in card. There is space for up to seven cards in the control unit and a corresponding number of component levels can be individually damped. This differentiation is essential as the target values vary depending on the component’s size, weight and loading.

But to what degree and at which frequencies is it necessary to have a correction? The answer to this question came from the Fraunhofer Institute using state-of-the-art laser measuring engineering. Problematic frequency modes were identified for component shelf sizes and at the same time the most effective positions were selected for the piezoceramic foils, i.e. for the



sensors and actuators (see the diagram below). When the control unit is switched on and correctly adjusted in the immediate vicinity of the audio rack a slight clear humming originating from the actuators is perceptible, but this is scarcely noticeable at a distance of two to three metres and further away it is masked even when music is played at low volumes.

Besides the electronic methods in the Emperor Finite Elemente obviously also relies on its tried-and-tested me

**The control unit is used to adjust up to seven plug-in cards individually depending on the shelves’ size and loading**

chanical measures to make this über-rack both stable and unresponsive to resonance. In addition to the highly suitable aluminium foam mentioned above the shelves are also interconnected to the side panels within the expandable modularity of the audio rack using hard ceramic balls. The similarly equipped Cerabase feet are also supplied by Finite Elemente as

**The Emperor technology**

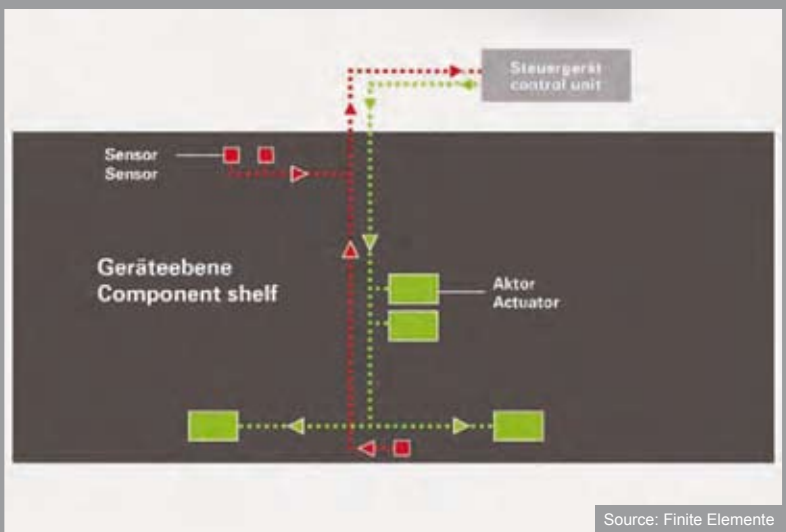
The principle of the Emperor rack is to actively counteract interference caused by vibrations. The effect of vibration is reduced using adaptronic elements that either identify the vibrations or attenuate these by initiating a countervibration. The Emperor uses piezoceramic foils that generate a tension when triggered by movement or set in motion when tension is added, acting either as sensors or actuators.

As sensors they detect vibrations and signal these to the connected control unit. The control unit then evaluates the interfering vibrations and transmits the appropriate counteracting correction signals to the stop actuators in real-time, which then mechanically introduce these into the component level using intrinsic vibration.

The top diagram demonstrates the theoretically simple, but in practice highly complex process due to the degree of precision required, in which the selected materials also play a vital role. For example the aluminium foam used for the sandwich levels is designed to guarantee optimum effectiveness.

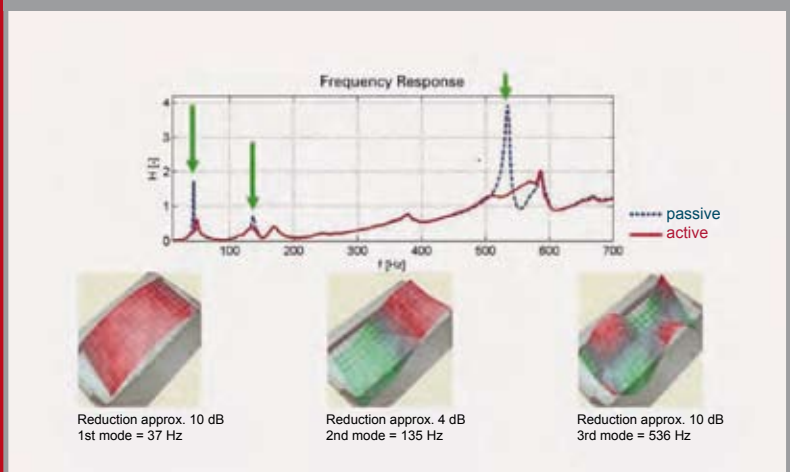
The second diagram shows the resonance spectrum for the 125 cm component shelf. Its interference peaks are clearly apparent at 37, 135 and 536 Hertz, jutting out from the surrounding vibration values and forming broad waves, as peaks and troughs in close proximity to each other or as focussed eruptions. Comparing the curves shows that the active mode (red) reduces the cut-off frequencies by ten decibels in each case, and the middle frequency is lowered by four dB. In total this means considerably less vibration interference that can be transferred to the components placed on the Emperor audio rack.

**ActiveVibeControl operational principle**



Source: Finite Elemente

**Vibration reduction by the active system**



Source: Fraunhofer LBF

standard – already accepted specialists when it comes to avoiding, absorbing and eliminating vibrations.

The side panels of the Emperor with a railing system allow flexible positioning and expansion of the component shelf levels which are available in three different widths (60, 80 and 125 centimetres). The version of the active rack we received (also available in a passive version, but it isn't possible to upgrade to active control later) came with two 1.25 metre long component levels in addition to the control unit. This configuration comes at a hefty 13,740 euros, of which 4,000 euros is taken up by the Control unit with two correction boards.

Even if the Emperor is actually an item of audio furniture, it is still a fine piece of furniture with a majestic appearance to match any exclusive furnishings of Italian manufacture. There is simply no comparison to the rather demure Pagode model.

**Triumph of active vibration control**

The main STEREO listening room was the scene for the final Finite Elemente showdown: Emperor versus Pagode Master Reference. First of all we used the Emperor in passive mode, i.e. with the Control unit switched off. Even without the active element the challenger still held its own. On the Emperor the components even sounded a touch more sonorous and sturdier, whereas the sound on the Pagode was somewhat livelier and leaner. Depending on the music style sometimes the one rack had the edge, and sometimes it was the other.

This changed when we switched on the Control unit to activate the piezoceramic foils within the component levels. Now the Emperor clearly tightened up the reproduction, and



The load-bearing element used for the levels is an aluminium foam laminated with aluminium and MDF (top left). Strong bolts hold them at the desired height in the side panels (bottom left), where – typical for Finite Elemente – ceramic balls create defined transfer points. These can be seen within the gap (right).

sound imposition increased noticeably across the full frequency range, particularly however in the lower ranges. Furthermore the components focussed their energy more precisely and managed to sound both powerful and delicate at the same time.

But that is all no more than a desirable side-effect of the Emperor's performance, as the real gain is to be found in the increase in authenticity, three-dimensionality and removal of the loudspeaker spectrum. The Emperor in active mode allows you to actually feel the dimensions of the hall where Antonio Forcione played his virtuoso „Attempo“, and the audience applause in Keith Jarrett's „Carnegie Hall Concert“ is even more extensive and tangible than when the music was played by the same components on the Master Reference.

Contrasts between front and rear were much more clearly defined with the Emperor, sometimes the front edge of the stage was in front of the loudspeakers, and the tonal qualities from this super-rack were extremely homogeneous and harmonious.

No doubt about it, the active vibration suppression works superbly. Just how perfect was demonstrated using a tuning fork fitted with piezoelectric foil that Luis Fernandes from Finite Elemente had brought along. Once triggered it vibrated for a long time at standard pitch A. Once the compensation effect was switched on, this pitch was silenced abruptly. And the actuators deal just as quickly with interfering noise in the Emperor. And this means that our top-of-the-range components sound even more spatial, layered, fluent and simply better than ever before.

*Matthias Böde*



Emperor developer Bernd Brockhoff presented the audio rack at the HighEnd Fair in Munich



The test with the primed tuning fork proved the effectiveness of the piezoceramic foil

Price: as shown with two active levels around €13,740 (extra level around €2,585), as shown with two passive levels around €8,540 (extra level around €1,985)

Dimensions:  
as shown 147x67x56 cm (WxHxD)  
Distributor: Finite Elemente,  
Tel.: ++49 (0)2961-966110  
[www.finite-elemente.de](http://www.finite-elemente.de)