Tonochi's Audio Room – Supplemental Info

Glossary

2021/02/15

Each description in this glossary is based on my personal memory and understanding. There is no academic backing or an authority from an authoritative person. Please acknowledge that point.

Glossary of Tonochi's Audio Room

ADP
The initials for Analog Disc Player.

amplifier (amp)
Audio equipment that amplifies audio signals. The amplifiers can be divided into two groups: preamplifiers and power amplifiers. The preamplifier amplifies voltage and has some controls such as a volume control. The power amplifier amplifies power of the audio signal. Crossover networks and phono equalizer amplifiers belong to the preamplifier group.

analog disc player (AD player; ADP)
Audio equipment that plays analog discs (vinyl records). The official name for record player.

analog source
Music media that contain analog signals like vinyl records.

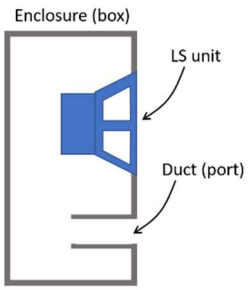
anti-skate mechanism
When a stylus of a pickup traces the groove of an analog disc, an inward force occurs to the stylus. The force pulls the pickup toward the center of the turntable. The anti-skate mechanism is a mechanism that is built in tonearms to negate the force. Every high-grade tonearm has this feature.

audiophile
A person whose hobby is audio.

audio system
A system designed to reproduce sounds of music. Basically, it consists of (a) player(s), (an) amplifier(s) and loudspeakers.
It is sometimes called 'music system' to emphasize its musicality.
The room acoustics and the quality of the AC power supply could influence the sound quality of the audio system more seriously than the quality of the audio devices. That's the reason why the system design of Gaudi II includes the room acoustics and the AC power supply design.

balanced line
A balanced line is a transmission line that has two conductors that have equal impedance with respect to ground and one cylindrical shield conductor that surrounds the former ones. The latter is grounded. The two central conductors conduct signal current only. XLR connectors (Canon connectors) are used at the both ends of the line.

Bass reflex enclosure; vented box
A measure to reinforce bass response with a resonator (duct or port) built in the baffle of a speaker enclosure. A sonic wave radiated by the inner side of the loudspeaker unit goes to the outside through the duct. When the frequency of the sonic wave matches the resonance frequency of the duct, the phase of the sonic wave is inversed, and it matches the sonic wave from the outer side of the LS unit in phase. Bass response can be strengthened by adjusting the resonance frequency of the duct to the lowest resonance frequency of the LS unit.
The duct can be positioned not only in the front baffle but in the other walls. The front baffle is most typical (front-duct layout). The next most typical is the back baffle (rear-duct layout).
The rear-duct layout is better than the front-duct layout in the level of distortion, because midrange and treble that come out of the rear duct scarcely go around to the front. As for the strength of bass, the front-duct layout is better. NOBODY-branded loudspeakers employ the rear-duct layout.



breakup motion range

The frequency range in which a cone-shaped diaphragm of a loudspeaker unit moves with deformation in its shape. The limit frequency of the pistonic motion is given by the following equation:

$f = c / 2\pi a$

where c is the sound velocity (about 345[m/sec]), and a is the effective diaphragm radius [m]

The diaphragm vibrates in pistonic motion at frequencies below f, and it vibrates in breakup motion above f.

cartridge; phono cartridge

A device that converts the vibration of the stylus into electrical signals. There are several methods for the conversion, such as electromagnetic, piezoelectric and photoelectric, but the electromagnetic type is overwhelmingly popular. The electromagnetic type can be divided into two groups: MM type and MC type.

Both MM type and MC type have their strong and weak points, but now there is no big difference between them in terms of sound quality, after many improvements have been implemented to both for many years.

Normally, a cartridge is mounted on a part called 'headshell'. The headshell can be attached/removed to/from a tonearm without a tool. You can exchange the cartridges quickly if you have multiple cartridges mounted on headshells.

coordinated design

[A technical term coined by Tonochi in October, 2020] A method to design all the components in the audio system so that they match each other electrically, mechanically, acoustically and visually. The term 'component' means all the elements to form the system, including the room and its interior (wallpapers, curtains, furniture, etc.). The following things are important in this method; for electronic devices like amplifiers, their specifications should be specified so as to draw out each other's best performance; the room and its interior should have good acoustics; the appearance of each component should be coordinated so as to produce a comfortable and artistic atmosphere.

crackling noise

A noise that is heard when a vinyl disc is played, due to dust and/or mold on the disc surface.

DAP (Digital Audio Player)

An audio device that plays digital music source like CDs and WAV files. E.g. CD player, SACD player, HDD player, etc.

DF (damping factor)

A datum that indicates driving ability of an amplifier. It is more important for power amplifiers than preamplifiers.

The following equation is the definition:

$DF = R_L[ohm] / R_O[ohm]$

Where R_L is the impedance of the load, R_O is the output impedance of the amplifier.

For example, when the load impedance is 8 ohm and the output impedance is 0.2 ohm, DF is 40.

digitally controlled analog volume control (EVR; electronic variable resistor)

Volume control circuit controlled by MCU, as against mechanical VR (variable resistor) that is controlled manually. Nowadays, ICs of this function are available. Though the IC is controlled by MCU, the internal circuit is analog. Many resistors are integrated in the chip, and attenuation is controlled by selecting some of the resistors and forming combination.

digital source

A music medium that has digital data such as CD.

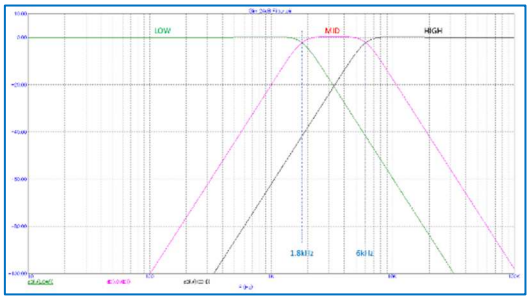
distortion ratio; distortion

The distortion ratio indicates how much components that are not included in the original signal are included in the output signal. It is the ratio of those components to the original signal. There a few definitions such as total harmonic distortion (THD) and intermodulation distortion (IMD). Usually, THD represents the distortion ratio.

dip

A sharp decline of the magnitude at a certain frequency in a frequency response curve.

crossover network



An audio device in a multi-amplifier system which divides the audio signal into some bands for loudspeaker units of multi-way speaker. It used to be called 'channel divider'. The word 'channel' used to signify frequency band. And, 'multi-amplifier system' used to be called 'multi-channel system'. Nowadays, the term 'multi-channel system' is obsolete, but 'channel divider' is still used.

DUT (Device Under Test)

A device (amplifier, loudspeaker) to be measured.

DVCS (Distributed Volume Control System)

[A technical term coined by Tonochi in June, 2020] In the system, each of the power amplifiers is equipped with a volume control chip that is controlled by the preamplifier. The preamplifier doesn't have the volume chip but the user interface in it. The audio signals flow from the player to the power amplifiers without attenuation. This improves the total SNR and dynamic range of the system.

dynamic range; D-range

The difference between the maximum and minimum values of audio signals (the ratio, to be exact). The unit is dB (decibel). For example, the dynamic range of 120dB indicates the ratio of the max to the min is 1,000,000 (one million). It is said that the ratio of the loudest to the smallest sounds in performance of an orchestra is 120dB. It is the target D-range for audio systems.

electric potential; potential

Electric potential is like water level. The water flows from the higher level to the lower level like the water flows from a lake in a mountainous area to the sea through a river. As with this, the electric current flows from the higher potential to the lower potential through an electric wire (conductor). If two spots that both have equal potential are connected, no current flows. The difference in potential is synonymous with voltage. (sorry it isn't a good explanation, since Tonochi isn't good at physics)

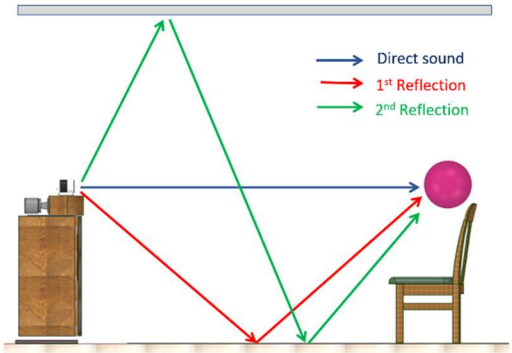
enclosure

A box in which (a) loudspeaker unit(s) is/are mounted. It is also called "speaker box."
Sometimes, a case (chassis) of an amplifier is also called "enclosure."

EVR; electronic variable resistor

The same as the digitally controlled analog volume control.

First reflection



The phenomenon that the sonic wave radiated by the loudspeaker reaches the listening position after bouncing on the surface of the boundary (floor, wall or ceiling) once. Or, that sonic wave itself is called 'first reflection'.
The first reflection impairs sound quality. Something has to be done to eliminate it.
If the sonic wave reflects twice before it reaches the listening position, it is called 'second reflection'. And, if it's three times, it is called 'third reflection', and so on.
The SPL of sonic wave decreases each time it reflects. So, the only first reflection causes the degradation in sound quality.

frequency band; frequency range; f-range

A region of frequencies. The audible frequency range covers 20Hz-20kHz, and it is called 'audio band'.

frequency domain

A concept where variation of quantity is observed on frequency scale. A frequency spectrum is a good example, where the X axis represents frequency and Y axis represents magnitude such as power.
This explanation may not right, because Tonochi is not good at mathematics and physics. Can anyone help me?

groove

A spiral groove inscribed in the vinyl disc. Audio signals are inscribed in the walls of the groove (a modulated groove).

listening position
The position the listener sits when he listens to music with an audio system. To get the best sound quality, you have to sit at the listening position. The sound quality isn't best when you sit at other positions in the room. Especially, stereo imaging is not precise at other positions.

headshell
The headshell is a part of a tonearm. A cartridge is mounted on the headshell. Most tonearms have a detachable headshell. The headshell can be attached/detached without a tool. The connector of the headshell is standardized, so it can be used for tonearms made by any other makers. The headshell itself is sold separately.

hi-fi (high fidelity)
Reproducing exactly the same sound as the original sound. However, there is a question; what is the original sound? For a component, hi-fi is the characteristics that all the input signals appear at the output without distortion nor noise. From the aspect of this, there are few hi-fi loudspeakers in the world, because few loudspeakers are able to reproduce 20Hz of deep bass. Since the audio band ranges 20Hz-20kHz, the true hi-fi loudspeaker must reproduce all the frequencies in the band without distortion.

level diagram
A diagram that indicates how the maximum values of the audio signal varies by being amplified and attenuated in an audio system.
For example, the max output of a DAP is 2V (rms). Assume that the gain of the preamplifier is -6dB (1/2) and the gain of the power amplifier is +20dB (10x), then the max value of the signal varies as follows: 2V → 1V → 10V. The level diagram visualizes this variation.

longitudinal wave
A wave in which the displacement of the medium is in the same direction as the direction of propagation of the wave. It is also called 'compressional wave' or 'pressure wave'.

loudspeaker
An audio device that converts the electric signal into acoustic wave. It is the most influential device in an audio system in terms of sound quality.
The loudspeaker is sometimes called 'speaker system' when it is complete as an audio component. The speaker system consists of (a) LS unit(s) and an enclosure.

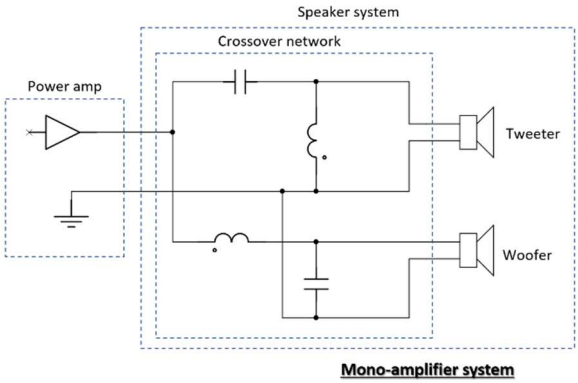
loudspeaker unit; LS unit
A loudspeaker element that is not mounted in an enclosure yet.
An LS unit for high frequencies is called 'tweeter', one for midrange is 'squawker' and one for bass is 'woofer'.

MC type (Moving Coil type)
One of electric generating mechanisms for cartridges. The vibration of the stylus (needle) is conducted to the coil. The coil vibrates in the magnetic field generated by the magnets which are fixed to the body of the cartridge. So, electromotive force (voltage) appears in the coil. This voltage is conducted to the amplifier as a signal.
The advantages of the MC type are: (1) A simple construction; (2) Most of high-end cartridges are MC type, so you have broad options; (3) The stylus force of the MC cartridge is relatively high, so budget-priced tonearms can go well with it.
The disadvantages are: (1) Low output level, which is as low as 1/10 of MM type. Some amplifiers are not compatible with MC type. In that case, you need a head amplifier or a step-up transformer to amplify the signal by 10 times (+20dB); (2) The stylus cannot be changed by the user; (3) Most of vintage MC cartridges have a peak at high frequencies (modern MC cartridges don't); (4) the frequency range of vintage MC cartridges is relatively narrow (the high end is 20kHz or so, but modern MC cartridges have wide frequency range).

MM type (Moving Magnet type)
One of electric generating mechanisms for cartridges. The vibration of the stylus (needle) is conducted to the magnet. The magnet vibrates in the coil which is fixed to the body of the cartridge. So, electromotive force (voltage) appears in the coil. This voltage is conducted to the amplifier as a signal.
The advantages of the MM type are: (1) high output voltage, about 10 times higher than MC; (2) Exchangeable stylus; (3) The compliance of the stylus is high, so the tracing ability is very good. But recent MC cartridges have as high tracing ability as MM. The high compliance can't be said to be the advantage of MM these days.
The disadvantages are: (1) Many of high-end MM cartridges are light stylus force type. There aren't so many tonearms available which fit to them; (2) Most of MM cartridges are budget-priced. You have limited choice for high-end MM cartridges.

mono-amplifier system

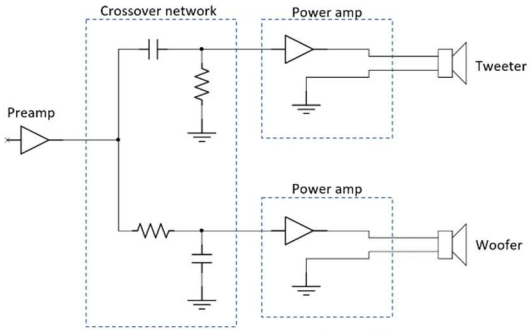
A system where every loudspeaker unit (LS unit) is driven by one power amplifier. The audio signal is divided into bands after the signal is amplified by the power amplifier. Inevitably, the filter in the crossover network must be passive type. Resistors cannot be used in the filter because it causes power loss. Inductors are used in stead of resistors. Both resistors and capacitors should be expensive ones because they must be the type that allow large currents.
In general, the crossover network is embedded in the speaker enclosure.



Mono-amplifier system

multi-amplifier system

A system where each loudspeaker unit (LS unit) is driven by its dedicated power amplifier. In the system, the audio signal is divided into the bands by a crossover network preceding the power amplifying stage, so relatively inexpensive resistors and capacitors can be used in the filter circuits in the crossover network. And, an active filter, in which a gain stage is used with the resistor/capacitor network, can be used in the crossover network. The active filter is much better in performance than the passive one.
In general, the crossover network is formed in a stand-alone device, and it's also called 'channel divider'. In most cases, the crossover network is composed of active filters.
There is no impedance between the power amplifier and the LS unit in the multi-amplifier system (to be exact, there is the impedance of the speaker cable, but it is low enough to ignore). The LS unit is precisely driven according to the audio signal. Thanks to this fact, the distortion level is so low.
2-way multi-amplifier system is also called 'biamplified system', and 3-way multi-amplifier system is also called 'triamplified system'.



Multi-amplifier system

musical hi-fi (musical high fidelity)

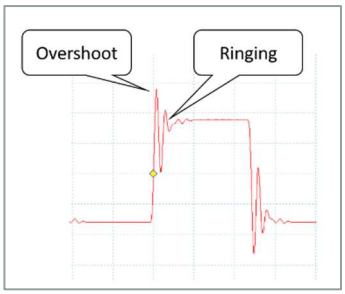
Exact reproduction of the sounds the musicians intend to convey to the listeners. In this context, the 'musician' means every staff concerning creation of music, which includes not only performers but also composers, arrangers, recording engineers, producers, etc.

op amp (operational amplifier)

Op amp was originally an amplifier module used in analog computers. As semiconductor technology grew, the whole amplifier module came to be integrated in only one IC chip. The application of the op amp IC has widely spread to many kinds of electronic equipment other than the analog computer. Since the mid 1970's, the term "op amp" means op amp IC.
Today, there are many op amps that are applicable to hi-fi audio. Some audio op amps are used in microphone amps and phono equalizer amps, which used to require discrete circuits for high performance.

overshoot

When a waveform that rises so fast such as an impulse and a square wave is fed to an audio device, the output can go higher than it should be at the rising edge. This phenomenon is called 'overshoot' (see the figure on the right).
The overshoot at the falling edge is called 'undershoot'.



peak

A pointy part in a frequency response curve where the magnitude is outstandingly high at a certain frequency.

phono equalizer amp; phono EQ; phono amp

An amplifier needed to play vinyl discs. If you don't have vinyls, this isn't necessary.
The signals inscribed in the vinyl discs are boosted in high frequency region and attenuated in low frequency region. This technique is called 'emphasis'. A filter is necessary to resume the original flat frequency response, when the disc is

played. The function of the filter is called ‘deemphasis’. The deemphasis brings about the flat response, so it is called ‘equalizer’.
The purpose of emphasis/deemphasis is to reduce noise and increase the playing time.
As for the characteristics of emphasis/deemphasis, there were many standards in the early era of the record history. In 1950’s, the specification specified by RIAA (Record Industry Association of America) became the industrial standard. Today, almost all the vinyl discs available are conforming to the RIAA spec. Therefore, the phono equalizer amp is sometimes called a ‘RIAA equalizer’.

pickup

The combination of a tonearm and a cartridge.

pistonic motion range

The frequency range in which a cone-shaped diaphragm of a loudspeaker unit moves without deformation in its shape. The limit frequency of the pistonic motion is given by the following equation:

$$f = c / 2\pi a$$

where c is the sound velocity (about 345[m/sec]), and a is the effective diaphragm radius [m]
The diaphragm vibrates in pistonic motion at frequencies below f, and it vibrates in breakup motion above f.

quasi-anechoic measurement

A method to measure characteristics of loudspeakers. The signal from the microphone is digitized, and the data of the reflections are eliminated by computing, so that the data of the direct sound from the loudspeaker are left. Normally, it is impossible to measure the characteristics of the loudspeaker itself, unless the measurement is made in an anechoic chamber. With this method, the measurement can be made in any room (regardless of the room acoustic).

recommended enclosure

An enclosure design recommended for a certain loudspeaker unit (LS unit) by the manufacturer of the LS unit. In many cases, only the dimension (inside dimension) is specified, and there isn’t any suggestion about materials and/or finish.

record

A record means (in Tonochi’s Audio Room) a medium that contains music information (signals or data), such as analog discs (SP, EP, LP), CD, SACD, DVD, and Blu-ray.
The term ‘record’ is a contrast to ‘live’.
In the narrow sense, it represents the analog disc (vinyl disc). In Tonochi’s Audio Room, this term is combined to another one to mean the vinyl disc. For example, ‘record player’ means an analog disc player. If it is used by itself, it means music media.

record player

An audio device that plays analog discs (vinyl records).
In 1970s, when Tonochi took up DIY audio as a hobby, ‘record player’ was the most commonly used term. Today, it is called ‘turntable’ or ‘TT’. But TT used to be a part of the record player, which consists of the platter and the motor. It didn’t include the tonearm, the cartridge and the cabinet. Tonochi doesn’t like to call the player ‘TT’. He thinks ‘record player’ is a proper expression.
Anyway, ‘record player’ is not an official term. ‘Analog disc player’, ‘AD player’ or ‘ADP’ is more official, I think.

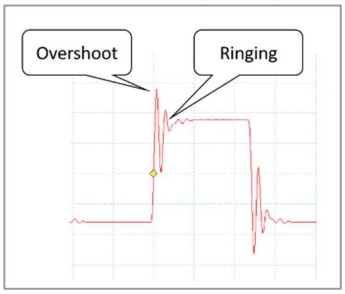
regulation

Regulation means the stability of the output voltage of a power supply unit (PSU). One of indices that represent the performance of the PSU. It is the ratio of the fluctuation of the output voltage to the nominal value. The fluctuation is caused by the fluctuation of the input voltage and that of the output current. “Good regulation” means the low fluctuation of the output voltage.

RF noise (radio frequency noise)

Frequencies higher than the audio band such as AM/FM radio waves are noise for audio equipment. They do matter, although human is unable to hear them. Most amplifying components used in audio equipment such as vacuum tubes, transistors and op amps are able to amplify frequencies up to some MHz. That is, they can amplify RF noise. That makes audio signals modulated (distorted) by the RF noise, or even the amplifying circuit malfunction.
Audio circuit designer should always be aware of this fact and devise methods to prevent the distortion caused by RF noise.

ringing



A phenomenon that appears at the output of an unstable amplifier. After an overshoot caused by an impulse or a square wave, the signal oscillates for a while instead of returning to the normal level soon (see the figure on the right). If the oscillation continues, it is called 'oscillation' (not ringing).

SNR (Signal-to-Noise Ratio)

The ratio of the signal power to noise power. It is one of the major indices that indicate performance of audio equipment just like THD and dynamic range.
The method to improve SNR is boosting the signal, reducing the noise, or both.
The first option (boosting the signal while the noise level remains the same) is a good solution, because it is effective yet easy to realize. The system design of Gaudi II is the good example (self-applause) where the volume control is built in the power amplifiers instead of the preamplifier. In this configuration, the high-level output of the preamp alleviates the adverse effect of noises that come up in the crossover network and the cables.

sound absorbing material; sound absorber

Materials that absorb sounds or products in which those materials used. Their purpose is reducing excessive reverberation in loudspeaker enclosures or listening rooms.
Glass wool used to be a typical material. Today, safer materials such as rock wool and felt and other high-tech materials are often used.
Tonochi's favorite is Micron Wool. It is a trade name. It consists of finer fibers than rock wool, and has better absorbing ability.

sound image

The sound image is an acoustical image that is formed by the sound generated by an audio system. It is perceived at the right position like a visible image. Forming sharp and right-positioned sound images of each musical instrument is an important performance in stereophonic reproduction.

SPL (Sound Pressure Level)

SPL is a datum that represents the conversion efficiency of a loudspeaker. It is the sound pressure at the position of 1m away from the loudspeaker when the input of the loudspeaker is 1W. The unit is dB/W. In another definition, the input is specified as 2.83V instead of 1W. 2.83V is the voltage across the load when the power of 1W is added to the 8-ohm load.
The exact definition of the conversion efficiency is the equation (1), but the SPL usually substitutes it. The relation between the efficiency and the SPL is defined as the equation (2).

$$E = ([\text{acoustical output}] / [\text{electrical input}]) \times 100\ [\%] \quad \ldots(1)$$

$$E = 62.8 \times 10^{((S/10)-11)} \quad \ldots (2)$$

Where S=[SPL], E=[conversion efficiency]
The equation (2) indicates the efficiency of 1% is equivalent to the SPL of 92dB/W. The SPL of 95dB/W is the efficiency of 2%.

squawker; midrange

A loudspeaker unit (LS unit) for mid frequency range.
I used to call it 'midrange'. But I've realized the term doesn't include the meaning of LS unit. Now I call it 'squawker', and use the term 'midrange' for the middle frequency region.
The reason why I used to avoid the term 'squawker' is that it has some negative meaning like 'noisy person' and 'grumbler'. I've decided to use 'squawker' because I'd like to avoid ambiguity.

squawker amp

A power amplifier dedicated to driving the squawker.
In Gaudi II, the squawker amp is specially designed for the horn-loaded squawker.

standing wave; stationary wave

A phenomenon that a sonic wave at a particular frequency last long between two walls in parallel. The sonic wave looks like not traveling but standing still there, so it's called 'standing wave' or 'stationary wave'. The sonic wave's wave length λ_n is equal to 1/n of the distance between the two walls L (n is natural number). The frequency f_n is calculated with the following equation: $f_n = c / \lambda_n$ (c is sonic velocity).
So called 'fluttering echo' is caused by the standing wave. Standing waves in a listening room impair sound quality.

system-level tuning

A new term Tonochi coined, which means a tuning of an audio system as a whole, which includes the room acoustics, based on measured data of the system.
The concrete steps are as follows: (1) Make the player replay a medium that contains test signals; (2) Digitally record the sound radiated from the loudspeaker with a measurement microphone; (3) Analyze the recording with FFT processor or other methods to obtain data to be indices; (4) Tune each component to minimize the difference between the measured data and the target values.
It's not unusual that a problem (a cause to impair sound quality) is found in those steps.

time domain

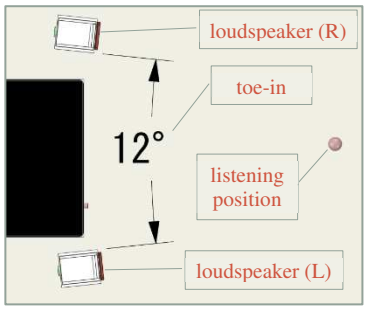
A concept where variation of quantity is observed on time scale. A waveform is a good example, where the X axis is the time scale and Y axis represents magnitude such as voltage, current, etc.
This explanation may not right, because Tonochi is not good at mathematics and physics. Can anyone help me?

THD (Total Harmonic Distortion)

THD is the ratio of the power of the harmonics to the power of the fundamental wave which appear at the output when a sine wave is fed to the input of audio equipment. The unit is % or dB.
THD is one of major indices that indicate distortion level. However, Tonochi doesn't attach importance to it. There is no big difference in sound quality between 0.1% and 0.001% of THD, he believes.

toe-in

A pair of loudspeakers in a stereo system should be placed so that they face inward to some degree. The angle between them is called 'toe-in'. When the toe-in is changed by a few degrees, sound quality is changed more than when the power amplifier is replaced. The toe-in is so an important factor.



tonearm

One of the components of a record player (AD player).

transverse wave

A wave in which the displacement of the medium is in the perpendicular direction to the direction of propagation of the wave.

tweeter

A loudspeaker unit (driver) designed to reproduce trebles (high frequencies).

tweeter amp

A power amplifier used to drive (a) tweeter(s). Some tweeter amps are specially designed to drive tweeter.

unbalanced line

An unbalanced line is a transmission line whose conductors have unequal impedances with respect to ground. One of the conductors is a wire that conducts a signal current only. The other one is a cylindrical shield conductor that surrounds the former one and conducts both the signal current and noise current. The latter is grounded.
Usually, cables that have one central conductor are used. In some cases, as in Gaudi II, cables that have two central conductors are used in order to separate the signal and noise currents.
In audio use, the connectors are RCA plug/jack.

VTA (Vertical Tracking Angle)

Vertical Tracking Angle (VTA) describes the angle between a line, from cantilever pivot to stylus contact area, and the record surface.

vinyl record; vinyl disc; vinyl; analog record; analog disc; phonograph; gramophone

Probably, 'analog record' is the official name, though, it is often called 'vinyl record' or 'vinyl disc' among audiophiles. I, too, sometimes call it "vinyl disc" in Tonochi's Audio Room. I think 'analog disc' is the most appropriate, because the term 'record' represents other recording media like recording tape in the broad sense.
Phonograph originally meant a talking machine invented by Thomas Alva Edison. Gramophone is the direct ancestor of modern analog discs invented by Emil Berliner. Both terms, 'phonograph' and 'gramophone', are still used to represent analog discs. Phonograph is often abbreviated to 'phono'.

woofer

A loudspeaker unit (driver) designed to reproduce bass sound (low frequencies).

woofer amp

A power amplifier used to drive (a) woofer(s). Some woofer amps are specially designed to drive woofers.

NOBODY Audio
Tonochi’s Audio Room - Supplemental Info