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Safety function, with Modems

Modern modems offer different safety functions to prevent dialing up by an authorised user. Among them is the simple protection by a password, stored in the modem (or in the attached computer) and the independently calling modem is queried for the password or is called back. The caller must give identification and then hang up. The modem then calls up this caller under a number stored in the system. Thus it is guaranteed that dialing up is possible only by certain users.

Safety insulation

A preventive measure against the existence of excessively high contact voltages through complete cover by insulation material of all accessible prominent parts that are, in the event of a fault, indirectly or directly under tension.

Scale

An older, and in non-technical areas still often used, designation "scale"; the part serving for the display of a measuring instrument, on which a mark is adjusted, or adjusts itself, to a certain position. The S. often covers a range which is larger than the measuring range. E.g. a certain location, a physical pointer or a light indicator, a vernier line, edge or other marking can serve as a mark (measurement mark, scale mark).

Scale factor

The value read off from a measuring instrument with a scale display reading must be multiplied by this factor, in order to obtain the measured value (often confused with the term 'sensitivity').

Scale mark

See Scale

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Scale value

The change of a measured variable, which causes a shift of the mark on a division scale or a number increment on a numeric scale. The S. is always indicated in the unit selected for the measured variable.

Scaling

The enlargement or reduction in one or several display elements of an indicator representation (display) through multiplication of the associated coordinates by constant values.

Selective orbit

Another name for selective shaft orbit

Selective shaft orbit

Selected harmonic portion of the kinetic shaft orbit. Of special importance (e.g. for the recognition of radial shaft cracks) are the selective portions of the rotational frequency, the second and the third harmonics of the rotational frequency signal components.

Self-induced vibration; self-excited oscillation

See Vibration, self-induced

Sensitivity (of a transducer)

Ratio of the output signal of a transducer in specified units to the corresponding input signal in other specified units. See also vibration sensor transfer coefficient.

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Sensitivity level (of a transducer)

The difference between an output level of particular type and the input level of particular type that produced this output level.

Note: The reference values of the input and output levels will affect the relative sensitivities and should be chosen accordingly.

Sensory analysis

The science and technology of the investigation, realization and use of sensors.

Sequential

Describing circumstances with several processes that the processes run off successively, whereby their process intervals in no time interval may also overlap only in pairs.

Note: If the process intervals sequence directly, then one can speak also of consecutive. Sequentially the characteristic designates an expiration (e.g. order of events of a program or process), whose elementary steps stand earlier/later in pairs in the designation, or a structure (e.g. a file), which is only intended or suitable for such an order of events.

Sequential circuit

A circuit which implements a sequence of logical operations, whose initial values depend at each given time on their input values and on the internal condition at this time, and whose internal condition depends on the directly preceding input values and the preceding internal condition.

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Serial

Temporally successively running in a sequential manner.

Serial analyser

See Analyser, serial

Serial interface

See Interface, serial

Serial operation

See Operation, serial

Series resistor

A resistor that is positioned ahead of the input of an electronic component or an electronic circuit for the purpose, for example, of limiting the current.

Server

Service-providing equipment within a client-server system: The services which can be provided (supply of software, communication systems, data bases, arithmetic performance, etc.) are made available to other computers (clients) by the S. (server).

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Shaft axis

The straight line that connects both bearing journal centre points of a rotor.

Shaft displacement

The change in position of a shaft when changing from one operational condition to another, especially from rest with cold machines to continuous operation with warm machines.

Shaft rotative speed

The speed of rotation with which a shaft is turning at one particular moment, expressed mostly in min^{-1} (or rpm <**r**evolutions **p**er **m**inute> or cpm <**c**ycles **p**er **m**inute>).

Shaft static position

See Shaft position, static

Shaft vibrations

Shaft vibrations are the rapid radial movements of rotating shafts. Compared to the bearing vibrations primarily caused by them, they are mostly larger in terms of amount. In general, they cause fluctuating bending stresses in the shaft material as well as dynamic loads on the bearings. The magnitudes of bearing vibration and shaft vibration depend on many influencing factors and stand in no fixed relationship to each other. Depending on the measuring task and machine type, one distinguishes between relative and absolute shaft vibration measurement.
Relative shaft vibration measurement is recommended if the stiffness of the bearing is equal to or greater than the stiffness of the shaft. Absolute shaft vibration measurement is recommended if the bearing vibrations lie within the range of the relative shaft vibrations. The measurement principle of the shaft

vibrations depends upon the change in separation between the surface of the shaft - often of the trunnion - and the sensor.

Therefore, it is affected by the

- Deviation of the shaft diameter from circular in the area of the measurement surface (mechanical runout)
- Inhomogeneities in the material, local residual magnetism, structural differences in the area of the measuring plane (electrical runout).

One must make sure that the mechanical and electrical runout are small compared with the actual shaft vibrations.

Shaft vibration measurement device

Shaft vibration measuring devices serve as the contact-less sensors for radial movements (static and dynamic) of rotating shafts, relative (as a rule) to the sensors.

Shannon sampling theorem

The S. formulates the relation between the maximum signal frequency and the minimum possible sampling rate with which this signal may be scanned.
In order to guarantee the reproducibility of the digitized signal form, the sampling rate (sampling frequency) must be at least twice as high as the frequency of the highest single-frequency signal component in the time signal.

Shock duration

The length of time, which the momentary value of an excitation needs for the rise of a certain fraction of its peak value up to the fall to the same fraction.

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Shock pulse

Excitation of a system, characterised by a rise and fall within a time interval, which is short compared with a half-oscillation of any mode of motion of the system.

See also S.-event, impulse-shaped; Impulse, unipolar (single-sided)

Shunt resistor

A resistance, which is arranged, e.g. in a parallel connection at the measurement input, for the measuring range extension of an ammeter. The S. thereby takes over an exactly specified part of the current which is to be measured.

Sideband

- Totality of the partial vibrations which result from modulation of a sinusoidal carrier and lie above and below the carrier frequency.
- Frequency band, which lies above and below the frequency of a sinusoidal carrier and which contains significant partial vibrations produced by modulation.

Sideband frequency

See Modulation

Sideband, lower

Sideband, which contains the partial vibrations whose frequencies lie below the carrier frequency.

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Sideband, upper

Sideband, which contains the partial vibrations whose frequencies lie above the carrier frequency.

Signal

The representation of messages or data with physical means.

Note 1: With abstract viewpoint the reference to a certain physical quantity can lapse if the physical implementation is not interesting or is not determined. In these cases also the mathematical quantity, which is the basis for the abstract consideration can be called the S. (see also DIN 40146-1)
Physical phenomenon, with which one or more characteristics can be changed for the representation of information.

Note 2: The physical phenomenon can be e.g. an electromagnetic wave or an acoustic wave and the characteristic can be an electrical field, an electrical tension or a sound pressure. Each representation of a message by physical dimension, e.g. electrical tensions or field strengths.
In communications technology the time functions of such quantities are particularly used as S. The S. itself can be of a temporally, momentary type (i.e. it occurs only in a short time period, e.g. an impulse), periodically (with repetitions) or coincidentally and not predictable. Furthermore one differentiates between time-continuous and time-discrete S. as well as analogue (value-continuous) and digital (value-discrete) S. Time-discrete S. are also called sampled S.; digital S. are also called quantized S. Analogue S. can be transformed by an encoder into digital S.

Signal, alternating symmetric

An alternating signal, where the values of the half-periods have the same amounts and opposite polarities.

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Signal amplitude

The maximum value of a harmonic signal.

Signal, analogue

A signal with which the curves of values of the signal parameters represent a message or data which consists of and/or exists only from continuous functions.

Note 1: See also DIN 40146-1.
A signal with which the characteristic quantity, which represents the information, can assume any value at any time within a continuous range of values.

Note 2: The represented information is presupposed as being value-continuous; see DIN 40146-1.

Note 3: For example an analogue signal can continuously follow the value of another physical quantity which represents the information.

Signal analysis

The acquisition and following evaluation of a signal using technical instrumentation. The correlation analysis and Fourier analysis, or frequency analysis, belong under the description of Signal analysis.

Signals, anisochronous

Signals, which are independent of a step raster (time slot pattern).

The converse are isochronous signals.

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Signal attenuation

- The reduction of the value of a signal without making a change to the fundamental characteristics of the signal.
- The factor of reduced tension at the input area (e.g. a FM tape deck).
- It acts thereby usually around a dimensionless quantity, e.g. in 0.5 – 0.2 – 0.1 steps.
- During the transmission of vibration energy from one machine part to another machine part (shaft in bearings, bearings on the foundation) the signal is weakened.
- Electronic construction elements (e.g. a filter) can also attenuate signals.

Signal, binary

A digital signal, consisting of and/or existing of only binary characters, with which the values of the signal parameter represent a message or data.

Signals, bipolar

Signals, with which the information parameter can assume positive and negative values.

Signals, demodulated

The original low-frequency signals, which have been modulated on a high-frequency carrier signal by means of a modulator, recovered by demodulation by means of demodulator.

Signal, desired

See Information signal

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Signal, digital; discrete signal

A signal, with which the values of the signal parameters represent a message or data which consists and/or exists only of characters.

Note 1: Thereby each character corresponds to a certain part of the range of values of the signal parameter or, as the case may be, a combination of parts of the ranges of values of several signal parameters (see also DIN 40 146-1).

Time-discrete signal, in which information is represented by a finite number of fixed discrete values, which one of its characteristic quantities can assume.

Note 2: The represented information is itself presupposed as value- and time-discrete; see DIN 40146-1.

Signal generator

An instrument or circuit for the creation of signals with predefined, commonly adjustable characteristics.

Signale, isochronous

Signals, which can begin and end only at discrete times in a uniform agreed upon step raster.

The converse are anisochronous signals.

Signal, modulated

A signal, vibration or wave created by modulation.

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Signal, modulating; modulating oscillation or wave

A signal, vibration or wave, whose process follows the carrier signal by modulation.

Sine-wave vibration vector

The complex amplitude (amount and phase) of the sinusoidal vibrations.

Sinusoidal quantity

See sinusoidal vibration: Quantity

Signal representation

The analogue (analogue signals) resp. digital (digital signals) representation of signals.

Signal, time-discrete

A signal formed from a set of temporally sequential elements, whereby each element has one or more characteristic quantities, which can represent information, e.g. its duration, time situation, temporal process and amount.

Signal-to-interference ratio; Signal/interference ratio; Noise ratio

The logarithmic relationship (generally expressed in decibels) of the power → information signal for the total output of the spurious signals and the noise, determined under given conditions at a given point of a channel.

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With external voltages, unweighted signal-to-noise ratio; with noise voltages, weighted signal-to-noise ratio (noise distance), the difference between a utilizable level and an interference level arising at the same location. Because the task is referred to power (P_N available power, P_S interference power) and is given in Decibels or Neper, the

$$\Delta p = 10 \log\left(\frac{P_N}{P_S}\right)$$

measured in Decibel;

$$\Delta p = \frac{1}{2} \log\left(\frac{P_N}{P_S}\right)$$

measured in Nepal

is the Information signal-noise signal ratio, Noise ratio, Signal-noise ratio (S/N, Abbr. for <**s**ignal-to-**n**oise ratio>). During digital transmission this is the quotient of the scanned value of the information signal and the RMS value of the interference signal.

Signal-to-noise ratio

See Signal-Noise ratio

Signal-to-noise ratio; Signal-noise ratio

Relationship of the power of the information signal to the existing noise at a given point of a transmission channel under certain given conditions.
Note 1: The signal cannot be completely separated from the noise and in practice the ratio (signal+noise) to noise is measured.

Note 2: In German the logarithm of the signal-noise ratio is named ”Signal-Noise-Distance“ and generally expressed in Decibel.

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Signal, undesired

A signal which can impair the receipt of an information signal.

Sinusoidal event

An alternating event $x(t)$ whose momentary value x runs sinusoidally with the time t:

$$x(t) = \hat{x}\sin(\omega t + \varphi)$$

Here x is the amplitude, $\omega = 2\pi f = 2\pi/T$ is the circular frequency (angular frequency), f the (period) frequency, T the period duration and φ the zero phase angle. The effective value is $\tilde{x} = \hat{x}\sqrt{2}$ (see DIN 5483-2).

Note 1: With two cooperating sinusoidal events of the same frequency the difference of the zero-phase angles φ_1 and φ_2 is called the phase-shift angle $\varphi_0 = \varphi_2 - \varphi_1$.

Note 2: The S. was earlier also known as harmonic vibration (see DIN 1311-1).
The designation harmonic vibration is today still very frequently used in vibration measuring technology.

Sinusoidal event, amplitude modulated

The amplitude $\hat{x}(t)$ alternates with time corresponding to a modulated event, in the simplest case sinusoidally:

$$\hat{x}(t) = \hat{x}_T + \Delta\hat{x}_T \sin(\omega_M t)$$

$\hat{x}_T$ carrier amplitude, $\Delta\hat{x}_T$ amplitude swing (see Note), $\Delta\hat{x}_T/\hat{x}_T$ Modulation degree, $f_M = \frac{\omega_M}{2\pi}$ modulation frequency.

The circular frequency $\omega(t) = \omega_T = \frac{d\Psi(t)}{dt}$ is constant; $f_T = \frac{\omega_T}{2\pi}$ is called carrier frequency.

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The time rule reads:

$$\hat{x}(t) = \hat{x}_T + \Delta\hat{x}_T \sin(\omega_T t + \varphi)$$

Note: Strictly speaking the amplitude swing – because it is the peak value of the change of a peak value - would have to actually be characterized by two ^ symbols:

$$\Delta\hat{x}_T$$

Sinusoidal event, exponentially increasing (waxing); Sinusoidal event, Exponentially decreasing (waning)

A sinusoidal related event with temporally constant circular frequency ω (according to ω_T the sinusoidal related event), whose amplitude increases (waxes) according to exponential law:

$$x(t) = \hat{x}_0 e^{\sigma t}\cos(\omega t) = \frac{\hat{x}_0}{2}\left[e^{(\sigma + j\omega)t} + e^{(\sigma - j\omega)t}\right] = \frac{\hat{x}_0}{2}\left[e^{\underline{p}t} + e^{\underline{p}^* t}\right] = \hat{x}_0 Re\left(e^{\underline{p}t}\right)$$

$\sigma > 0$	Rise coefficient, Growth coefficient
$\underline{p} = \sigma + j\omega$	Complex circular frequency, Complex rise coefficient
$\underline{p}^* = \sigma - j\omega$	Conjugated complex circular frequency, conjugated complex rise coefficient

For the case of the exponentially vibrating (fading) sinusoidal event more frequently occurring in reality, the growth coefficient σ will be negative and be replaced by the fading coefficient $\sigma = -\sigma > 0$.

Sinusoidal event, frequency modulated

The circular frequency $\omega(t) = \frac{d\Psi(t)}{dt}$ alternates temporally according to a modulated event, in the simplest case sinusoidally:

$$\omega(t) = \omega_T + \Delta\hat{\omega}_T \cos(\omega_M t)$$

$f_T = \frac{\omega_T}{2\pi}$,	Carrier frequency (centre frequency),
$\Delta\hat{f}_T = \frac{\Delta\omega_T}{2\pi}$,	frequency swing,
$m = \frac{\Delta\hat{\omega}_T}{\omega_T}$,	modulation factor,
$f_M = \frac{\omega_M}{2\pi}$,	modulation frequency.

The peak value of the phase swing $\eta = \frac{\Delta\hat{\omega}_T}{\omega_M}$ is the modulation index. The amplitude $\hat{x}(t)$ is constant and equal to $\hat{x}_T$.

The time rule reads:

$$x(t) = \hat{x}_T \sin\left(\omega_T t + \varphi + \frac{\Delta\hat{\omega}_T}{\omega_M} sin(\omega_M t)\right)$$

Note 1: In the bibliography one finds as a symbol for the modulation index occasionally also instead of η.

Note 2: During a sinusoidal modulating event the time progression of the frequency-modulated and the phase-modulated sinusoidal event do not differ, if the modulating events in both cases have the same frequency, are shifted against each other by the phase angle $\eta/2$ and the phase swing is in both cases equally large.

Sinusoidal event, modulated

A sinusoidal related event $x(t) = \hat{x}(t)\sin(\Psi(t))$. In which the amplitude $x(t)$ or the phase angle deviation $\Delta\Psi(t)$ or the circular frequency $w(t)$ changes temporally, corresponding to a modulated (time-dependent) event.

One calls the corresponding modulation types amplitude-, phase- and frequency modulation; phase- and frequency-modulation are combined under the concept “phase-modulation“. Amplitude- and phase-modulation can also occur simultaneously. The non-modulated sinusoidal event is called carrier oscillation or carrier; its frequency

$$f_T = \frac{\omega_T}{2\pi}$$

is called carrier frequency.

The modulated event depends clearly on the realigning or signal event to be transferred; in the simplest case it is identical to this event. If the modulated event is a sinusoidal event, then its frequency is called modulation frequency and is:

$$f_M = \frac{\omega_M}{2\pi}$$

Sinusoidal event, phase-modulated

The phase angle deviation $\Delta\Psi(f)$ of the modulated sinusoidal event from the non-modulated sinusoidal event changes temporally in clear dependence from a modulating event.
The term of the phase-modulated S. covers the two possible forms of the phase-modulated and the frequency-modulated sinusoidal event.

Sinusoidal event, phase-modulated

The phase angle deviation $\Delta\Psi(t)$ of the modulated sinusoidal event from the non-modulated sinusoidal event changes temporally in clear dependence from a modulating event, in the simplest case sinusoidally:

$$x(t) = \Psi(t) - (\Delta\omega_T + \varphi) = \Delta\widehat{\Psi}_T \sin(\omega_M t)$$

Thereby $\Delta\widehat{\Psi}_T$ is phase swing, $f_M = \frac{\omega_M}{2\pi}$ modulation frequency. The amplitude $x(t)$ is constant and equal to $\hat{x}_T$.

The time rule reads:

$$x(t) = \hat{x}_{\mathrm{T}} \sin\left(\omega_T t + \varphi + \Delta\widehat{\Psi}_{\mathrm{T}} sin(\omega_M t)\right)$$

Sinusoidal event, polyphaser

Several homogeneous sinusoidal events of the same frequency, with arbitrary amplitudes $\hat{x}_{\mathrm{i}}$ and different zero-phase angles φ_i, cooperating in a common system:

$$x_1 = \hat{x}_1 \sin(\omega t + \varphi_1)$$

$$x_2 = \hat{x}_2 \sin(\omega t + \varphi_2)$$

...

$$x_m = \hat{x}_{\mathrm{m}} \sin(\omega t + \varphi_m)$$

$i = 1 \ldots m$; m number of strands.

Sinusoidal event, symmetrical polyphase

A polyphase sinusoidal event with the same amplitudes $\hat{x}$ and with zero-phase angles φ, which differ around the same amount:

$$x_1 = \hat{x} \sin(\omega t + \varphi)$$

$$x_2 = \hat{x} \sin\left(\omega t + \varphi - \frac{2\pi}{m}\right)$$

$$x_3 = \hat{x} \sin\left(\omega t + \varphi - 2\frac{2\pi}{m}\right)$$

...

$$x_m = \hat{x}\sin\left(\omega t + \varphi - (m-1)\frac{2\pi}{m}\right)$$

m number of strands.

Examples: Polyphase (m-phase) electrical tension, polyphase (m-phase) electric current, three-phase electric current is commonly called three-phase alternating current.

Sinusoidal vibration (wave), frequency modulated

See sinus event, frequency-modulated

Sinusoidal vibration impulse, short: Vibration impulse; in acoustics: Tone impulse

A sinusoidal event, whose envelopes (within the positive and negative range) have the time progression of a unipolar impulse.

Examples: High-frequency impulse, Gauß tone.

Sinusoidal vibration; in acoustics: Sound

If the time dependence of an event is described by a sine or a cosine function, whose argument (phase angle) is a linear function of the time, then the S. event, and the associated physical dimension, is called a sinusoidal oscillation quantity; in short: sinusoidal quantity.

Note 1: The fact that the addition and subtraction of two S. of the same frequency as well as their integration and deviation lead again to S., makes the S. the simplest mode of vibration.

Note 2: The S. is also called harmonic vibration.

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Sinusoidal vibration, modulated

See sinus event, modulated

SI system

See International Unit system

Slow-roll operation

See RDV operation

Soft bearing balancing machine

See Balancing machine, path measuring

Sound

Note 1: The designation S. is used both in the sense of a comprehensive term and for an individual oscillation or wave.

Note 2: S. occurs in fluid media and also in solid bodies.

According to the frequency range one distinguishes between audio sound ($16\ Hz$ to $20\ kHz$), infra-sound (below $16\ Hz$) and ultra-sound (above $20\ kHz$). If the oscillation producing the wave runs sinusoidally, one speaks of a tone. A mixture of different tones is characterised as sound, irregular oscillations result in a noise or a bang.
The wavelength λ, the frequency f and the velocity c of the S. are coupled with one another through the relationship

$$c = \lambda f$$

The mean values for c are e.g. in air $334\ m/s$, in water $1{,}440\ m/s$ and through steel $5{,}800\ m/s$. Unpleasantly loud S. is noise.

S., in particular ultrasonic, which is used for technical purposes and transfers higher energies than during the transmission of acoustic information, is called power sound.

Sound absorption

The attenuation of the oscillation amplitude of sound through conversion of the sound energy into heat.

Sound damping

Restraining the sound radiation and transmission, i.e. the reduction of noise. One differentiates between air-borne, impact and solid-borne sound damping. With questions of the S. this concerns spatial acoustics.

Sound displacement

Designation for the deflection change assigned to the sound.

Sound energy

Kinetic and potential energy of the sound.

Sound energy density

With regular waves the temporal average value of the sound energy for each cm^3.

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Sound level meter

Instrument for measurement of sound pressure level, as the case may be, with standardized frequency and/or time evaluation.

Note: S. essentially consists of a microphone, an amplifier and a display section. Frequently battery-powered and often portable.

Sound pressure

Designation for the pressure change assigned to sound in a volume element.

Sound pressure level; Sound level

Tenfold decade logarithm of the relationship of the square of the rms value of the sound pressure to the square of the reference sound pressure p_0 with $p_0 = 20\mu Pa$ in air and $p_0 = 1\mu Pa$ in other media.

Specific unbalance

The amount of static unbalance, distributed across the mass of the rotor. It corresponds to the displacement of the centre of gravity away from the shaft axis (centre of gravity eccentricity).

Spectra, exponential averaging

The principle of exponential averaging consists in the fact that the individual spectra have a different influence on the average value, i.e. they are not weighted in a linear manner. The most weight is always given to the most recently acquired spectrum, while the influence of earlier spectra becomes ever smaller with increasing temporal distance. As a parameter of the exponential M. a time constant and/or a temporally limited weighting function is to be given, which specifies how strongly the influence of the individual spectra decreases with the time. In order to obtain a better comparability with linear averaging, this time constant is, in the case of many analysers, often also to be selected only through a formal averaging number. With this averaging number then the time constant can be given indirectly in such a way that statistical security of the average is equal to averaging in the case of linear averaging with the equivalent averaging number. Contrary to linear averaging the exponential M. supplies an average value spectrum sequentially (a sliding calculation of the average values). The averaging process has to be manually terminated. The deployment of the exponential M. is recommended whenever the frequency spectrum of a running machine is to be observed during a longer period or the influence of different operating parameters is to be examined.

Spectral components

The addends of the equation for the “harmonic synthesis” are called spectral components and in acoustics, partial tones.
The spectral component belonging to ordinal number n is called the nth spectral component (nth partial tone) or the nth harmonic.

Note: You are advised not to use the designation $(n-1)$th harmonic for the nth spectral component since this can lead to confusion with the $(n-1)$th spectral component. On the other hand, it can be advantageous and sometimes even necessary to speak about the harmonics.

Example: The fundamental frequency output and harmonic output (cf. DIN 40110).
Every sinusoidal oscillation, that contributes to a signal spectrum of a noise spectrum.

Spectral energy density

See Power density, spectral

Spectral function of vibrations with restricted duration

The integral always existing with events of limited duration

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$$\underline{X}(\omega) = \int_{-\infty}^{+\infty} x(t)e^{-j\omega t}dt$$

is the Fourier transform associated with the time progression $x(t)$ (see. DIN 5487 [56]) and is called the S. $\underline{X}(\omega)$. Since the S. according to its definition is complex, the marking of the complex character by underlining is usually omitted.
The application of the absolute value $|X|$ the spectral function X over the frequency results, in contrary to the amplitude spectrum, in that only lines of discrete frequencies exist and is therefore also called a “line spectrum”, a surface limited through a curve, which is characterised as a “continuous spectrum”.

Note: The transition from the complex amplitude spectrum to the spectral function is kept at its simplest, if one lets the period duration become ever longer during a pulse oscillation. Thereby the spectral lines move ever closer together while their lengths become smaller. If one multiplies these by T, one obtains with this border transition a remaining finite representation of the spectral distribution. For the simplification of the integral one still multiplies by the factor $1/2$. Other standardisations are also found in the literature.

Spectral line

Each discrete part of a line spectrum.

Spectrum analyser

An instrument which is able to extract (analyse) any arbitrary electrical signal into its components.
As result of the analysis the frequency spectrum (usual abbreviation: spectrum) is obtained.
A S. usually has outputs for the connection of printers or plotters and/or a computer interface.

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Spectrum analyser, analogue

With an analogue S. signal processing takes place for the processing of the frequency spectrum on analogue principles. The group of analogue S. is divided into:

- Analysers with a serial process (filter analysers, wobble-generator type)
  The time signal is processed by a single filter which has an adjustable centre frequency. The centre frequency is varied over the frequency range to be analysed.

- Analysers with a parallel process (parallel-filter analysers)
  The time signal is passed through a series of parallel filters which then completely cover the frequency range to be analysed.

Spectrum analyser, digital

This type of analyzer is based upon a fast mathematical algorithm, which simulates hundreds or even thousands of parallel switched band-pass filter or narrow-band filters.
An analogue signal arrives over an adaptor amplifier, an anti-alias filter and a scanning and holding circuit at the input of an analogue-to-digital data converter (ADC). The ADC divides the analogue signal into a series of discrete amplitude values. It scans the signal with short impulses. Therefore one also calls this process scanning and the frequency at which the scanning is effected is called the sampling rate.
The scanned values are quantified and converted into binary data words. The data words are stored and/or processed directly by a microcomputer by application of a special computing algorithm. Usually a modified form of the Fourier transform, the Fast Fourier transform, is used (FFT). The digital S. is therefore named after this computer algorithm and designated an FFT analyser. As a result of the computation one then obtains the graphic representation (spectrum) on the computer screen.

Spectrum, complex

Representation of a signal or a noise as a complex function of the frequency either through its Fourier transforming or through the consequence of the complex coefficients of its Fourier series.

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Spectrum, continuous

Spectrum, whose various values, from zero, occupies one or more continuous frequency bands.

Example: The sequential value quantity of the Fourier transform, which represents a non-periodic signal. Spectrum as a result of the analysis of vibrations with limited duration. The spectrum consists of infinitely many portions. The representation takes place therefore as a closed curve, contrary to the amplitude spectrum.

Stability of a machine with rotating shaft

A machine with a rotating shaft is stable, if at operating speed all rotating parts (shafts, impellers, blades, etc.) and the static equilibrium of stationary parts (supports, bearings, housing, foundations) do not cause larger vibration magnitudes than the normally acceptable levels. The definition is valid also for the start-up and coast-down operation (at variable rotational speed).

Stability of a mechanical system

A mechanical system is considered stable, if in practice any possible disturbing influence causes a reaction with the vibration magnitude which is not larger than the normally acceptable level.

Standing wave

See Wave, standing

State

The state of an entity at the moment of observation.

Note: The above state in the sense of determining the tolerance ranges for quality parameters involves boundary conditions and should, in order to avoid confusion with target values, not be referred to as “target condition”.

Static

S. designates the characteristic of not changing, i.e. to assume no different conditions. S. is used also from the attribute for characteristics or descriptions of characteristics, which refer only to conditions (and not on condition transitions, e.g. static consistency).

Static balancing

See Single-plane balancing

Static measurement

See Measurement, static

Static memory

See Memory, static

Static measurement data under operational conditions

See Measurement data under operational conditions, static

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Static measurement value, or data

See Measurement data, static

Static RAM

See RAM, static

Static shaft position

Average kinetic shaft path in the bearing clearance or the static measurement (equivalent) of the shaft vibration signal.

Static unbalance

See Unbalance, static

Stationary

One calls S. a condition, which does not change with time. In addition, the designation S. is applied to periodic vibrations, if their characteristic values (e.g. RMS and $-/+$ peak value) do not change with time.

Stationary condition

See Condition, stationary

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Stationary deterministic signals

Deterministic time signals can be described precisely and completely in mathematical terms (e.g. as Fourier series), even when most complicated. From the description, the momentary value at every point in time in the past and in the future can be given precisely. They have a constant peak value, effective value and DC voltage value in relationship to the time axis. The stationary deterministic time signals are further divisible into periodic and quasi-periodic time signals.

Stationary deterministic time signals

Time signals which are stationary (as described above) and deterministic.

Stationary machine

See Machine, stationary

Stationary process

See process, stationary

Stationary stochastic signals

These time signals (e.g. noise, cavitation, turbulence) have a temporal course with randomly distributed momentary values, i.e. their time function cannot be described mathematically (indeterminate).

Various temporal average values can be given but the exact value of the function for a particular point in time cannot be determined. A mathematical description of the stationary stochastic time signal is only possible by using a series of probability functions. An infinitely long record is needed to describe it and this is not practical.

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The spectra of stationary stochastic time signals are continuous, i.e. they have infinitely many spectral lines.

Stationary stochastic (random) time signals

See Time signals, stationary stochastic

Stationary system

See System, stationary

Stationary time signals

By stationary is meant time signals whose statistical parameters remain constant over time. Since as a rule in technology, the parameters of time signals change over long time intervals (e.g. wear, abrasions, cracks), one speaks of a technically stationary condition, if the changes in the parameters of individual measurements during the observation period are negligible. Stationary signals can be further subdivided into deterministic and stochastic time signals.

Stationary vibration monitoring system

See Vibration monitoring system, stationary

Statistical inference

See Inference, statistical

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Steady state

The condition of a system in which the information parameters no longer change with time (e.g. constant current, constant voltage, constant amplitude, constant frequency). The stationary condition arrives, as a rule, after a transient phenomenon.

Step response

Time function at the output of a transmission element if the initial size of the jump function is $\sigma(t)$. Linear transmission elements are fully characterised by the step response. This has the advantage of easy measurability and vivid display. If $\pi(t)$ is the step response of a linear transmission element, the relationship to the step response $H(s)$ is described by:

$$L\{\pi(t)\} = \frac{H(s)}{s}$$

where $L\{\pi(t)\}$ is the Laplace transformation of $\pi(t)$.

Stiffness, dynamic

In a system, in which friction and inertia effects are negligible, the quotient from the force at one point and the equi-phase deflection at this point during a sinusoidal motion.

Note: In case of the torsional rigidity, “power" is replaced by “torque " and “deflection" by “angular displacement".

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Stochastic

If a term is provided with the adjective S., then one refers thereby to the random-dependent characteristics of the term.

Stochastic (random) time signals

See Time signals, stochastic

Stop band; **filter attenuation band**

Frequency range of a system (e.g. an electrical filter), within which oscillations or vibrations are not transferred (do not pass). The converse is a pass band.

Stroboscope

A device for observing and measuring rapidly-occurring events (e.g. speed measurement) with the help of a periodically interrupted ray of light (duration e.g. $10^{-5}\ sec.$). If the frequency of the S. and the event being measured coincide, then the event appears to be stationary, because each flash lights up the same movement condition (stroboscope effect).

Structure

Over a quantity of objects, that selected quantity of relationships which is raised through a given viewpoint.

Note 1: The elements of the object quantity do not have to be of the same kind. Graphic means are frequently used for the representation of S.

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Examples of this are chain, ring, tree, layering. Often one understands the object quantity as well as the selected quantity of relationships also by S.
Note 2: See also DIN 19226-1.

Structural resonance

For vibration monitoring on the basis of vibration spectra, frequency ranges are observed in relation to the background noise increased auto-power density.
Such arise with deterministic excitation at frequencies which are in a firm, usually integral relationship with the exciter frequency.
In contrast to this, S. is when increased heights (“peaks”) occur, with wide-band (noise) excitation at the position of the natural frequencies of the mechanically excited system. Their location is to a large extent independent of the exciter spectrum.

Structural resonance monitoring

S. is the tracking of the position, height and possibly the form of the structural resonances, in order to judge by these parameters changes (damage) in the vibrating system. Such changes are most frequently rigidity losses in mechanical couplings (e.g. screw connections and spring couplings), which manifest themselves in a decrease of the associated natural frequency. In addition also increases in stiffness by additional boundary conditions (e.g. unintentional demand) are observed. For single peaks a change in the peak form, peak position and height are not to be expected with unchanged excitation.

Subdirectory

A list of data and programs that are present in a higher level directory.

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Sub-harmonic vibrations; subharmonics

See Vibrations, sub-harmonic

Sub-synchronous vibrations

See Vibrations, sub-synchronous

Sub-system

A subordinate system.

Super-harmonic vibrations; Superharmonics

See Vibration, super-harmonic

Superposition

In general, the addition of two or more physical effects, e.g. of forces in the force parallelogram during movements or vibrations and shafts, respectively.

Super-synchronous vibrations

See Vibrations, super-synchronous

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SVGA

Acronym for <**S**uper **v**ideo **g**raphics **a**rray>
Graphic standard, which offers a screen resolution of $800\ x\ 600$ pixels with $35{,}000$ produced character rows in a second. Thus SVGA supplies a better resolution than VGA. Of the VESA, SVGA is so far not standardized. There are also SVGA cards with $640\ x\ 400$, $1{,}024\ x\ 768$ and $1{,}280$ pixels picture resolution. SVGA cards can normally also display VGA.

Sweep filter

A bandpass filter, which automatically tunes an interesting frequency range. Devices with this filter can be used for determination of frequency spectra, as long as the frequency portions of the signal are constant during the sweep.

Swing frame

A frame for installation in cabinets, desks or housings which hinges outward, preferably around the vertical axis. It serves to accommodate modules, trays, compartments and other installations and can be operated for maintenance purposes without interruption of the operating condition.

Symmetrical (alternating) signal

Signal, alternately symmetrical

Symmetrical (isotropic) rotor

See Rotor, symmetrical (isotropic)

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Symmetrical polyphase phenomenon

See sinus event, symmetric polyphase

Synchronise

See Synchronisation

Synchronism

The condition, in which two time-dependant features, time slot patterns or signals are synchronous.
The temporal synchronization between periodic or temporally corresponding events.

Synchronous

Designates two time-dependant features, time-slot patterns or signals, whose appropriate significant points in times are separate from each other by time intervals of the same desired duration.

Note: Time-dependant features, time slot patterns or signals can be synchronous, without being isochronous. From the Greek: παράλληλων (parallel). During the data communication, the transmission of the individual data elements synchronously to the system clock, which can be transferred either over its own cable or derived from the received data signal.

Synchronous averaging

See Averaging, synchronous; Time-domain averaging

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Synchronous vibration

See Vibration, synchronous

Synthesis (Fourier series) of the periodic oscillation, harmonic

The additive composition of a periodic oscillation from sinus vibrations in the period duration

$$T_n = \frac{T_1}{n}$$

(n whole number), also the frequency $f = nf_1$ is called S. (Fourier series).

For the affiliated vibration quantity x the following is valid:

$$x(t) - \overline{x}(t) = \sum_{n=1}^{\infty} \hat{x}_n \cos(\varphi_0 n + 2\pi n f_1 t) = \sum_{n=1}^{\infty} \hat{x}_n \operatorname{Re}\{\underline{\hat{x}}_n e^{j2\pi n f_1 t}\}$$

Note: The designation “harmonic synthesis” is correctly applied to both meanings of the word “harmoniously”, in that on the one hand it deals with the summand with harmonic vibrations and on the other hand, as their frequencies stand in the relationship of whole numbers.