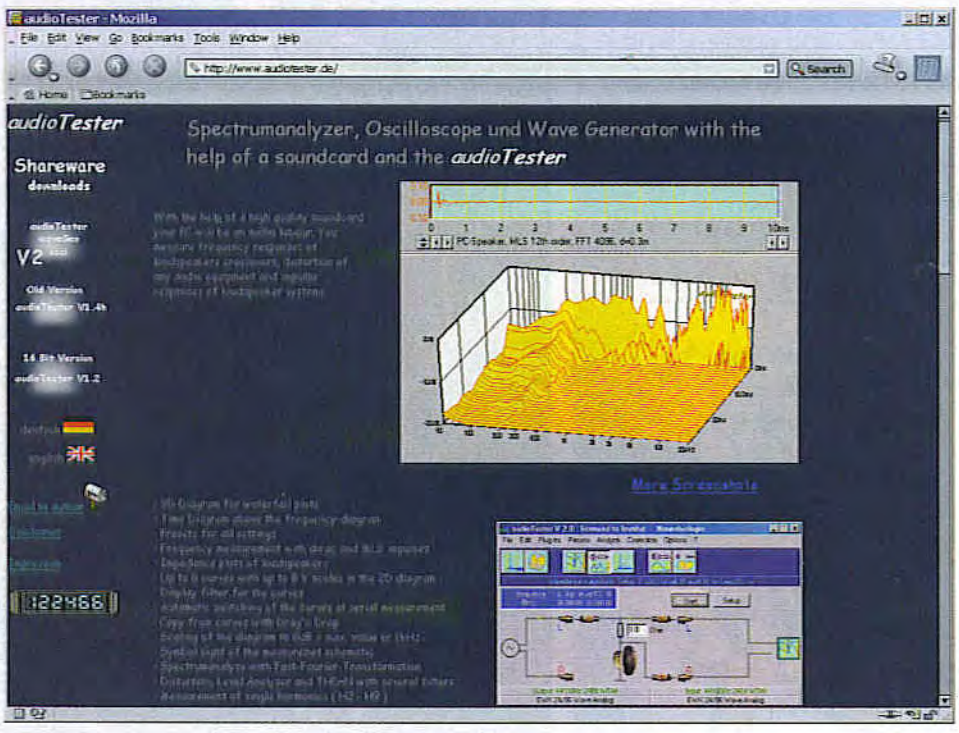
SOUNDCARD AS TEST INSTRUMENT

Perfect for audio frequency measurements!

Harry Baggen



It's safe to say that every modern PC for home or office use has an internal soundcard. In general, the quality of the PC's sound subsystem is sufficient to allow measurements in the audio frequency range. With software in abundance on the Internet, nothing to keep you from turning your PC into an oscilloscope or a function generator.

These days it's hard to find a new PC without an internal soundcard or a sound chip integrated on the motherboard. Whatever the configuration, the 'sound' hardware in the PC often offers advanced features like 5.1-surround sound. Although such 'bells and whistles' will not be used by everyone, technical developments in PC sound technology have resulted in much improved audio reproduction characteristics as compared with a few years ago. Not only do we have a wide frequency range available, there's also a good signal/noise ratio and low distortion. All in all, the perfect behaviour to enable you to perform the occasional measurements in the audio range, especially if you do not want to splash out on a real oscilloscope or an external PC 'scope. Today, advanced soundcards are available at reasonable prices from, among others, Creative, Hercules and Terratec. These products offer 24-bit resolution and 192-kHz sampling. An excellent starting point for a modest PC-based measurement system!

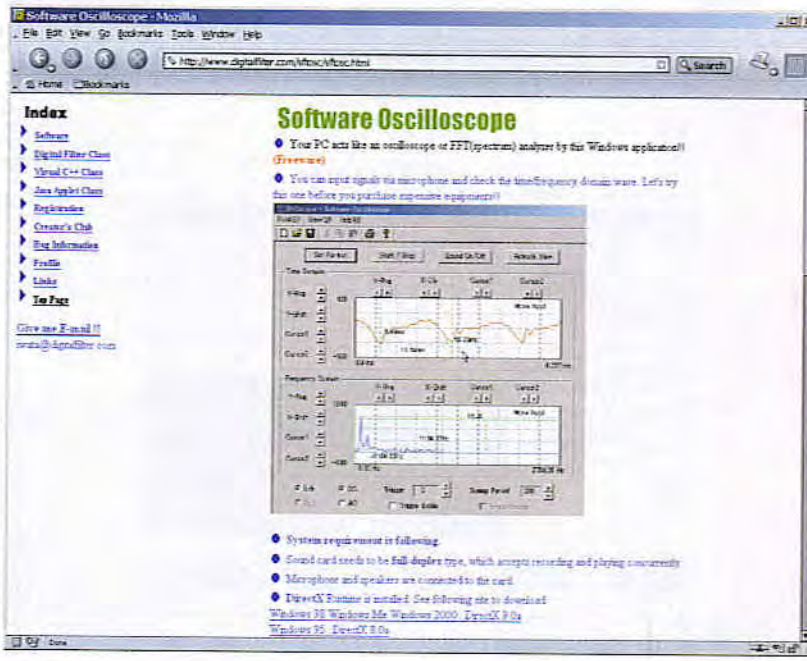
As far as software is concerned, lots of programs are available that give the PC the functionality of an oscilloscope, a spectrum analyser or a function generator, all relying on the specifications of the soundcard. Lots of software comes as freeware or shareware, so there's really no reason why electronics engineers and hobbyists should not have a go at PC-based test & measurement. If you are satisfied with displaying just a few waveforms on your PC screen, you're perfectly served by Konstantin Zeldovich's **Oscilloscope for Windows** [1], a program that's not only small (90 kB, how's that) but also free. The program may be found on the University of Moscow's website.

David Taylor's **Audio Sweep Generator** [2] is a good add-on for the above mentioned oscilloscope program. David's software is easy to operate, yet offers all necessary ingredients to produce a single frequency or a sweep. The start and end frequencies may be set, as well as the sweep rate, a linear or logarithmic sweep and the output signal levels. A few extra programs are available, too, like a toneburst generator and a vectorscope.

The **Daqarta Signal Generator** (DaqGen) [3] is another signal generator for the PC soundcard, but one with lots of bells and whistles. It allows you to choose from different waveforms like sinewave, triangular wave, sawtooth, square wave and even custom defined ones. Various modulation types may be added like PWM, AM and FM, while swept frequency ranges are also possible — of the latter, the program will also display the waveform and the Fourier analysis.

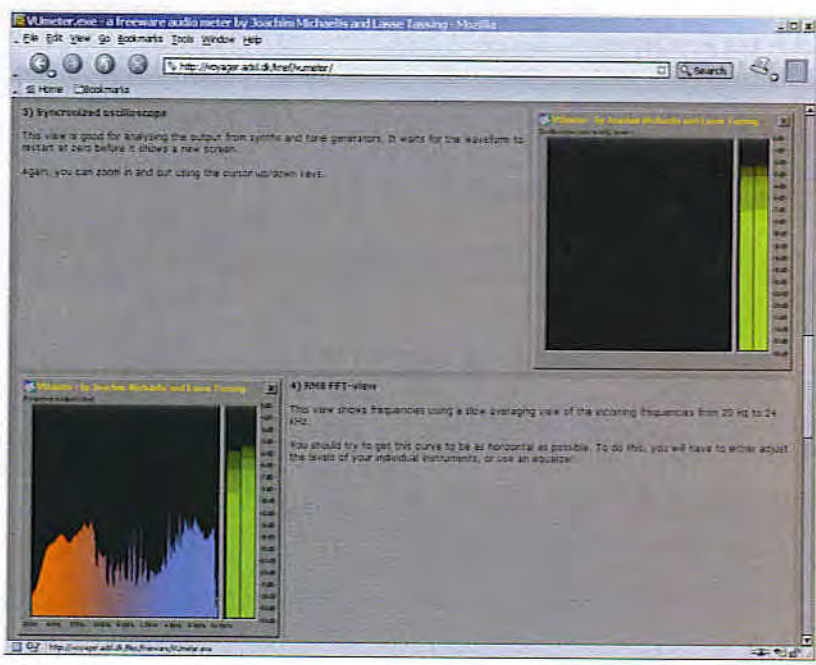
Software Oscilloscope [4] is a free program by Toshio Iwata that does more than just display the signal applied to the soundcard input — one window shows the time domain and the other, the frequency domain. This website also has lots of other interesting software in store, including advanced filter calculations.

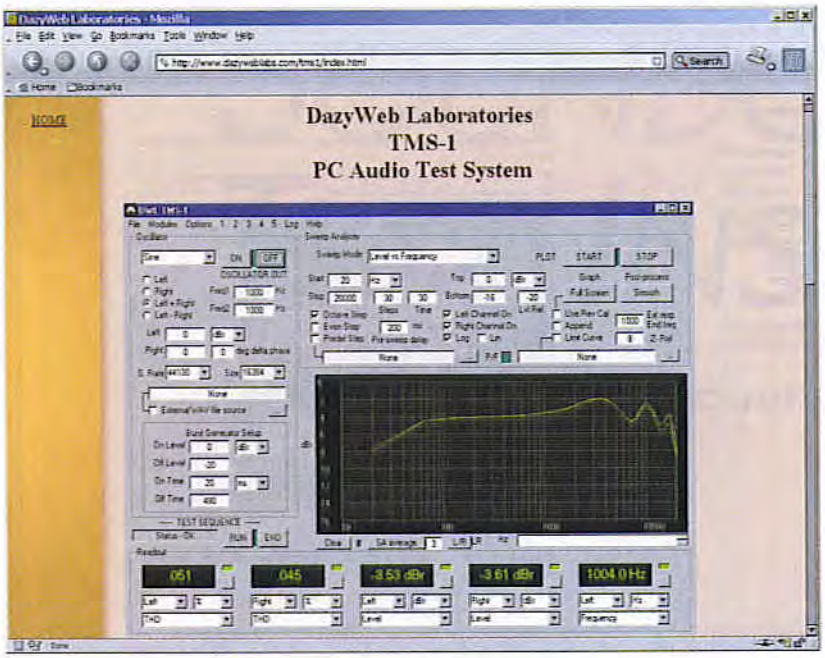
On the website published by **Thimo Esser** [5] we found a variety of small audio-related programs of which



evaluation versions may be downloaded. The available utilities include a test tone generator, a multitone generator and — quite uncommon — a Home Audiometer that allows you to evaluate your own hearing ability. All programs can be bought at low cost if you want to continue using them.

VUMeter [6] by Joachim Michaelis and Lass Tassing is also a rather specialised program. Besides the two usual bar-type level displays we all know from traditional VU





meters, the program offers a separate window where you can select the phase difference between the two channels, the waveforms (oscilloscope), an RMS, peak or stereo phase FFT image. Very useful to watch soundcard input signal levels, or analysed them.

The **Dazyweb Laboratories** website [7] offers a whole range of free PC-hosted instruments for test & measurements: oscilloscope, spectrum analyser, function generator, frequency meter, sine generator, a complete audio test system and various utilities for audio calculations. Most programs are written in Visual Basic 6 and the author normally makes the source code files of his programs freely available.

If you do not have too much experience with Fourier analysis, you may want to play around with **Sound Frequency Analyzer** by Reliable Software [8]. This little program employs a FFT (fast Fourier transform) to perform real-time analysis of the signal at the soundcard input, for example, a speech signal picked up by a microphone. This supplies a beautifully coloured 'landscape' providing a good impression of the signal's composition in terms of frequency.

Ulrich Müller's **AudioTester** [9] comprises several instruments like an extensive spectrum analyser, a signal generator and an oscilloscope. This software suite allows you to do measurements on loudspeaker boxes with the aid of so-called MLS pulses, which largely eliminate the room effects. Distortion, spectrum analysis and even a 3-D waterfall spectrum are within the possibilities. The program is not free but may be given a try as shareware. For just 28 euros (approx. 20 pounds), the full version is certainly worth buying.

The **AtSpec Spectrum Analyzer** [10] is more aimed at pure Fourier analysis, offering lots of specialised control and analysis options. A built-in generator allows tones or noise to be generated. This is also shareware (the lite version costs $29).

Finally, at **The Sonic Spot** [11] we found an interesting collection of programs and utilities for measuring and processing audio signals. Well worth exploring.

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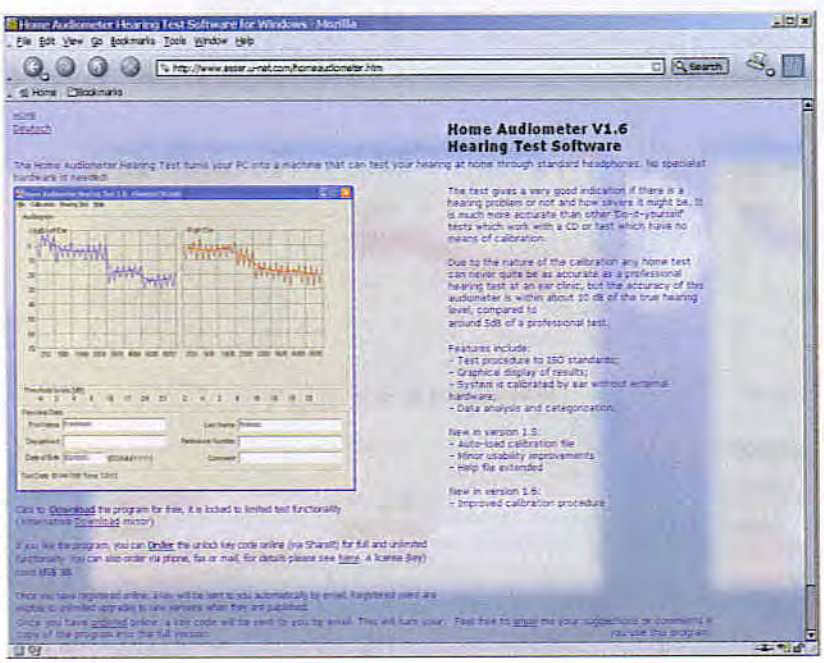

Internet addresses

[1] Oscilloscope for Windows: http://polly.phys.msu.su/~zeld/oscill.html
[2] Audio Sweep Generator: www.david-taylor.pwp.blueyonder.co.uk/software/audio.html
[3] Daqarta Signal Generator: www.daqarta.com/DGINTRO.HTM
[4] Software oscilloscope: www.digitalfilter.com/sftosc/sftosc.html
[5] Thimo Esser's Audio Software: www.esser.u-net.com/home.htm
[6] VUmeter: http://voyager.adsl.dk/knef/vumeter/
[7] Dazyweb Laboratories: www.dazyweblabs.com/shannonsoft/page3.html
[8] Sound Frequency Analyzer: www.relisoft.com/freeware/index.htm
[9] AudioTester: www.audiotester.de/
[10] AtSpec Spectrum Analyzer: www.taquis.com/atspec.htm
[11] The Sonic Spot: www.sonicspot.com/utils.html