

Trinnov Optimizer

Hugh Robjohns MIBS reviews a sophisticated digital room correction system.



An electronic solution to room acoustics problems has long been a holy grail, but it is only with recent sophisticated DSP technologies that significant progress has been made. Simple analogue EQ generally brings as many new problems to the table as those it purports to fix, whereas DSP offers far more flexibility with linear phase filters, much narrower bandwidths, and the ability to correct group delay issues and other time domain problems with relative ease.

Many professional and high-end consumer loudspeaker manufacturers now offer relatively simple integral DSP speaker and room correction, and several companies offer more advanced room correction systems, too. One of these, possibly the leading exponent, is Trinnov.

This French research-based company specialises in the innovative digital processing of acoustic fields. Formed in 2000 to develop commercial applications for its state of the art techniques to enhance recording and reproduction accuracy, the company already has five international patents and two products, the SRP surround microphone array and the Optimizer room correction system.

Optimizer

Launched in 2005, the Optimizer is used by NRK, ORF, Fox Studios, France3, IRT, Radio France, SWR, ZDF and the BBC – amongst many others. The system is based around a powerful dual-core PC running a Linux operating system and bespoke acoustic software. It is installed in the monitor chain and processes the audio signals to correct for a wide range of speaker and room anomalies. Several different versions are available for both stereo and multichannel applications.

The underlying concept of the Optimizer is to 'take the room out of the acoustic equation', thereby improving the accuracy and consistency of the monitoring system as a whole and allowing the sound balancer to achieve higher quality mixes that translate more reliably from one room to another. Other claimed benefits include: faster and more accurate mixing as EQ, panning and reverb settings are easier to discern, removal of the masking effects of room mode peaks and dips, improved and more stable sound stages, and reduced listening fatigue. Impressive claims, indeed.

The review model's attractive 4U custom case was fitted with high quality

commercial audio interfaces. Fan noise was negligible but there was an annoying HF whistle from the touch-screen display – although I'm told this is not normal and it could be turned off when not required anyway, so it wasn't a major issue. Slightly lower cost versions are available without the touch-screen, or in a 3U case (with or without LCD text displays). A network port enables remote configuration, and audio interfaces can be specified to suit the installation, including analogue, AES3, MADI and ADAT.

Also included is a bespoke calibration microphone with four capsules in a tetrahedral array to gather information about the amplitude and direction of sound wavefronts arriving at the listening position.

Processing

The system is commissioned by connecting the test microphone, telling the software what arrangement of speakers you are trying to align, and then starting the test sequence. It takes about thirty seconds to test each speaker, after which the system reports what it has measured and what it proposes to do about it. The extent of the processing can be determined and



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IS YOUR ROOM UNDER CONTROL?

Trinnov's Optimizer:

- Resolves acoustical/monitoring problems
- Improves tonal balance and soundstage
- Trust your monitors and focus on the mix



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fine-tuned by the user – pretty much everything is tweakable. The manufacturer can also interrogate the system via an IP address if required, to modify or update parameters. All settings can be saved as presets and recalled easily via an IR remote control.

The first processing stage is sophisticated equalisation to correct the response of the speakers, in both amplitude and phase. It aims to obtain a neutral timbre for every speaker, and can match dissimilar front and rear speakers in a surround array remarkably well. Correcting the phase response of each speaker optimises the spatial resolution with improvements in the imaging of phantom sources. Bass management facilities are also provided, and the overall tonal character of the system can be adjusted further if required (eg, to provide the cinema X-curve).

The next element tackles acoustic phenomenon which are divided into 'mostly deterministic' (such as the early reflections), and 'mostly statistic' (such as correction of the room energy response). The early reflections are tackled with a high degree of intelligence in the way the processing is applied so that attempts to correct one defect don't blindly introduce others.

Low frequency room modes below 300Hz are corrected, with optional limits on the number of filters used and the amount of gain that can be introduced to fill 'holes.' Room reverberation is also taken into account in terms of the acoustic colouration it introduces, and this is compensated for in the mid and high frequency regions.

Since the system is aware of the physical positions of each loudspeaker in relation to the listening axis it can, if required, 'remap' their outputs to match a

standard arrangement (eg. ITU775). Apparently, this is performed through the use of 'Fourier-Bessel decomposition of the acoustic field into spherical harmonics.' Basically, the 3D acoustic field is analysed in the space domain



The Trinnov measurement mic with four capsules for 3D room analysis

in the same kind of way that standard Fourier analysis allows a complex signal to be deconstructed in the frequency domain. A 'remapping matrix' can then be calculated to modify the input signals to create the acoustic field in the room that would have been obtained had the speakers been positioned correctly in terms of distance and azimuth. The Trinnov goes a step further than any other system too, in that it can correct for elevation as well. This might sound like science fiction, but I have to say it works brilliantly – and without any obvious side effects.

Listening Tests

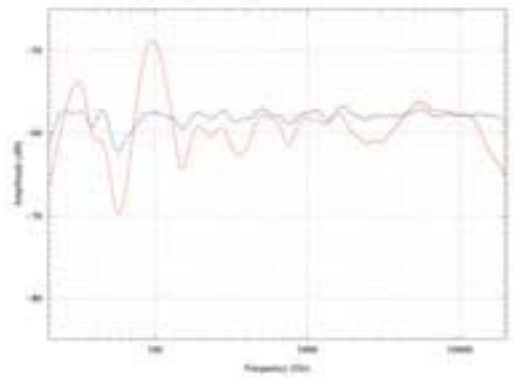
The review system was installed into a 5.1 system set up in my living room, comprising PMC IB1s for front left and right, an LB1 for the centre, a pair of DB1s for the rears, and a TLE1 subwoofer. Inevitably, the constraints of a living room meant the speakers weren't ideally placed: the centre speaker was too high (above the TV screen) and slightly right of centre, the left and right speakers were a little too widely spaced, and the rears were too close and narrowly spaced. On running the calibration tests, all of these positional errors were detected to within a degree and a few millimetres. After calibration, the system produces a PDF file for each configuration setting, detailing all the 'before and after' measurements with position, impulse, frequency and phase responses for each speaker.

During the calibration, presets were created for a variety of different configurations: a system bypass, three full correction settings with varying levels of reflection cancelling, two further versions with 2D and 3D speaker position correction, one setting used minimum-phase filters (instead of the default linear phase), and one for a simple stereo arrangement.

While the performance of this 'raw' living room 5.1 rig was, by most domestic standards, very good, I was acutely aware of various acoustic issues and had taken some steps to address them – including installing some bass traps. However, the improvements brought by the Optimizer were quite remarkable and consistent over most of the room.

The single room mode 'suck-out' at 48Hz and related peaks at 24Hz and 96Hz were removed almost completely. That was clearly audible as a more consistent bass response – all bass notes sounded equally, regardless of the key the music was played

2.2 Frequency response



in – and the bass was faster and tighter with virtually no audible room ringing!

Precise tonal matching between the speakers also enhanced the realism of sounds that moved around the surround image, and positional accuracy and stability were also improved, especially at the rear. The whole sound stage became a continuous entity, extending smoothly down the sides and joining up properly with the rear images, rather than having gaps and 'puddles' of sound.

Switching between the spatial correction modes (none, 2D and 3D) impressed in the way the imaging and spatial linearity improved dramatically without any obvious side effects.

Impressions

This box of DSP wizardry improved the sound of a somewhat disparate 5.1 system in an average domestic room to a level of precision and quality that I have heard only rarely in top professional control rooms! Moreover, I found myself hearing new things all the time in material I thought was very familiar. I also found myself listening to a lot of material over extended listening sessions – fatigue never became an issue, which has to be a good sign.

The Optimizer is an expensive tool, and it can't perform miracles, but it can dramatically improve acoustically bad environments and poor quality loudspeakers to deliver a near perfect sound stage astonishingly well. A personal investigation of this technology is highly recommended.

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Trinnov Optimizer

4U case with touch-screen
Stereo Model £5487
5.1 Model £7579

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