DICTIONARY OF ACOUSTIC TERMS

A-B Test: A test between two components or rooms. For example, a test between two different pre-amplifiers. For the test to be scientifically valid the levels should be matched.

AC3: See Dolby Digital.

Accelerance: The frequency response function of acceleration/force. Also known as inertance

Acoustic Emission: The detected energy that is generated when materials are deformed or break. For rolling element bearing analysis, it is the periodic energy generated by the over rolling of particles or flaws and detected by the display of the bearing flaw frequencies.

Acoustic impedance: Z=R+jX ; [ML-4T-1] ; mks acoustic ohm *(Pa· s/m3) ---of a surface, for a given frequency, the complex quotient obtained when the sound pressure averaged over the surface is divided by the volume velocity through the surface. The real and imaginary components are called, respectively, acoustic resistance and acoustic reactance.

Acoustic material: Any material considered in terms of its acoustical properties. Commonly and especially, a material designed to absorb sound.

Airborne sound: Sound that arrives at the point of interest, such as one side of a partition, by propagation through air.

Airflow resistance, R: [ML-4T-1]; mks acoustic ohm *(Pa· s/m3) ---the quotient of the air pressure difference across a specimen divided by the volume velocity of airflow through the specimen. The pressure difference and the volume velocity may be either steady or alternating.

Airflow resistivity: *[ML-3T-1]; mks rayl/m *(Pa· s/m3) ---of a homogeneous material, the quotient of its specific airflow resistance divided by its thickness.

Ambience: The acoustic characteristics of a space with regard to reverberation. A room with a lot of reverb is said to be "live"; one without much reverb is said to be "dead".

Ambient noise: The composite of airborne sound from many sources near and far associated with a given environment. No particular sound is singled out for interest.

Absorption: In acoustics, the changing of sound energy to heat.

Absorption Coefficient: The fraction of sound energy that is absorbed at any surface. It has a value between 0 and 1 and varies with the frequency and angle of incidence of the sound.

Acoustics: The science of sound. It can also refer to the effect a given environment has on sound.

AES: Audio Engineering Society.

Amplification Factor (Q): The amount of mechanical gain of a structure when excited at a resonant frequency. The ratio of the amplitude of the steady state solution (amplitude at resonance) to the static deflection for the same force F. The amplification factor is a function of the system damping. For a damping ratio $\zeta=0$ (no damping) the amplification factor is infinite, for $\zeta=1$ (critically damped) there is no amplification.

Amplitude: The instantaneous magnitude of an oscillating quantity such as sound pressure. The peak amplitude is the maximum value. Acoustic amplitude is measured and expressed in three ways: Displacement (commonly in mils Pk-Pk); Velocity (commonly in In/Sec Pk); and Acceleration (commonly in gs RMS). Amplitude is also the y-axis of the vibration time waveform and spectrum, it helps define the severity of the vibration.

Analog: An electrical signal whose frequency and level vary continuously in direct relationship to the original electrical or acoustical signal.

Anechoic: Without echo.

Anechoic chamber: A room designed to suppress internal sound reflections. Used for acoustical measurements.

Articulation: A quantitative measure of the intelligibility of speech; the percentage of speech items correctly perceived and recorded.

Artificial Reverberation: Reverberation generated by electrical or acoustical means to simulate that of concert halls, etc., added to a signal to make it sound more lifelike.

Arithmetic mean sound pressure level: Of several related sound pressure levels measured at different positions or sound pressure levels measured at different positions or different times, or both, in a specified frequency band, the sum of the sound pressure levels divided by the number of levels.

ASA: Acoustical Society of America.

ASHRAE: American Society of Heating, Refrigerating, and Air-Conditioning Engineers.

Asynchronous, Nonsynchronous: Frequencies in a vibration spectrum that exceed shaft turning speed (TS), but are not integer or harmonic multiples of TS. Also commonly referred to as non-synchronous.

Attack: The beginning of a sound; the initial transient of a musical note.

Attenuate: To reduce the level of an electrical or acoustical signal.

Audible frequency range: The range of sound frequencies normally heard by the human ear. The audible range spans from 20Hz to 20,000Hz

Audiophile: A person who is interested in sound reproduction.

Auditory Area: The sensory area lying between the threshold of hearing and the threshold of feeling or pain.

Aural: Having to do with the auditory mechanism.

Average room absorption coefficient: Total room absorption in sabins or metric sabins, divided by total room surface area in consistent units of square feet or square meters.

Average sound pressure level: Of several related sound pressure levels measured at different positions or different times, or both, in a specified frequency band, ten times the common logarithm of the arithmetic mean of the squared pressure ratios from which the individual level were derived.

Axial Mode: The room resonances associated with each pair of parallel walls.

A-weighting: A frequency-response adjustment of a sound-level meter that makes its reading conform, very roughly, to human response.

Background noise: Noise from all sources unrelated to a particular sound that is the object of interest. Background noise may include airborne, structureborne, and instrument noise.

Baffle: A movable barrier used to achieve separation of signals from different sources. The surface or board upon which a loudspeaker is mounted.

Bandpass filter: A filter that attenuates signals both below and above the desired passband.

Bandwidth: The total frequency range of any system. Usually specified as something like: 20-20,000HZ plus or minus 3 db.

Bass: The lower range of audible frequencies.

Beaming: The phenomenon of sound being emitted within a comparatively small solid angle. This characteristic becomes more acute as the frequency increases.

Beats: Periodic fluctuations that are heard when sounds of slightly different frequencies are superimposed.

Binaural: A situation involving listening with two ears.

Boomy: Listening term, refers to an excessive bass response that has a peak(s) in it.

Broad band noise: Spectrum consisting of a large number of frequency components, none of which is individually dominant.

Bright: Listening term. Usually refers to too much upper frequency energy.

Byte: A term used in digital systems. One byte is equal to 8 bits of data. A bit is the elemental "high" or "low" state of a binary system.

Cepstrum: The cepstrum is the forward Fourier transform of a spectrum. It is thus the spectrum of a spectrum, and has certain properties that make it useful in many types of signal analysis. One of its more powerful attributes is the fact that any periodicities, or repeated patterns, in a spectrum will be sensed as one or two specific components in the cepstrum. If a spectrum contains several sets of sidebands or harmonic series, they can be confusing because of overlap. But in the cepstrum, they will be separated in a way similar to the way the spectrum separates repetitive time patterns in the waveform. Gearboxes and rolling element bearing vibrations lend themselves especially well to cepstrum analysis. The cepstrum is closely related to the auto correlation function.

Channel Balance: In a stereo system, the level balances between left and right channels. Properly balanced, the image should be centered between the left-right speakers. In a home-theater system, refers to achieving correct balance between all the channels of the system.

Characteristic impedance of the medium: [ML-2T-1]; mks rayl *(Pa· s/m) - the specific normal acoustic impedance at a point in a plane wave in a free field. It is a pure specific resistance since the sound pressure and the particle velocity are in phase and it is equal in magnitude to the product of the density of the medium, p, and the speed of sound in the medium, c. Its value when the medium is air at 20 degrees Celsius and 101.25 kPa is 413 mks rayl (Pa-s/m),

Clipping: Refers to a type of distortion that occurs when an amplifier is driven into an overload condition. Usually the "clipped" waveform contains an excess of high-frequency energy. The sound becomes hard and edgy. Hard clipping is the most frequent cause of "burned out" tweeters. Even a low-powered amplifier or receiver driven into clipping can damage tweeters which would otherwise last virtually forever.

Coherence: Coherence is a number between one and zero, and is a measure of the degree of linearity between two related signals, such as the input force of a structure related to the vibration response to that force. Coherence is thus a two-channel measurement, and does not apply to single-channel measurements of vibration signatures. In a frequency response measurement of a mechanical structure, if the structure is linear, the coherence will be one, but if there is some nonlinearity in the structure or if there is noise in a measurement channel, the coherence will be less than one. The dual-channel FFT analyzer is able to measure the coherence between the two channels, and it is a useful tool in determining good from noisy or meaningless data.

Coherence Function: Coherence is a function of frequency that measures amount of power in the response (output) that is caused by the power in the excitation (input). If it is 100% coherent, the value is 1.

Coloration: Listening term. A visual analog. A "colored" sound characteristic adds something not in the original sound.

The coloration may be euphonically pleasant, but it is not as accurate as the original signal.

Comb filter: A distortion produced by combining an electrical or acoustical signal with a delayed replica of itself. The result is constructive and destructive interference that results in peaks and nulls being introduced into the frequency response. When plotted to a linear frequency scale, the response resembles a comb, hence the name.

Compliance: 1) Frequency response function of displacement/force. Also known as Dynamic Compliance. 2) Property of a confined gas proportional to its volume and inversely proportional to its density.

Compression: In audio, compression means to reduce the dynamic range of a signal. Compression may be intentional or one of the effects of a system that is driven to overload. It is also the portion of a sound wave in which molecules are pushed together, forming a region with higher-than-normal atmospheric pressure.

Critical band: In human hearing, only those frequency components within a narrow band, called the critical band, will mask a given tone. Critical bandwidth varies with frequency but is usually between 1/6 and 1/3 octaves.

Critical Damping: The smallest amount of damping required to return a system to its equilibrium condition without oscillating.

Critical Distance: The distance from a sound source at which direct sound and reverberant sound are at the same level.

Critical Frequency: The frequency below which standing waves cause significant room modes.

Cross-talk: Unwanted breakthrough of one channel into another. Also refers to the distortion that occurs when some signal from a music source that you are not listening to leaks into the circuit of the source that you are listening to.

Crossover frequency: In a loudspeaker with multiple radiators, the crossover frequency is the 3-dB point of the network dividing the signal energy.

Cutoff frequency: Of an anechoic wedge or set of wedges, the lowest frequency above which the normal incidence sound absorption coefficient is at least .990.

Cycles per second: The frequency of an electrical signal or sound wave. Measured in Hertz (Hz).

Damp: To cause a loss or dissipation of the oscillatory or vibrational energy of an electrical or mechanical system.

Damping Factor or Damping Ratio: The ratio of actual damping in a system to its critical damping.

DB: See decibel.

DB (A): A sound-level meter reading with an A-weighting network simulating the human-ear response at a loudness level of 40 phons.

DB (B): A sound-level meter reading with a B-weighting network simulating the human-ear response at a loudness level of 70 phons.

DB (C): A sound-level meter reading with no weighting network in the circuit, i.e., flat. The reference level is 20 uPa.

Decade: Ten times any quantity or frequency range. The range of the human ear is about 3 decades.

Decay rate: d, [T-1]; dB/s--for airborne sound, the rate of decrease of vibratory acceleration, velocity, or displacement level after the excitation has stopped.

Decibel: dB---the term used to identify ten times the common logarithm of the ratio of two like quantities proportional to power or energy. (See level, sound transmission loss.) Thus, one decibel corresponds to a power ratio of 100.1.

Deterministic: A type of signal whose spectrum consists of a collection of discrete components, as opposed to a random signal, whose spectrum is spread out or "smeared" in frequency. Some deterministic signals are periodic, and their spectra consist of harmonic series. Vibration signatures of machines are in general deterministic, containing one or more harmonic series, but they always have nondeterministic components, such as background noise.

Diaphragm (also diaphragmatic): Any surface that vibrates in response to sound or is vibrated to emit sound, such as in microphones and loudspeakers. Also applied to wall and floor surfaces vibrating in response to sound or in transmitting sound.

Differentiation: In vibration analysis, differentiation is a mathematical operation that converts a displacement signature to a velocity signature, or a velocity signature to an acceleration signature. It is performed electronically on an analog signal or can be performed digitally on a spectrum. Differentiation is an inherently noisy operation, if performed on an analog signal, adding a significant amount of high frequency noise to the signal, and is generally not used very much in machinery vibration analysis. It is not inherently noisy if it is done digitally on the FFT spectrum. See also Integration, which is the inverse of differentiation.

Diffraction: A change in the direction of propagation of sound energy in the neighborhood of a boundary discontinuity, such as the edge of a reflective or absorptive surface.

Diffuse field: An environment in which the sound pressure level is the same at all locations and the flow of sound energy is equally probable in all directions.

Digital: A numerical representation of an analog signal. Pertaining to the application of digital techniques to common tasks.

Dipole: An open-back speaker that radiates sound equally front and rear. The front and rear waves are out of phase and cancellation will occur when the wavelengths are long enough to "wrap around". The answer is a large, wide baffle or to enclose the driver creating a monopole.

Directivity index (DI): The difference between sound pressure level in any given direction in the acoustic far field and the average sound pressure level in that field.

Discrete Fourier Transform: The mathematical calculation that converts, or "transforms" a sampled and digitized waveform into a sampled spectrum. The fast Fourier transform, or FFT, is an algorithm that allows a computer to calculate the discrete Fourier transform very quickly. See also Fast Fourier Transform.

Distortion: Anything that alters the musical signal. There are many forms of distortion, some of which are more audible than others.

Divergence: The spreading of sound waves which, in a free field, causes sound pressure levels in the far field of a source to decrease with increasing distance from the source.

Dolby Digital: Is a five-channel system consisting of left, center, right and left rear, right rear channels. All processing is done in the digital domain . Unlike Dolby Prologic in which the rear effects channels are frequency limited to approx. 100-700Hz, Dolby Digital rear channels are specified to contain the full 20-20Khz frequency content. The AC3 standard also has a separate subwoofer channel for the lowest frequencies.

Dolby Prologic: Is a four-channel system consisting of left, center, right and rear channel, (the single rear channel is usually played through two speakers).

DTS: Digital Theater System. A multi-channel encoding/decoding system. Used in some movie theaters. Also now included in some home-theater processors. A competitor to Dolby Digital.

DSP: Digital Signal Processing. DSP can be used to create equalization, compression, etc. of a digital signal.

DVD: Digital Video Disc or Digital Versatile Disc. A relatively new standard that seeks to combine better-than-laser-disc quality video with better-than-CD quality audio in a disc the size of a CD. Requires special players. Seems to be a viable candidate to replace both Laser Discs and CDs, but the jury is still out.

Dynamic Headroom: The ability of an audio device to respond to musical peaks. For example, an amplifier may only be capable of a sustained 100 watts, but may be able to achieve peaks of 200 watts for the fraction of a second required for an intense, quick sound. In this example the dynamic headroom would equal 3 dB.

Dynamic range: The range between the loudest and the softest sounds that are in a piece of music, or that can be reproduced by a piece of audio equipment without distortion (a ratio expressed in decibels). In speech, the range rarely exceeds 40 dB; in music, is greatest in orchestral works, where the range may be as much as 75 dB.

Dyne: The force that will accelerate a 1-gram mass at the rate of 1 cm/sec. The old standard reference level for sound pressure was .0002 dyne/sq. cm. The same level today is expressed as 20 micro pascals, or 20 uPa.

Echo: A delayed return of sound that is perceived by the ear as a discrete sound image.

Echograms: A record of the very early reverberatory decay of sound in a room.

EES: Early, early sound. Structure-borne sound may reach the microphone in a room before the air-borne sound because sound travels faster through denser materials.

EFC: Energy-frequency curve.

EFTC: Energy-frequency-time curve.

Ensemble: Musicians must hear each other to function properly; in other words ensemble must prevail. Diffusing elements surrounding the stage area contribute greatly to ensemble.

Equal loudness contour: A contour representing a constant loudness for all audible frequencies. The contour having a sound pressure level of 40 dB at 1,000Hz is arbitrarily defined as the 40-phon contour.

Equalizer: A device for adjusting the frequency response of a device or system.

Equalization: The process of adjusting the frequency response of a device or system to achieve a flat or other desired response.

ETC: Energy-time curve.

Euphonic: Pleasing. As a descriptive audio term, usually refers to a coloration or inaccuracy that none-the-less may be sonically pleasing.

Extension: How extended a range of frequencies the device can reproduce accurately. Bass extension refers to how low a frequency tone will the system reproduce, high-frequency extension refers to how high in frequency will the system play.

Far field: That part of the sound field in which sound pressure decreases inversely with distance from the source. This corresponds to a reduction of approximately 6 dB in level for each doubling distance.

Fast Fourier Transform (FFT): The FFT is an algorithm, or digital calculation routine, that efficiently calculates the discrete Fourier transform from the sampled time waveform. In other words it converts, or "transforms" a signal from the time domain into the frequency domain.

Feedback, acoustic: Unwanted interaction between the output and input of an acoustical system, e.g., between the loudspeaker and the microphone of a system.

Field sound transmission class, FSTC: Sound transmission class calculated in accordance with Classification E 413 using values of field transmission loss.

Field transmission loss, FTL: Sound transmission loss measured in accordance with Annex A1 of Test Method E 336.

Flame spread: A measure of the time it takes for flame to spread. Compared to red oak, whose Flame Spread Index (FSI) is 100 in accordance with ASTM E 84. The infill of IAC sound absorptive metal panels has an FSI of 20.

Flanking transmission: Transmission of sound from the source to a receiving location by a path other than that under consideration.

Fletcher-Munson Curve: Our sensitivity to sound depends on its frequency and volume. Human ears are most sensitive to sounds in the midrange. At lower volume levels humans are less sensitive to sounds away from the midrange, bass and treble sounds "seem" reduced in intensity at lower listening levels.

FTC: Frequency-time curve.

FFT: Fast Fourier Transform. An iterative program that computes the Fourier Transform in a shorter time. It converts, or "transforms" a signal from the time domain into the frequency domain.

Fidelity: As applied to sound quality, the faithfulness to the original.

Filter, high pass: A filter that passes all frequencies above a cutoff frequency.

Filter, low pass: A filter that passes all frequencies below a certain cutoff frequency.

Filter, band pass: A filter that passes all frequencies between a low-frequency cutoff point or a high-frequency cutoff point.

Flutter: A repetitive echo set up by parallel reflecting surfaces.

Fourier, Jean Baptiste: The famous many-talented French engineer, mathematician, and one time president of Egypt, who devised the Fourier series and Fourier Transform for the conversion of time functions into frequency functions and vice versa.

Fourier Transform: The mathematically rigorous operation which transforms from the time domain to the frequency domain and vice versa. See also Fast Fourier Transform.

Fourier Analysis: Fourier analysis is another term for spectrum analysis, although it generally refers to analysis using an FFT analyzer. The application of the Fourier transform to a signal to determine its spectrum.

Free field: An environment in which a sound wave may propagate in all directions without obstructions or reflections. Anechoic rooms can produce such an environment under controlled conditions.

Frequency: The measure of the rapidity of alterations of a periodic signal, expressed in cycles per second or Hz.

Frequency response: The changes in the sensitivity of a circuit ,device, or room with frequency.

Forced Vibration: The oscillation of a system under the action of a forcing function.

Fuel contributed: A measure of temperature rise in flame as a function of the time compared to red oak whose fuel contribution index (FCI) is 100 in accordance with ASTM E 84. The infill of IAC sound absorptive metal panels has an FSI of 15.

Fundamental: The lowest frequency of a note in a complex wave form or chord.

Fusion Zone: All reflections arriving at the observer's ear within 20 to 40 msec of the direct sound are integrated, for fused together, with a resulting apparent increase in level and a pleasant change of character. This is the Haas Effect.

Gain: To increase in level. The function of a volume control.

Grain: Listening term. A sonic analog of the grain seen in photos. A sort of "grittiness" added to the sound.

Grating, diffraction: An optical grating consists of minute, parallel lines used to break light down into its component colors. The principle is now used to achieve diffraction of acoustical waves.

Grating, reflection phase: An acoustical diffraction grating to produce diffusion of sound.

Haas effect: See fusion zone. Also called the precedence effect. Delayed sounds are integrated by the auditory apparatus if the fall on the ear within 20 to 40 msec of the direct sound. The level of the delayed components contributes to the apparent level of the sound, and it is accompanied by a pleasant change in character.

Hard room: A room in which the surfaces have very low values of sound absorption and are therefore highly reflective.

Harmonics: Also called overtones, these are vibrations at frequencies that are multiples of the fundamentals. Harmonics extend without limit beyond the audible range. They are characterized as even-order and odd-order harmonics. A second-order harmonic is two times the frequency of the fundamental; a third order is three times the fundamental; a fourth order is four times the fundamental; and so forth. Each even-order harmonic: second, fourth, sixth, etc.-is one octave

or multiples of one octave higher than the fundamental; these even-order overtones are therefore musically related to the fundamental. Odd-order harmonics, on the other hand: third, fifth, seventh, and up-create a series of notes that are not related to any octave overtones and therefore may have an unpleasant sound. Audio systems that emphasize odd-order harmonics ten to have a harsh, hard quality.

Headroom: The ability of an amp to go beyond its rated power for short durations in order to reproduce musical peaks without distortion. This capability is often dependent on the power supply used in the design.

Hearing Sensitivity: The human ear is less sensitive at low frequencies than in the midrange. Turn your volume knob down and notice how the bass seems to "disappear". To hear low bass requires an adequate SPL level. To hear 25Hz requires a much higher SPL level than to hear 250Hz.

Hertz: the unit of frequency, abbreviated Hz. The same as cycles per second. The name is in honor of Heinrich Hertz, an early German investigator of radio wave transmission.

Helmholtz resonator: A reactive, tuned, sound absorber. A bottle is such a resonator. They can employ a perforated cover or slats over a cavity.

High-pass filter: See filter, high pass.

Hysteresis: Non-uniqueness in the relationship between two variables as a parameter increases or decreases. Also called deadband, or the portion of the system's response where a change in input does not produce a change in output.

Hysteresis Damping (Hysteretic Damping, Structural Damping): Energy losses within a structure that are caused by internal friction within the structure. These losses are independent of speed or frequency of oscillation but are proportional to the vibration amplitude squared.

IEEE: Institute of Electrical and Electronic Engineers.

Imaging: Listening term. A good stereo system can provide a stereo image that has width, depth and height. The best imaging systems will define a nearly holographic re-creation of the original sound.

Impedance: The opposition to the flow of electric or acoustic energy measured in ohms.

Impact insulation class, IIC: A single-number rating derived from measured values of normalized impact sound pressure levels I accordance with Annex A1 of Test Method E 492. It provides an estimate of the impact sound insulating performance of a floor-ceiling assembly.

Impulse: A very short, transient, electric or acoustic signal.

Impulse response: Sound pressure versus time measurement showing how a device or room responds to an impulse.

In phase: Two periodic waves reaching peaks and gong through zero at the same instant are said to be "in phase."

Insertion loss, IL: Of a silencer or other sound-reducing element, in a specified frequency band, the decrease in sound power level, measured at the location of the receiver, when a sound insulator or a sound attenuator is inserted in the transmission path between the source and the receiver.

Inertance: The frequency response function of acceleration/force. Also known as accelerance.

Integration: Integration is the mathematical operation which is the inverse of differentiation. In vibration analysis, integration will convert an acceleration signal into a velocity signal, or a velocity signal into a displacement signal. Integration can be done with excellent accuracy with an analog integrator in the time domain or can be done digitally in the frequency domain. For this reason an accelerometer is the transducer of choice because velocity and displacement can be so easily derived from its output. An analog integrator is actually a low pass filter with 6 dB of attenuation per octave. This is true of an analog integrator only above its low cutoff. And since the low cutoff cannot be zero, analog integrators have low-frequency limits, usually either 1 or 10 Hz.

Interference: The combining of two or more signals results in an interaction called interference. This may be constructive or destructive. Another use of the term is to refer to undesired signals.

Initial time-delay gap: The time gap between the arrival of the direct sound and the first sound reflected form the surfaces of the room.

Inverse-square law: Under far field/free field conditions, sound intensity varies inversely with the square of the distance from the source. In pure spherical divergence of sound from a point source in free space, the sound pressure level decreases 6 dB for each doubling of the distance.

ITD: Initial time-delay gap.

Intensity: Acoustic intensity is sound energy flux per unit area. The average rate of sound energy transmitted through a unit area normal to the direction of sound transmission.

JASA: Journal of the Acoustical Society of America.

JAES: Journal of the Audio Engineering Society.

KHz: 1,000Hz.

Law of the first wave front: The first wave front falling on the ear determines the perceived direction of the sound.

LEDE: Live end dead end.

Level, L: Ten times the common logarithm of the ratio of a quantity proportional to power or energy to a reference quantity of the same kind. (See sound power level, sound

pressure level.) the quantity so obtained is expressed in decibels.

Level reduction, LR: In a specified frequency band, the decrease in sound pressure level, measured at the location of the receiver, when a barrier or other sound-reducing element is placed between the source and the receiver.

Linear: A device or circuit with a linear characteristic means that a signal passing through it is not distorted.

Live end dead end: An acoustical treatment plan for rooms in which one end is highly absorbent and the other end reflective and diffusive.

Logarithm: An exponent of 10 in the common logarithms to the base 10. For example, 10 to the exponent 2=100; the log of 100=2.

Loudspeaker: An electroacoustical transducer that changes electrical energy to acoustical energy.

Loudness: A subjective term for the sensation of the magnitude of sound.

Masking: The amount (or the process) by which the threshold of audibility for one sound is raised by the presence of another (masking) sound.

Mass law: An approximation that describes the Sound Transmission Loss (TL) of a limp, flexible barrier in terms of mass density and frequency. For each doubling of the weight or frequency of a partition, mass law predicts a 6 dB increase in TL.

Mean free path: For sound waves in an enclosure, it is the average distance traveled between successive reflections.

Mechanical Impedance: The frequency response function of force/velocity.

Metric sabin: [L2]---the unit of measure of sound absorption in the metre-kilogram-second system of units.

Microphone: An acoustical-electrical transducer by which sound waves in air may be converted to electrical signals.

Midrange: A speaker, (driver), used to reproduce the middle range of frequencies. A midrange is combined with a woofer for low frequencies and a tweeter for high frequencies to form a complete, full-range system.

Millisecond: One thousandth of a second, abbreviated ms or msec.

Mobility: The frequency response function of velocity/force. Mobility is the inverse of mechanical impedance. It is a measure of the ease with which a structure is able to move in response to an applied force, and varies it with frequency.

The vibration measured at a point on a machine is the result of a vibratory force acting somewhere in the machine. The magnitude of the vibration is equal to the magnitude of the force times the mobility of the structure. From this it follows that the amplitude of the destructive forces acting on a machine are not determined directly by measuring its vibration if the mobility of the machine is not known. For this reason, it is a good idea to measure the mobility at the bearings of a machine in order to find out the levels of the forces acting on the bearings due to imbalance or misalignment.

Modal Analysis: The process of determining a set of generalized coordinates for a system such that the equations of motion are both inertially and elastically uncoupled. More commonly, it is a process of determining the natural frequencies, damping factors, and mode shapes for a structure. This is usually done either experimentally through frequency response testing or mathematically using finite element analysis. Mode Shape The relative position of all points on a structure at a given natural frequency.

Mode: A room resonance. Axial modes are associated with pairs of parallel walls. Tangential modes involve four room surfaces and oblique modes all six surfaces. Their effect is greatest at low frequencies and for small rooms.

Monaural: See monophonic.

Monitor: Loudspeaker used in the control of a recording studio.

Monophonic: Single-channel sound.

Monopole: Any speaker that encloses the back-wave of the speaker device even though part of this back-wave may be released via a port or duct. The primary radiation at most frequencies will be from the driver front. If the driver is not enclosed it becomes a dipole.

Muddy: Listening term. A sound that is poorly defined, sloppy or vague. For example, a "muddy" bass is often boomy with al the notes tending to run together.

Muting: To greatly decrease the volume level. Many receivers and pre-amplifiers have a muting control which allows the volume level to be cut way down without changing the master volume control. Great for when the phone rings.

NAB: National Association of Broadcasters.

Near field: Locations close to the sound source between the source and the far field. The near field is typically characterized by large sound pressure level variations with small changes in measurement position from the source.

Noise: Interference of an electrical or acoustical nature. Random noise is a desirable signal used in acoustical measurements. Pink noise is random noise whose spectrum falls at 3 dB per octave: it is useful for use with sound analyzers with constant percentage bandwidths.

Noise criteria: Standard spectrum curves by which a given measured noise may be described by a single NC number.

Noise isolation class, NIC: A single-number rating calculated in accordance with Classification E 413 using measured values of noise reduction. It provides an estimate of the sound isolation between two enclosed spaces that are acoustically connected by one or more paths.

Noise reduction (NR): The difference in sound pressure level between any two points along the path of sound propagation. As an example, noise reduction is the term used to describe the difference in sound pressure levels between the inside and outside of an enclosure.

Noise reduction coefficient (NRC): The arithmetic average, to the nearest multiple of .05, of the sound absorption coefficients in the 1/3 octave bands centered at 250 Hz, 500Hz, 1000 Hz, and 2000 Hz..

Normal incidence sound absorption: *; [dimensionless]---of a surface, at a specified frequency, the fraction of the perpendicularly incident sound power absorbed or otherwise not reflected.

Normal mode: A room resonance. See mode.

Normalized noise isolation class, NNIC: A single-number rating calculated in accordance with Classification E413 using measured values of normalized noise reduction. (See normalized noise reduction.)

Normalized noise reduction, NNR: Between two rooms, in a specified frequency band, the value that the noise reduction in a given field test would have if the reverberation time in the receiving room were .5 s.

Null: A low or minimum point on a graph. A minimum pressure region in a room.

Nyquist Frequency: Digital signal processing requires analog to digital (A to D) conversion of the input signal. The first step in A to D conversion is sampling of the instantaneous amplitudes of signal at specific times determined by the sampling rate. If the signal contains any information at frequencies above one-half the sampling frequency, the signal will not be sampled correctly, and the sampled version of the signal will contain spurious components. This is called aliasing. The theoretical maximum frequency that can be correctly sampled is equal to one-half the sampling rate, and is called the Nyquist frequency.

In all digital signal processing systems, including FFT analyzers, the sampling rate is made to be significantly greater than twice the highest frequency present in the signal in order to be certain the aliasing will not occur.

Nyquist Plot: 1) A plot of the real part versus the imaginary part of the frequency response function. For a single-degree-of-freedom system, the Nyquist plot is a circle. 2) The Nyquist plot is representation of a frequency response function by graphing the "real" part versus the "imaginary" part. In the Nyquist plot, a resonance shows up as a circle, but there is no indication what its frequency is -- the Nyquist plot is like sighting down the frequency axis at the real and imaginary parts of the function.

Oblique mode: See mode.

Octave: An octave is a doubling or halving of frequency. 20Hz-40Hz is often considered the bottom octave. Each octave you add on the bottom requires that your speakers move four times as much air!

Octave bands: Frequency ranges in which the upper limit of each band is twice the lower limit. Octave bands are identified by their geometric mean frequency, or center frequency.

One-third octave bands: Frequency ranges where each octave is divided into one-third octaves with the upper frequency limit being 2* (1.26) times the lower frequency. Identified by the geometric mean frequency of each band.

Overtone: A component of a complex tone having a frequency higher than the fundamental.

Particle velocity, u: [LT-1]; m/s---a fluctuating velocity superimposed by the presence of sound on the other velocities with the particles of the medium may have. In analogy with alternating voltage its magnitude can be expressed in several ways, such as instantaneous particle velocity or peak particle velocity. In air, the other velocities are those due to thermal agitation and wind currents.

Passive absorber: A sound absorber that dissipates sound energy as heat.

Peak: The maximum positive or negative dynamic excursion from zero (for an AC coupled signal) or from the offset level (for a DC coupled) of any time waveform. Sometimes referred to as "true peak" or "waveform peak."

Peak-to-peak: The amplitude difference between the most positive and most negative value in the time waveform.

Peak sound pressure level: LPK[nd] ----ten times the common logarithm of the square of the ratio of the largest absolute value of the instantaneous sound pressure in a stated frequency band during a specified time interval to the reference sound pressure of 20 micro pascals.

Period: A signal that repeats the same pattern over time is called periodic, and the period is defined as the length of time encompassed by one cycle, or repetition. The period of a periodic waveform is the inverse of its fundamental frequency.

Periodic: A signal is periodic if it repeats the same pattern over time. The spectrum of a periodic signal always contains a series of harmonics.

PFC: Phase-frequency curve.

Phase: Phase is the measure of progression of a periodic wave. Phase identifies the position at any instant which a periodic wave occupies in its cycle. It can also be discribed as The time relationship between two signals.

Phase shift: The time or angular difference between two signals.

Phase (time lag or lead): The difference in time between two events such as the zero crossing of two waveforms, or the time between a reference and the peak of a waveform. The phase is expressed in degrees as the time between two events divided by the period (also a time), times 360 degrees.

Phon: The unit of loudness level of a tone.

Pink noise: Noise with a continuous frequency spectrum and with equal power per constant percentage bandwidth. For example, equal power is any one-third octave band.

Pitch: A subjective term for the perceived frequency of a tone.

Polarity: The positive or negative direction of an electrical, acoustical, or magnetic force. Two identical signals in opposite polarity are 180 degrees apart at all frequencies. Polarity is not frequency dependent.

Plenum: An absorbent-lined cavity through which conditioned air is routed to reduce noise.

% Alcons: The measured percentage of Articulation Loss of Consonants by a listener. % Alcons of 0 indicates perfect clarity and intelligibility with no loss of consonant understanding, while 10% and beyond is growing toward bad intelligibility, and 15% typically is the maximum loss acceptable.

Power Spectral Density: Power spectral density, or PSD, is a method of scaling the amplitude axis of spectra of random rather than deterministic signals. Because a random signal has energy spread out over a frequency band rather than having energy concentrated at specific frequencies, it is not meaningful to speak of its RMS value at any specific frequency. It only makes sense to consider its amplitude within a fixed frequency band, usually 1 Hz. PSD is defined in terms of amplitude squared per Hz, and is thus proportional to the power delivered by the signal in a one-Hz band.

Pressure zone: As sound waves strike a solid surface, the particle velocity is zero at the surface and the pressure is high, thus creating a high-pressure layer near the surface.

Psychoacoustics: The study of the interaction of the auditory system and acoustics.

Pure tone: A tone with no harmonics. All energy is concentrated at a single frequency.

Random noise: A noise signal, commonly used in measurements, which has constantly shifting amplitude, phase, and a uniform spectral distribution of energy.

Rarefaction: The portion of a sound wave in which molecules are spread apart, forming a region with lower-than-normal atmospheric pressure. The opposite of compression.

RASTI: Rapid Speech Transmission Index expressed in a decimal range of 0.2 for "bad" to 1.00 for "Excellent"

Ray: At higher audio frequencies, sound may be considered to travel in straight lines, in a direction normal to the wave front.

RC (Room Criteria) Curves: Undesirable rumble can result if NC curves are determined mainly by low frequency noise. Similarly, a hissing effect can result from NC level being controlled by higher frequency sounds. To achieve a better balance between low frequency and high frequency components, RC curves have been established for which the objective is to design spectra that meet an RC curve within + 2 dB at all frequencies. A spectrum that exceeds an RC curve by more than 5 dB at frequencies below 250 Hz is likely to result in unacceptable rumble. Above 2000 Hz, on the other hand, a spectrum more than 5 dB higher than the RC curve might have too much of a hissing quality.

Reactance: The opposition to the flow of electricity posed by capacitors and inductors.

Reactive absorber: A sound absorber, such as the Helmholtz resonator which involves the effects of mass and compliance as well as resistance.

Receiving room: In architectural acoustical measurements, the room in which the sound transmitted from the source room is measured.

Reflection: For surfaces large compared to the wavelength of impinging sound, sound is reflected much as light is reflected, with the angle of incidence equaling the angle of reflection.

Reflection-phase grating: A diffuser of sound energy using the principle of the diffraction grating.

Refraction: The bending of sound waves traveling through layered media with different sound velocities.

Resistance: That quality of electrical or acoustical circuits that results in dissipation of energy through heat.

Resonance: A natural periodicity, or the reinforcement associated with this periodicity.

Resonant frequency: Any system has a resonance at some particular frequency. At that frequency, even a slight amount of energy can cause the system to vibrate. A stretched piano string, when plucked, will vibrate for a while at a certain fundamental frequency. Plucked again, it will again vibrate at that same frequency. This is its natural or resonant frequency. While this is the basis of musical instruments, it is undesirable in music-reproducing instruments like audio equipment.

Response: See frequency response.

Reverberant sound field: The sound in an enclosed or partially enclosed space that has been reflected repeatedly or continuously from the boundaries.

Reverberation: The persistence of sound in an enclosed or partially enclosed space after the source of sound has stopped; by extension, in some contexts, the sound that so persists.

Reverberation room: A room so designed that the reverberant sound field closely approximates a diffuse sound field, both in the steady state when the sound source is on, and during the decay after the source of sound has stopped.

Reverberation time: The tailing off of a sound in an enclosure because of multiple reflections from the boundaries.

RFZ: Reflection-free zone.

Room mode: The normal modes of vibration of an enclosed space. See mode.

RT60: Reverberation time.

Sabin: [L2]---the unit of measure of sound absorption in the inch-pound system.

Sabine: The originator of the Sabine reverberation equation.

Self-extinguishing: A material which will not support combustion when external source of flame is removed.

Self-noise, n: Extraneous non-acoustical signals, generated or induced in a measurement system.

Signal-to-noise (SN) Ratio: The range or distance between the noise floor (the noise level of the equipment itself) and the music signal.

Sine Wave: A periodic wave related to simple harmonic motion.

Slap back: A discrete reflection from a nearby surface.

Smoke developed: Measure of smoke density developed by a material when compared with red oak, which has a smoke density index (SDI) of 100 in accordance with ASTM E 84. The infill of IAC sound absorptive metal panels has an SDI of 20.

Soft room: Room with highly sound absorptive surfaces.

Sone: The unit of measurement for subjective loudness.

Sound: Sound is vibrational disturbance, exciting hearing mechanisms, transmitted in a predictable manner determined by the medium through which it propagates. To be audible the disturbance must fall within the frequency range 20Hz to 20,000Hz.

Sound Absorption: (1) The process of dissipating sound energy. (2) The property of possessed by materials, objects and structures such as rooms of absorbing sound energy. (3) **A: [L2]; metric sabin---**in a specified frequency band, the measure of the magnitude of the absorptive property of a material, an object, or a structure such as a room.

Sound absorption coefficient, *: [dimensionless]; metric sabin/m* ---of a surface, in a specified frequency band, the measure of the absorptive property of a material as approximated by the method of Test Method C423. Ideally, the fraction of the randomly incident sound power absorbed or otherwise not reflected.

Sound attenuation: The reduction of the intensity of sound as it travels from the source to a receiving location. Sound absorption is often involved as, for instance, in a lined duct. Spherical spreading and scattering are other attenuation mechanisms.

Sound Energy, E: [ML2T-2]; J-energy added to an elastic medium by the presence of sound, consisting of potential energy in the form of deviations from static pressure and of kinetic energy in the form of particle velocity.

Sound energy density, D: [ML-1T-2]; J/m---the quotient obtained when the sound energy in a region is divided by the volume of the region. The sound energy density at a point is the limit of that quotient as the volume that contains the point approaches zero.

Sound insulation: The capacity of a structure to prevent sound from reaching a receiving location. Sound energy is not necessarily absorbed; impedance mismatch, or reflection back toward the source, is often the principal mechanism.

Sound intensity, I: [MT-3]; W/m2 the quotient obtained when the average rate of energy flow in a specified direction and sense is divided by the area, perpendicular to that direction, through or toward which it flows. The intensity at a point is the limit of that quotient s the area that includes the point approaches zero.

Sound isolation: The degree of acoustical separation between two locations, especially adjacent rooms.

Sound level: Of airborne sound, a sound pressure level obtained using a signal to which a standard frequency-weighting has been applied.

Sound power, W: [ML2T-3]; W---in a specified frequency band, the rate at which acoustic energy is radiated from a source. In general, the rate of flow of sound energy, whether from a source, through an area, or into an absorber.

Sound power level, Lp: Of airborne sound, ten times the common logarithm of the ratio of the sound power under consideration of the standard reference power of 1 pW. The quantity so obtained is expressed in decibels.

Sound pressure, p: [ML-1T-2]; Pa-a fluctuating pressure superimposed on the static pressure by the presence of sound. In analogy with alternating voltage its magnitude can be expressed in several ways, such as instantaneous sound pressure or peak sound pressure, but the unqualified term means root-mean-square sound pressure. In air, the static pressure is barometric pressure.

Sound Pressure Level (SPL): Given in decibels (dB) is an expression of loudness or volume. A 10db increase in SPL represents a doubling in volume. Live orchestral music reaches brief peaks in the 105db range and live rock easily goes over 120db.

Sound receiver: One or more observation points at which sound is evaluated or measured. The effect of sound on an individual receiver is usually evaluated by measurements near the ear or close to the boy.

Sound spectrograph: An instrument that displays the time, level, and frequency of a signal.

Soundstage: A listening term that refers to the placement of a stereo image in a fashion that replicates the original performance. A realistic soundstage has proportional width, depth and height.

Sound transmission class, STC: A single-number rating, calculated in accordance with Classification E413 using values of sound transmission loss. It provides an estimate of the performance of a partition in certain common sound insulation problems.

Sound transmission coefficient, r: [dimensionless]---of a partition, in a specified frequency band, the fraction of the airborne sound power incident on the partition that is transmitted by the partition and radiated on the other side.

Sound transmission loss, TL: Of a partition, in a specified frequency band, ten times the common logarithm of the ratio of the airborne sound power incident on the partition to the sound power transmitted by the partition and radiated on the other side. The quantity so obtained is expressed in decibels.

Sound Waves: Sound waves can be thought of like the waves in water. Frequency determines the length of the waves; amplitude or volume determines the height of the waves. At 20Hz, the wavelength is 56 feet long! These long waves give bass its penetrating ability, (why you can hear car boomers blocks away).

Source room: In architectural acoustical measurements, the room that contains the noise source or sources.

Speaker Level: Taken from the speaker terminals. This signal has already been amplified.

Specific airflow resistance, r: [ML-2T-1]. Mks rayl (Pa-s/m)---the product of the airflow resistance of a specimen and its area. This is equivalent to the quotient of the air pressure difference across the specimen divided by the linear velocity, measured outside the specimen, of airflow through the specimen.

Spectral balance: Balance across the entire frequency spectrum of the audio range.

Specular reflections: Mirrorlike reflections of sound (angle of incidence equals angle of reflection) from a flat surface. Reflections that do not spread out.

Spectrum: the distribution of the energy of a signal with frequency.

Spectrum analyzer: An instrument for measuring, and usually recording, the spectrum of a signal.

Speech Intelligibility: A measure of sound clarity that indicates the ease of understanding speech. It is a complex function of psychoacoustics, signal-to-noise ratio of the sound source, and direct-to-reverberant energy within the listening environment.

Spherical divergence: Sound diverges spherically from a point source in free space.

Splaying: Walls are splayed when they are constructed somewhat "off square," i.e., a few degrees from the normal rectilinear form.

Standing wave: A resonance condition in an enclosed space in which sound waves traveling in one direction interact with those traveling in the opposite direction, resulting in a stable condition.

Steady-state: A condition devoid of transient effects.

Stereo: From the Greek meaning solid. The purpose of stereo is not to give you separate right and left channels, but to provide the illusion of a three-dimensional, holographic image between the speakers.

STI Speech Transmission Index: A single number that indicates the effect of a transmission system on speech intelligibility.

Structureborne noise: Generation and propagation of time-dependent motions and forces in solid materials which result in unwanted radiated sound.

Sub Harmonic: Sub harmonics are synchronous components in a spectrum that are multiples of 1/2, 1/3, or 1/4 of the frequency of the primary fundamental. They are sometimes called "sub-synchronous" components. In the vibration spectrum of a rotating machine, there will normally be a component at the turning speed along with several harmonics of turning speed. If there is sufficient looseness in the machine so that some parts are rattling, the spectrum will usually contain sub harmonics. Harmonics of one-half turning speed are called "one-half order sub harmonics," etc.

Subwoofer: A speaker designed exclusively for low-frequency reproduction. A true subwoofer should be able to at least reach into the bottom octave (20-40Hz). There are many "subwoofers" on the market that would be more accurately termed "woofers".

Superposition: Many sound waves may transverse the same point in space, the air molecules responding to the vector sum of the demands of the different waves.

T60: See RT60.

Tangential mode: A room mode produced by reflections off four of the six surfaces of the room.

TDS: Time-delay spectrometry.

TEF: Time, energy, frequency.

Threshold of hearing: The lowest level sound that can be perceived by the human auditory system. This is close to the standard reference level of sound pressure, 20uPA.

Threshold of feeling (pain): The sound pressure level that makes the ears tickle, located about 120 dB above the threshold of hearing.

THX: Refers to a series of specifications for surround sound systems. Professional THX is used in commercial movie theaters. Home THX specifications are not published and manufacturers must sign non-disclosure waivers before submitting their products for THX certification. Manufacturers that receive certification for their products must pay a royalty on units sold.

Timbre: The quality of a sound that distinguishes it from other sounds of the same pitch and volume. The distinctive tone of an instrument or a singing voice.

Timbral: Refers to the overall frequency balance of a system. In a perfect world, all systems would have complete tonal neutrality. With current technology, this ideal is approached but not met. Listening to many equally "good" speakers will reveal that some sound warmer than others, some sound brighter etc. In a surround sound system it is important that all speakers have a close timbral match for the highest degree of sonic realism.

Time-delay spectrometry: A sophisticated method for obtaining anechoic results in echoic spaces.

Tonal:, adj.: In reference to audible sound, capable of exciting an auditory sensation having pitch.

Tone: A tone results in an auditory sensation of pitch.

Tone burst: A short signal used in acoustical measurements to make possible differentiating desired signals from spurious reflections.

Total harmonic distortion (THD): Refers to a device adding harmonics that were not in the original signal. For example: a device that is fed a 20Hz sine wave that is also putting out 40Hz, 80Hz, etc. Not usually a factor in most modern electronics, but still a significant design problem in loudspeakers.

Transducer: Any device that translates the magnitude of one quantity into another quantity. Three of the most common transducers used in vibration measurements are accelerometer, velocity transducer, and eddy current probe.

Transfer Function: The output to input relationship of a structure. Mathematically it is the Laplace transform of the output divided by the Laplace transform of the input.

Transform: A transform is a mathematical operation that converts a function from one domain to another domain with no loss of information. For example, the Fourier transform converts a function of time into a function of frequency.

Transient response: The ability of a component to respond quickly and accurately to transients. Transient response affects reproduction of the attack and decay characteristics of a sound.

Transients: Instantaneous changes in dynamics, producing steep wave fronts.

Transparency: Listening term. An analog that can be best "pictured" in photography. The more "transparent" the sound, the clearer the auditory picture.

Treble: The higher frequencies of the audible spectrum.

Tuning Frequency: The helmholtz resonant frequency of a box. Also refers to the resonant frequency of other types of systems.

Velocity Transducer: An electrical/mechanical transducer whose output is directly proportional to the velocity of the measured unit. A velocity transducer consists of a magnet suspended on a coil, surrounded by a conductive coil. Movement of the transducer induces movement in the suspended magnet. This movement inside the conductive coil generates an electrical current proportional to the velocity of the movement. A time waveform or a Fourier transform of the current will result in a velocity measurement. The signal can also be integrated to produce a displacement measurement.

Viscous Damping: Damping that is proportional to velocity. Viscous damping is used largely for system modeling since it is linear.

Vibration isolation: A reduction, attained by the use of a resilient coupling, in the capacity of a system to vibrate in response to mechanical excitation.

Volume: Colloquial equivalent of sound level.

Warmth: A listening term. The opposite of cool or cold. In terms of frequency, generally considered the range from approx. 150Hz-400Hz. A system with the "proper" warmth will sound natural within this range.

Watt: The unit of electrical or acoustical power.

Wattage: Is the unit of power used to rate the output of audio amplifiers. For a wattage number to have meaning the distortion level and impedance must also be specified.

Wave: A regular variation of an electrical signal or acoustical pressure.

Wavelength: The distance th sound wave travels to complete one cycle. The distance between one peak or crest of a sine wave and the next corresponding peak or crest. The wavelenth of any frequency may be found by dividing the speed of sound by the frequency. (speed of sound at sea level is 331.4 meters/second or 1087.42 feet/second).

Weighting: Adjustment of sound-level meter response to achieve a desired measurement.

White noise*(ANS): Noise with a continuous frequency spectrum and with equal power per unit bandwidth. For example, equal power in any band of 100-Hz width.