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Encyclopedia

B

Background noise level

See Level

Balancing

A procedure by which the mass distribution of a rotor is examined and, if necessary, corrected, in order to guarantee that the residual unbalances, or the rotating-frequency vibrations at the bearing journals and/or the bearing forces, are within fixed limits at the operational speed.

A procedure for adjusting the radial mass distribution of a rotor so that the central principal axis coincides as closely as possible with the rotational axis of the shaft. The rotational-frequency bending vibration of the rotor, and thus the forces effective at the bearings (due to unbalance), are reduced.

Balancing, according to natural mode

A procedure for balancing flexible (shaft-elastic) rotors, by which a change in the mass distribution of a rotor is made in such a way that the vibration amplitudes of the interesting natural modes are individually reduced to within certain limit values.

Balancing, dynamic

Two-plane balancing

Balancing, high-speed

With flexible (shaft-elastic) rotors; balancing at a rotational speed at which the rotor is no longer considered rigid.

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Encyclopedia

B

Balancing, low-speed

With flexible rotors; balancing at a rotational speed at which the rotor probably behaves rigidly.

Balancing machine

A machine, which provides the measured values for the unbalance of a supported rotor which can be used for the correction of the mass distribution, so that the rotational-frequency vibrations at the bearing journals or the bearing forces can, if necessary, be reduced.

Balancing machine accuracy

The limits within which the magnitudes and angles of unbalance under fixed conditions can be measured.

Balancing quality

With rigid rotors the product of the referred residual unbalance (*referred unbalance*) and the max. operating angular velocity of the rotor.

Balancing run

A cycle consisting of a measuring run and the corresponding unbalance correction.

Balancing speed

The rotational speed at which a rotor will be balanced.

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B

Balancing, static

Single-plane balancing

Band limiting

B. describes the attenuation of frequency components in an output signal outside of the operating frequency range. It is effected by high and low-pass filtering (high-pass and low-pass filters) and described by the limit or corner frequencies as well as the flank steepness. For a complete description the type of filter characteristic (e.g. Butterworth filter) must be consulted.

Bandwidth

Difference between the limit frequencies of a frequency band.

Note: The concept B. s determined by a single value and does not depend upon the position of the band in the frequency spectrum. The width between given borders of the amplitude fall-off or rise of a bandpass or band-blocking frequency band in a transfer element (channel, filter, amplifier, or the like). For determination of B. the amplitude frequency response is measured. As absolute bandwidth, measured in Hz, one describes the difference between an upper and a lower limit frequency (f_o *resp.* f_u*).* Usually one uses the frequencies, with which power output has dropped to half of the reference value and/or the output voltage and the factor $1/\sqrt{2}$ (-3dB; Decibels) as critical frequencies. With band filters the critical frequencies are those with which the damping increased by a fixed value. As relative bandwidth one describes the relationship of the absolute B. to a reference frequency, mainly the frequency in the centre of the bandpass region (with a resonant circuit the resonance frequency). This band centre frequency is given by the geometric centre of the limit frequencies

$$f_m = \sqrt{f_o f_u}$$

Encyclopedia

B

Thus the relative B. is given by

$$b = \frac{f_o f_u}{f_m} = \frac{1}{Q}$$

whereby Q is the quality.

Bandwidth (of a device)

Spread of a frequency band, in which a given characteristic of a measuring device or a transfer channel differs more than a fixed value or a fixed relationship from a reference value.

Note: The given characteristic can be e.g. the amplitude-frequency characteristic or the phase-frequency characteristic.

Bandwidth, relative

Bandwidth

Band filter

A filter which possesses a lower bandpass attenuation between a lower limit frequency f_u and an upper limit frequency f_o.

Band centre

See Band centre frequency

Encyclopedia

B

Band centre frequency; Band centre

The B. describes the frequency in a bandpass filter which lies in the centre of the bandpass region.

See also Bandwidth

Bandpass

See Bandpass filter

Bandpass filter; Bandpass

<band pass filter>

A filter which transfers an electrical signal (vibration) between a *lower limit frequency* f_u and an upper limit frequency f_o . As a measure of the frequency range in which this transfer is done, the *bandwidth* is

$$f_b = f_o = f_u$$

or the relative bandwidth

$$b = \frac{f_o - f_u}{\sqrt{f_o f_u}}$$

In the bandpass region of the B. the damping D is the lowest, in the blocking region it is the highest. B. can be constructed from a combination of high-pass filter and low-pass filter. The converse is a band-blocking or band-suppression filter.

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Encyclopedia

B

Bandpass filtering

The filtering of vibrations by means of a bandpass filter.

Band-blocking; Band-suppression filter

<band-stop filter; notch filter>

A filter which blocks an electrical signal (vibrations) in a specific frequency range with high damping (attenuation). Thereby the B. possesses the inverse damping (attentuation) of a bandpass filter.

Band-suppression filter

<notch filter>

Band-block

Bar chart

A graphic display of measured values in bar form next to one another. Stacked bars, which characterise the summary of a value are stacked on top of one another.

Basic probability assignment

A generalisation of the probability measure (probability) for the evaluation of uncertain statements on the basis of vague dimensions.

A vague measurement V must satisfy the conditions $V(O) = 0, V(l) = 1$ where 0 and 1 are respectively the impossible and sure event. In addition, for a quantity S of events, it must be true that if an $s \subset S$ entails a $t \subset S$, then $V(t) > V(s)$.

In addition, a basic probability assignment (Abbreviation: GWZ) is satisfied by the condition

Encyclopedia

B

$$\sum_{s \subset S} V(s) = 1$$

The GWZ makes it possible to define the “credibility” of a statement as a special vague measurement. In addition, the “plausibility” of a statement can be defined. Two special cases are the consonant and dissonant GWZ: the latter provides the well-known probability measure.

Basic tone

<basic tone>

The lowest tone which a vibrating body delivers.

BCD

Abbr. for <**B**inary **c**oded **d**ecimal>

Binary-coded decimal number. Coded display of decimal numbers in the BCD code.

BCD code

<BCD code>

A 4-Bit binary code with which the 10 decimal digits are coded. Each position of a decimal number is individually coded. Example: $0101 = 5;\ 0101\ 0101 = 55.$

BCS

Abbr. for <**B**ear**c**on **s**ignature>

Bearcon Signature Analysis

Encyclopedia

B

BCU

Abbr. for <**b**ear**c**on **u**nit>

Dimensionsless unit of measure for the evaluation of rolling-element bearing condition according to the BEARCON method.

Bearcon Signature Analysis

The method is in the first step comparable with the BEARCON method.
The high-frequency resonance signal of the bearing structure and the acceleration sensor used for the measurement, which is excited by shock impulses due to damage in the rolling-element bearing, is used. The low frequency machine vibrations are suppressed by a high-pass filter. A high-speed peak-detector rectifier determines the envelope of the time function and thus eliminates the decaying portion of each shock impulse. This signal is transferred to the frequency domain by a Fourier Transformation. The frequencies of the determined spectral lines correspond exactly to the repeat rate of the shock impulses and thereby the typical damage frequencies of the rolling-element bearing components.

BEARCON method

The B. serves for assessment of rolling-element bearing condition. This touches on the measurement and assessment of shock impulses and the vibrations at the surface of the machine or bearing casing. A vibration acceleration sensor, which has a resonance frequency of approx. 32 kHz and is as a rule identical to one used for measurement of absolute casing vibration, is employed. The sensor converts the mechanical vibrations into an electrical signal. The shock impulses excite the sensor into vibrations at its resonance frequency of 32 kHz and are then superimposed onto the electrical output signal. The sensor can be compared to a bell which is excited by periodic impacts (shock impulses). After each impact the bell vibrates for a short time at its natural frequency, where the strength of the impact (= amplitude of the shock impulses) coincides with the loudness of the sound (= amplitude of the resonance vibration). Thus the output signal of the sensor is also a representation of the vibrations and shock impulses that occur at the measurement point. To suppress the energy-rich low frequency machine vibrations and the ever-present electronic noise in the upper frequency range, the sensor signal is fed through a filter with a bandpass between15 and 60 kHz. Predominantly only the shock impulses remain in the measured signal. A specially designed peak value detector determines the energy content of the shock impulses and delivers this as a measurement result in BCU units.

Bearing housing vibration

B. are the vibrations which arise at the machine surface in the proximity of the bearings or at the bearings. They give qualitative references over the effect of the vibrations on machine housings and environment, but contain however also the vibrations which are due to the environment, electrical machines and also the supports. Statements about dynamic forces, which will transfer from the machine to the environment, as well as statements about the vibration demands on parts of the machines cannot be made on the basis of the B.
The measurement is recommended,

- if the rigidity of the bearings is substantially smaller than the rigidity of the shaft,
- with aggregates having rolling-element bearings.

Beat procedure

Sum of two sine-wave procedures with (usually small) different rotational frequencies ω_1 and ω_2:

$$x = \hat{x}_1 \sin(\omega_1 t + \varphi_1) + \hat{x}_2 \sin(\omega_2 t + \varphi_2)$$

The troughs or valleys of the envelope curves follow each other with the cycle of the beat frequency f_b

$$f_b = |f_2 - f_1| = |(\omega_2 - \omega_1)/2\pi|$$

In the case of the same amplitudes $\hat{x}_1 = \hat{x}_2$ as a special case, the result is a pure beat.

Note: In practice B. arises e.g. if two or several spatially neighbouring and not sufficiently isolated machines run with slightly different rotational speeds. The problem of a B. also arises whenever machines themselves have several components with closely adjacent rotational speeds (e.g. Föttinger couplings and decanters) or vibration-excited forces with a small frequency differences arise (e.g. asynchronous motors with a beat created by the rotational frequency (mechanical vibration) and mains power frequency (electrical vibration).

Benchmark

1) General point of reference, fixed point, point of notice, made from measurements.
2) A test for comparing various instruments *(peripheral instruments).*

Bessel Filter

A *filter* in which a Bessel-Polynomial transfer function occurs. For a Bessel low-pass a transfer function is given

$$A(s) = \frac{1}{\frac{1}{15}s^3 + \frac{2}{5}s^2 + s + 1} = \frac{1}{B_3(s)}$$

$B_3(s)$ is the Bessel-Polynomial 3rd order and s is the complex frequency. The Bessel low-pass is also known as a Thomson low-pass. A rectangular impulse is transferred from a Bessel low-pass with the smallest change to the form of its curve (no overshoot). The good transient response is an advantage, the low flank steepness is a disadvantage compared with a power or Tschebyscheff filter.

Bifilar winding

A winding made up of two parallel wires lying next to one another.

Encyclopedia

B

Binary

The characteristic to be able to accept in each case one of two values or conditions.
Remark: The expression 'logical' instead of 'binary' is to be avoided to prevent misunderstanding. B. is not synonymous with 'dual'.

Binary characters

Characters from a character stock of only two characters.

Remark: As B. any arbitrary characters can be used, e.g. O and L; when there is no danger of confusion with digits, also O and 1; word pairs such as Yes and No, True and False, 12 V and 2 V can be a pair of B.

Binary code

A code with which each indication of the character range of a word is from binary characters (binary word <binary word>). If this word consists of n binary characters, then it is also called an n-Bit character.

Note: There are B.s, with which the binary words of the range have different lengths.

Binary-decimal code

<binary coded decimal>

BCD code

Encyclopedia

B

Binary number system

Numbering system based on the number 2. Every character can take on the value of 0 or 1.

Binary signal

Signal, binary

Binary system

Number system, binary

BIOS

Abbr. for <**b**asic **i**nput **o**utput **s**ystem>

The BIOS controls all input and output processes of a computer. This includes not only the keyboard input but also access to the serial and parallel interfaces. Diskette drives and hard drives, etc. are to be understood.

Bit

<bit>

Abbr. for <**b**inary dig**it**>
A B. is the smallest basic binary information with which the conditions „0 " and „1 " „off " and "on" or <low> and <high> etc. can be represented. In each case 8-bits are combined into a byte.
Special unit for the number of binary decisions different from zero.

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Encyclopedia

B

Remark: All logarithmically defined variables of the information theory (s. DIN 44 301), such as decision content, information content, redundance, etc. are received in Bit, when the logarithm base 2 is used (1 bit, 2 bit,...).

Example: To differentiate between 2^n conditions (n is an integer positive number) lb 2^n bit = n bit, i.e. n binary differentiations are required; these can be displayed with n Bits, i.e. n binary characters.

Bit error rate

The amount of defective transferred binary information (Bit) within a defined time period at a defined transfer speed.

Bitmap graphic

The form of display and storage of graphics by computer. The display consists of individual pixels and each pixel is allocated one or more Bits in the memory. The number of colours to be displayed (e.g. 8 Bit = 1 Byte with 256 colours). From this Bit information the display on the screen or the printout on paper can be created.

See also vector graphic

Bit pattern

The repeated sequence of Bits. This Bit sequence is assigned a specific meaning.

Encyclopedia

B

Bit parallel; character parallel

The parallel transfer of characters over multiple channels: Multiple Bits (e.g. one Byte = 8 Bit) are transferred in one word. For the transfer one channel (transfer channel) per Bit is required. The converse is Bit serial.

Bit position

The position of a Bit in a binary word. The highest value Bit is the MSB <most significant bit>, the lowest value is the LSB <least significant bit>.

Bit-rate
<bitrate>

The number of information bits per second that is to be transferred is evaluated and given in the unit bit/s or bps. The B. is given by the Baudrate multiplied by the number of possible conditions.

Bitrate

Bitrate; Bit speed

Bit/s
<bps>

The mass unit for the transfer speed in a digital system. This states how many Bits per second is actually being transferred. 1000 bit/s is 1 kbit/s. This is not synonymous with Baud.

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B

Bit serial; character serial

The serial transfer of characters over a channel: The individual Bits of a word are transferred one after another (serial) over a channel. Advantage: Each transfer direction requires only two channels. The converse is Bit parallel.

Blade-pass frequency

The basic frequency of vibration components which can be contained in the vibration signal of bladed machines. This corresponds to the product of the number of blades and the rotational speed (vibrations, blade-excited) and also characterized as rotational noise.

Block diagram

A representative diagram for a complex electronic circuit or functional unit, which allows identification of only the conduct of, or parameters at, the external terminals without providing details about the internal circuits or the inner construction of the circuits or functional units.

BMSR-technique

<automation>

Abbr. for Operational measurement-, Control- and Regulation-technique
Concept for the technique of development, production and employment of instruments and plant for measuring, controlling and regulating industrial processes. The BMSR-t. is the most important technical prerequisite for automation. The mechanisms of the BMSR-T. operate to the predominant part on an electronic basis. The rapidly growing requirements of the BMSR-T. force the creation of complex equipment systems, which is the basis for a uniform basic concept. The three pillars of the BMSR-t. are the Operational measurement technique, the Control technique and the Regulation technique, supplemented by the Process calculation technique.

Encyclopedia

B

Bodé diagram

1) The B. is a representation of the frequency response of transfer elements, common in electro-technology. Amplitude and phase response are thereby separately illustrated in logarithmic representations over the frequency.
2) For the documentation of the vibration response of machines in the B., the amplitude and phase curve of harmonic vibrations over the frequency are represented in cartesian coordinates. Thus the transient characteristic of a machine structure can be documented. The course of the amplitude and phase can also be recorded over the rotational speed, e.g. with a run-up or coastdown of the machines.

Note: The B. has greatest importance for the representation of the rotational-frequency vibration components ($1n$-vibration indicator) during the coastdown of machines. It is used also for representation of higher harmonic vibrations ($2n, 3n,$ etc.)

Bridge circuit

Short bridge, a ring-shaped circuit arrangement of four elements. According to the type of elements and the application one distinguishes between, e.g. impedance bridges and resistance bridges. With impedance bridges the four elements have impedance (e.g. capacitors, when capacitance measurements should be carried out). Resistance bridges contain only real resistors. Bridges serve as measurement bridges.

Bridge amplifier

Difference amplifier, which strengthens a bridge current or a bridge voltage in a bridge connection.

Encyclopedia

B

Buffer

1) See also Isolation amplifier
2) A memory, which temporarily takes up data which will transfer from one functional unit to another.

Buffer amplifier; buffer (stage); separative amplifier

Amplifier that is especially designed to prevent the input signal from being affected by changes in the attributes of the electrical circuit at the output. An amplifier for which the input and output are galvanically separated from one another for safety reasons. This can be achieved with for example, optical couplers.

Buffer memory; Cache memory

Memory unit as an intermediate carrier of data of two communicating functional units of different data-flow speeds.

Part the memory hierarchy of a data processing system (computing system). With efficient central processing units, data and instructions from the main memory must be made available with such a short access time, which is not economically realizable with the simultaneously required large memory capacity of the main memory.

Bus access procedure

In a communications network access must be regulated on the common transmitting medium (line). This takes place via the B.

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B

Bus access procedure

Multiple participants can take part in the coordination of bus access. The bus system remains functional with the drop out of any arbitrary participant. A contrary method is a central bus access method (Master-slave method).

Bus coupler

<transceiver>

Equipment/building group for attaching a participant/terminal (DTE) to a network.

Bus driver

Electronic circuits, which possess sufficient amplification in order to reload the load capacities of the connection lines (bus system) and the load impedance in the time demanded by the operating speed of the system.

Bus system

A bus system (abbr. Bus) is a communication system to which a number of participants can have access.

1) In a network one speaks of a Bus structure when individual lines (segments) exist to which the individual participant can be connected.
2) Within a system, e.g. a computer, the Bus forms the connection between the individual hardware components (constructional groups). Here the bus represents the summary of several lines.

The advantage lies in the easy extendability through additional devices or modules. One distinguishes between the following Buses:

- Address bus: For the transfer of addresses, e.g. from/to memory.
- Data bus: For the transfer of data. In microprocessors one often finds the designation 8-Bit, 16-Bit or 32-Bit processor. This states how many data lines the data bus embraces. For example with a 16-Bit processor, 16 data lines are available; thus 16 data bits can be transferred simultaneously.
- Control bus: For the transport of control signals. In contrast to a Bus there is point-to-point connection. Examples of Bus systems: VMEbus (Motorola), Multibus (Intel), CAN-Bus (Bosch).

Butterworth filter

Filter in which the transfer function of the Butterworth-Polynomial is used. For a Butterworth low-pass (low-pass filter) the following transfer function is given:

$$A(s) = \frac{1}{s^3 + 2s^2 + 2s + 1} = \frac{1}{P_3(s)}$$

Thereby $P_3(s)$ is the 3rd order Butterworth-Polynomial and s is the complex frequency. The transfer function of a Butterworth low-pass is maximally flat with $\omega = 0$; overshooting does not arise. The slope of the drop-off of the amount of the transfer function outside of the pass band increases with the order. The step response (impulse response) overshoots strongly against it. B. can therefore not faithfully transfer the form of impulses. A Bessel filter is more suitable here.

Butterworth low-pass

Butterworth-Filter

Encyclopedia

B

Byte

A group of eight from “one” and “zeros”, thus from 8-bits. A B. can take therefore from 256 different numerical values, which represent determined numbers, letters, special characters or control characters according to the appropriate coding. A B. is the most common unit, which is usually simultaneously processed by computers. With 16 Bit = 2 Byte.

n-Bit characters, with which n is fixed and predefined.

Remark: n is fixed in a given connection by construction. n is mostly 8; then the indication Byte is also called <octet>.

Blade-pass frequency

A frequency calculated from the product of the number of blades on an impeller and the rotational speed.