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COMPENDIUM OF SPECIMEN MULTI-CHOICE EXAMINATION QUESTIONS

CONTENTS

Acoustic Emissions 2
Infrared Thermography 3
Lubrication Analysis 5
Vibration Analysis 7
Vibration Analysis Answers 29
Análisis de vibraciones 50
Schwingungsanalyse 62
振动分析 74

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Acoustic Emissions

Category 1

The acoustic coupling of an AE transducer or AE sensor to the surface of the item being monitored is critical to a good measurement. Which of the following is suitable?

a) helium jet

b) paint

c) a grease or viscous oil

d) air

Which of the following would be the most appropriate center frequency for detecting superheated steam leaks in a plant room?

a) 400Hz

b) 40KHz

c) 4MHz

d) 400KHz

Category 2

When an AE wave front is detected by multiple AE sensors what term is usually used to describe the order in which they are detected?

a) burst sequence

b) event sequence

c) hit sequence

d) arrival sequence

Category 3

Can the time domain AE signal or an isolated AE transient be used to determine the dynamic time profile of its source function?

a) never

b) under special circumstances

c) in most cases

d) always

Infrared Thermography

Category 1

What qualification shows that a person is a competent thermographer?

a) ISO 9000 certification

b) ISO 18436-7 certification

c) 10 years' experience

d) a high resolution camera

Which of these wavelengths is infrared radiation?

a) 500 nanometers

b) 3 nanometers

c) 8 micrometers

d) 10 millimeters

What affects the apparent temperature of an object in a thermal image?

a) emissivity transmissivity and surrounding temperature

b) reflectivity moisture content and weight

c) mass, specific heat and temperature

d) length width and height

What is reflected apparent temperature?

a) The average temperature of objects in the field of view

b) The average temperature of objects behind the object of interest

c) The apparent temperature of reflections from an object

d) The average effective temperature of those surfaces in the hemisphere facing the object

What is the minimum size of object for which a temperature can be accurately assessed with a thermographic camera?

a) The size covered by one pixel of the camera detector

b) The size covered by four pixels of the camera detector

c) The size covered by nine pixels of the camera detector

d) The size covered by the camera detector

What is the maximum recommended wind speed for thermographic surveys of the outside of buildings?

a) 3m/s

b) 5m/s

c) 10m/s

d) 5mph

What is a typical emissivity for concrete?

a) 0.15

b) 0.50

c) 0.95

d) 1.00

Why might an internal thermographic survey produce better results?

a) the thermographer is kept warm and dry

b) the wall is below the dew point of air

c) the internal surface resistance is lower

d) the temperature difference between well and poorly insulated areas is greatest

What might cause the apparent surface temperature on part of the outside wall of a heated building to be lower than the surrounding areas?

a) less effective thermal insulation

b) cold bridging

c) a lower emissivity

d) increased wind speed

When can cold air be detected with an infrared camera?

a) never

b) when it leaks into a building and cools the surrounding surfaces

c) on the outside of a heated building

d) when it gets between the camera and the object being viewed

Lubrication Analysis

Category 1 Field

What does the "B" in BN stand for?

a) basic

b) base

c) binary

d) brass

Category 1 Laboratory

What is the test to provide PPM of water in oil?

a) crackle

b) Indicator paper

c) Karl Fischer

d) Dean and Stark

Category 2 Field

Under microscopic analysis what particles have a curved appearance?

a) Cutting wear

b) Fatigue wear

c) Corrosive wear

d) Rolling wear

Category 2 Laboratory

What region does a carbonyl peak appear in an FTIR trace?

a) 2400 – 2100 /cm

b) 750 – 600 /cm

c) 1200 – 1100 /cm

d) 1750 – 1630 /cm

Category 3 Field

Which of the following techniques would be most suitable for monitoring a truck engine?

a) AE

b) IRT

c) LA

d) VA

(A written explanation of your choice may be required)

Category 3 Laboratory

Which ISO standard should you require from your oil analysis laboratory?

a) ISO 17025

b) ISO 9001

c) ISO 4406

d) ISO 2241-2

Vibration Analysis

Category 1

A vibration velocity is measured to be 5mm/s pk-pk. What is the equivalent value in pk?

a) 2 mm/s

b) 2.5 mm/s

c) 3 mm/s

d) 3.5 mm/s

Which of the following is the MOST common vibration amplitude parameter used for general plant machines with rolling element bearings running at speeds between 750 and 2950 rev/min?

a) displacement

b) velocity

c) acceleration

d) cycles

A single measurement point on a machine shows an abnormally high vibration level of 100mm/sec RMS in one direction only, whereas all other readings measured in the same, and other directions are all less than 1.00 mm/sec rms. Which of the following would be the MOST LIKELY cause of the high vibration reading?

a) all bearings are defective

b) poor data collection methods

c) coupling misalignment

d) poor bearing lubrication

What type of data is seen in a vibration spectrum plot?

a) amplitude and frequency

b) amplitude and time

c) amplitude and phase

d) amplitude only

When is off-line vibration monitoring carried out?

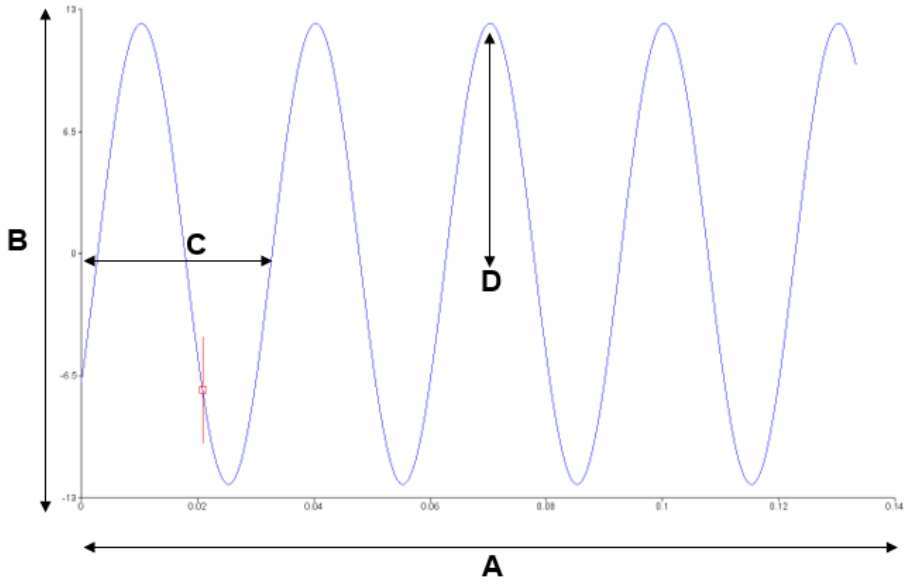
a) when the machine is switched off

b) only when the machine is noisy

c) periodically

d) continuously

In the figure below, what is represented by B?



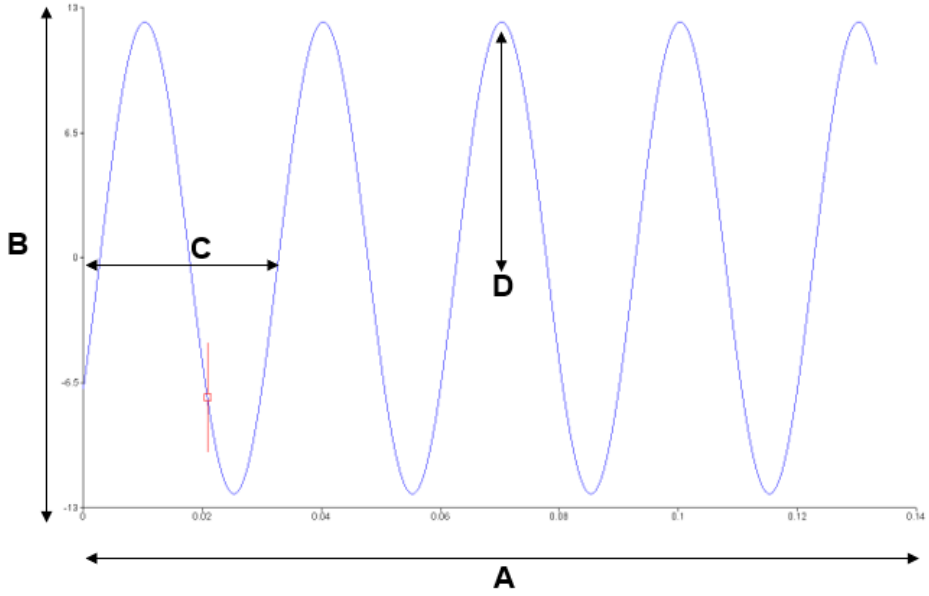
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by A?



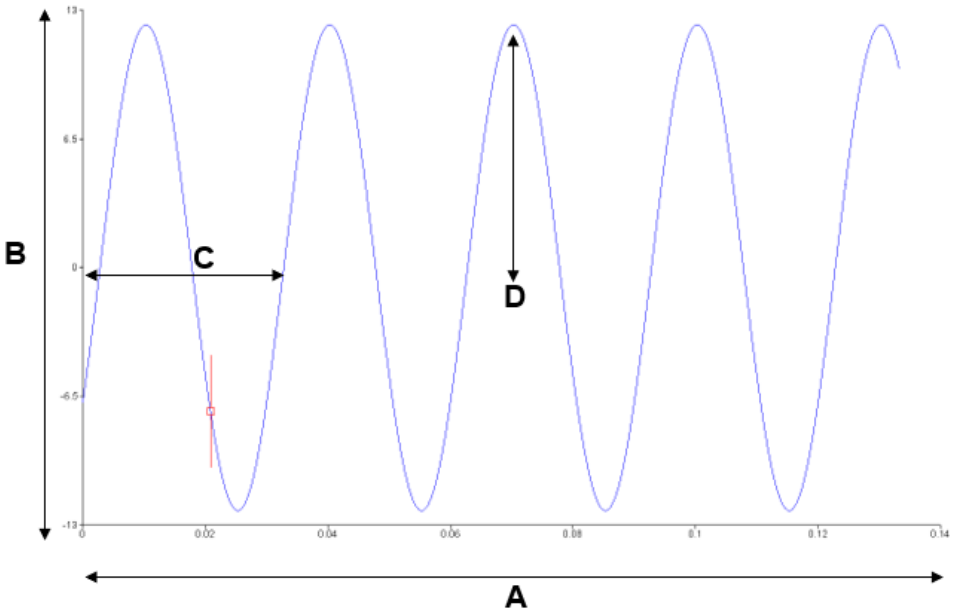
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by C?



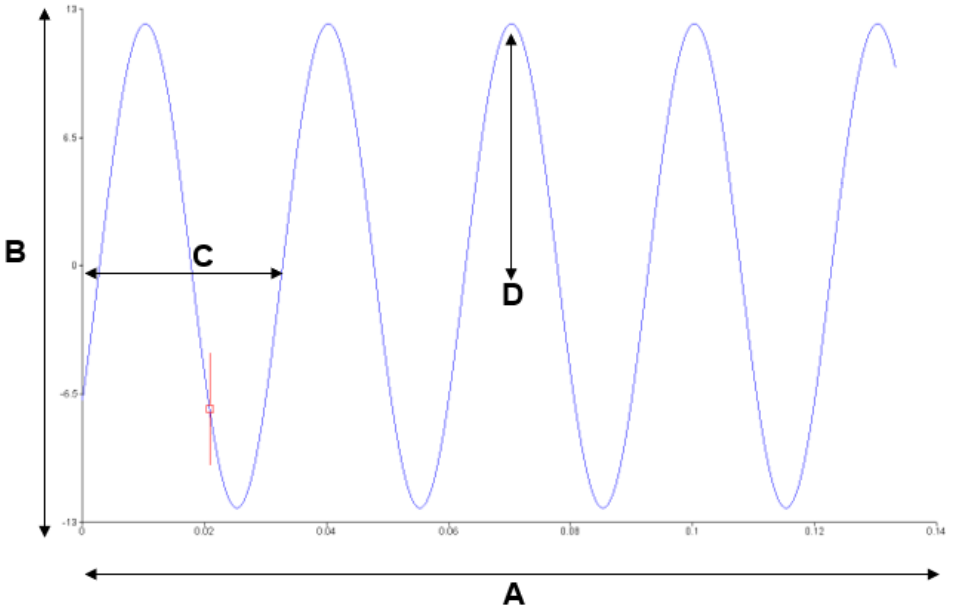
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by D?



a) period

b) amplitude axis

c) frequency

d) peak amplitude

What is the principal axis of a single axis accelerometer?

a) 90º to the sensitive axis

b) 45º to the sensitive axis

c) the direction in which the sensor is placed

d) the axial direction only

Regarding condition monitoring of a fan running at 1480 rev/min, which of the following monitoring parameters would best detect an unbalanced rotor?

a) shock pulse

b) vibration velocity

c) oil analysis

d) ultrasonic

Which of the following technologies <u>CANNOT</u> be used as the basis for non-intrusive condition monitoring of an electric motor?

a) vibration analysis

b) motor resistance analysis

c) infrared thermography

d) acoustic emissions

Which Condition Monitoring technology involves tribology?

a) vibration

b) thermography

c) oil analysis

d) acoustic emission

Shock pulse is measured as a function of?

a) speed only

b) viscosity of the lubricant

c) rotational speed (rev/min) and shaft size

d) displacement level and rotational speed

Where should a vibration reading ideally be taken on a machine?

a) as close to the loaded zone of a bearing housing as possible

b) in the middle of the motor frame

c) on the motor fan cowl (cover)

d) on the supporting baseplate

When a bearing has been running in perfect condition for 6 months the dB_m/dB_c values drop considerably and generate an alarm, what has happened?

a) the normal clearance within the bearing has been lost

b) unbalance has occurred

c) a soft foot condition has developed

d) a misalignment has occurred

High frequency vibration parameters such as Shock Pulse, HFD and Spike Energy are best used for:

a) diagnosing a misalignment

b) diagnosing a structural looseness problem

c) diagnosing an unbalance

d) early warning of bearing and lubrication problems

Category 2

Which unit is most appropriate for detecting high frequency vibration components (>1kHz)

a) acceleration

b) velocity

c) displacement

d) speed

Which is the characteristic fault frequency of an AC induction motor with a soft foot condition?

a) 2x electrical supply frequency

b) 1x electrical supply frequency

c) 1x rotational frequency

d) 2x rotational frequency

For a rigid rotor producing a sinusoidal vibration due to an unbalance, which one of the following applies?

a) the unbalance force will reduce in proportion to the cube of the speed

b) the unbalance force will increase in proportion to the square of the speed

c) the unbalance will remain constant regardless of the speed

d) the unbalance force will be proportional to half the speed

Vibration spectra were originally collected from 0 to 500Hz with 800 lines of resolution and 4 averages. For the same Fmax and averages, decreasing the number of lines to 400 will:

a) increase the amount of time to collect the reading

b) make no difference to the time to collect the reading

c) decrease the amount of time to collect the reading

d) require more data collector memory

Which one of the following would define the ratio of the minimum and maximum range of a vibration signal?

a) average amplitude range

b) dynamic range

c) frequency range

d) average frequency range

What can commonly cause artificially amplified vibration at the lower end of a velocity spectrum where the frequency range has been set according to expected frequencies?

a) a misalignment problem at 2xRPM

b) a unbalance problem at 1xRPM

c) badly collected data

d) a bearing cage defect

Which of the following <u>IS NOT</u> a form of averaging?

a) phase

b) linear

c) time synchronous

d) rms

Which of the following describes a bandpass filter?

a) it passes frequencies between a specified lower and upper range

b) it passes frequencies only above a specified range

c) it rejects frequencies between a specified lower and upper range

d) it passes frequencies only below a specified range

Which of the following <u>IS NOT</u> a filter used for vibration analysis?

a) low pass filter

b) high pass filter

c) bandpass filter

d) band exchange filter

Which of the following is generally an indication of a resonance condition on a centre-hung fan?

a) vibration will be significantly high is all three directions

b) vibration will be significantly high and equal in all three directions

c) vibration will be significantly low in both radial directions

d) vibration will be significantly higher in one direction

For a 4 pole AC motor on a 50 Hz supply, with a 1x vibration of 5 mm/s rms, what is the peak-to-peak displacement (approximately)?

a) 45 µm pk-pk

b) 90 µm pk-pk

c) 0.3 µm pk-pk

d) 30 µm pk-pk

Which of the following is likely to generate a beat frequency?

a) on a belt driven motor fan unit with a pulley ratio of approximately 1:1

b) on a direct driven motor fan unit that varies in speed

c) on a direct driven motor fan unit that is a fixed speed machine

d) on a belt driven motor fan unit with a pulley ratio of exactly 1:1

Which of the following would cause asynchronous vibration on a centrifugal pump?

a) large unbalance

b) damaged outer race

c) primary belt defect

d) raised blade pass

The Nyquist Criterion states that a signal should be sampled at?

a) exactly at the highest frequency of interest

b) greater than 2.0 times the highest frequency of interest

c) greater than 0.5 times the highest frequency of interest

d) 1.5 times the highest frequency of interest

Which of the following is correct in terms of time synchronous sampling?

a) a speed signal is sampled in conjunction with many time domain averages (i.e. 100), producing a frequency spectrum that contains only synchronous energy

b) a speed signal is sampled in conjunction with many frequency domain averages (i.e. 100), producing a frequency spectrum that contains only synchronous energy

c) a speed signal is sampled in conjunction with many time domain averages (i.e. 100), producing a frequency spectrum that contains only asynchronous energy

d) a signal can be collected with a single channel vibration analyser without any other inputs and many time domain averages (i.e. 100) producing a resultant frequency spectrum that contains only synchronous energy

What is an alias frequency?

a) a frequency that occurs when two frequencies are close together

b) a frequency that occurs when you have a bearing inner race defect due to the modulating characteristics of the defect entering the bearing load zone

c) a frequency created by sampling a signal with a sampling rate that is too low

d) a component defect frequency from within the machine

When sampling a signal, which of the following ensures that the frequency spectrum contains genuine frequencies?

a) using 4 to 6 averages

b) setting the Fmax in accordance with ISO 10816 / 20816

c) use of an anti-aliasing filter

d) using good resolution

Which of the following would define the total duration of a time waveform?

a) Fmax divided by number of lines

b) 2.5 x Fmax divided by number of lines

c) Fmax minus number of lines

d) number of lines divided by Fmax

What is a cascade (or waterfall) diagram used for?

a) identification of a bearing defect on a rolling element bearing

b) confirmation of a bearing defect on a rolling element bearing

c) identification of resonance frequency

d) confirmation of a structural looseness

Which of the following conditions would result in a change of 1x vector on a centrifugal fan?

a) aerodynamic vibration

b) rotor unbalance

c) bearing defect

d) Rotating stall

What is the following expression a function of?

$\int v\,dt$

a) acceleration

b) displacement

c) phase

d) velocity

What is the following expression a function of?

dv/dt

a) phase

b) displacement

c) acceleration

d) velocity

What is the dynamic range of an A to D converter with 12-bit resolution?

a) 90 db

b) 16 dB

c) 66 dB

d) 160 dB

Which of the following <u>WOULD NOT</u> be used for resonance testing and assessment?

a) impact testing

b) bode plot

c) shock pulse

d) modal testing

Which of the following <u>DOES NOT</u> influence the length of a sample required for an FFT?

a) number of lines

b) dynamic range

c) frequency range

d) number of samples

If an 800-line FFT is required to have a maximum span (F_{max}) of 1000 Hz how long must the time waveform sample be?

a) 1.25 seconds

b) 1.6 seconds

c) 2.5 seconds

d) 0.8 seconds

If a 1600-line FFT is required to have a maximum span (F_{max}) of 108,000 CPM, what would be the approximate bin width?

a) 6.8 Hz

b) 2.5 Hz

c) 1.1 Hz

d) 0.2 Hz

Which of the following would you use to assess a motor and pump unit with rolling element bearings for an acceptance test?

a) capture shaft rider measurements in the vertical, horizontal and axial directions at all bearing locations

b) capture casing measurements in the vertical, horizontal and axial directions at all bearing locations

c) capture shaft probe measurements in the vertical, horizontal and axial directions at all bearing locations

d) capture casing measurements in the vertical, horizontal and axial directions at one bearing only on each component

When monitoring a sleeve bearing, which of the following is the most appropriate parameter to measure?

a) displacement

b) acceleration

c) shock pulse

d) jerk

Which of the following faults would benefit from synchronous sampling?

a) spalled bearing race

b) resonance

c) chipped gear tooth

d) poorly lubricated bearing

For which of the following defects would an FFT zoom analysis be most appropriate to use?

a) unbalance

b) mechanical looseness

c) chipped gear tooth

d) rotor bar problem

Category 3

A peak in a velocity spectrum appears to be a multiple of the running speed of the motor. Which of the following should be used to confirm if the frequency is related to shaft speed?

a) vary the instantaneous sampling rate

b) time synchronous averaging

c) linear averaging with a low pass filter set below the running speed

d) orbit of sub synchronous harmonics

What does dynamic range in a digital systems relate to?

a) the frequency resolution within the FFT

b) the number of samples with the time range

c) the amplitude resolution

d) the highest maximum frequency that the digital analyser can measure to

Which of the following should be used to understand the average shaft centerline position within a sleeve bearing?

a) monitoring the A.C. voltage from a proximity probe

b) Adjust the sensitivity of a proximity probe as the machine runs up

c) monitoring the D.C. gap voltage from a proximity probe

d) monitoring the A.C. voltage from an accelerometer

The appearance of rolling element bearing fault frequencies within an enveloped vibration spectrum:

a) does not mean anything as rolling element bearings always generate fault frequencies

b) always means that bearing replacement is required

c) indicates early stage defect to one or more of the components of the bearing is present

d) indicates that the natural frequencies of the machine are being excited

When conducting an ODS study on a motor/pump assembly with a dual channel vibration analyser, what is most important regarding the position of the sensors?

a) the reference sensor must not be moved

b) the roving sensor is placed only on anti-node points

c) the roving sensor is not placed on node points

d) a different phase reference is used for each reading

What is the dynamic range of a 12 bit A/D convertor?

a) 96db

b) 90db

c) 66db

d) 138db

Which one of the following applies to a Hanning window?

a) it offers improved frequency resolution versus a flat top window

b) it offers improved amplitude resolution versus a flat top window

c) it would only be used when calibrating a sensor mounted to a shaker table

d) it would only be used when conducting a bump test

What name is given to the plot that represents the average shaft position both on run-up and steady state running conditions?

a) centerline plot

b) cascade/waterfall diagram

c) bode plot

d) spectrogram

Which one of the following situations would cause rotating aerodynamic stall in a centrifugal fan?

a) where a fan balance is well under residual unbalance limits

b) where a mechanical unbalance of the fan exists

c) where flow is not freely dissipated between blades

d) where a fan is operating on its design curve

For which one of the following defects would time synchronous averaging be applicable?

a) outer race bearing defect

b) rotating stall

c) inner race bearing defect

d) chipped gear tooth

If a machine running at 1200 rev/min exhibits a 1x vibration of 4 mm/s rms, what (approximately) is the peak-to-peak displacement?

a) 18 µm pk-pk

b) 180 µm pk-pk

c) 90 µm pk-pk

d) 9 µm pk-pk

If a machine running at 1200 rev/min exhibits a 1x vibration of 50 µm pk-pk, what (approximately) is the rms velocity?

a) 4 mm/s rms

b) 2 mm/s rms (actually 2.2mm/sec)

c) 15 mm/s rms

d) 10 mm/s rms

In the equation for forced harmonic oscillation, which term represents stiffness?

$$m\frac{\mathrm{d}^2x}{\mathrm{d}t^2} + c\frac{\mathrm{d}x}{\mathrm{d}t} + kx = F_0e^{i\omega t}$$

a) m

b) c

c) x

d) k

In what frequency range would you normally detect symptoms of oil whirl?

a) asynchronous

b) synchronous

c) sub-synchronous

d) across all the above frequency ranges

When carrying out a balancing exercise on a rigid rotor where weight is being added to a single balance place, what is the minimum number of runs that will be required to achieve a residual balance state (assuming the influence coefficients are unknown)?

a) 4

b) 3

c) 2

d) 1

The tribo-electric effect can be caused by which one of the following?

a) an overloaded accelerometer signal

b) damaged displacement probe tip

c) a non-powered velocity sensor

d) movement or bending of cables

Which of the following would contribute to non-vibration run-out when measuring vibration on a rotating shaft with proximity probes?

a) Seismic casing measurements

b) Hydrodynamic oil films

c) Incorrect oil viscosity

d) Local residual magnetism

In terms of machine reliability what does MTBF represent?

a) mean time before failure

b) mean time before fixing

c) mean time between failure

d) maximum time to failure

Which of the following is most likely to be seen in the event of rolling element bearing inner race fault (where the inner race is fixed and the outer race rotates)?

a) running speed sideband frequencies will typically surround the primary inner race frequency and related harmonics

b) only the running speed and related harmonics will be present

c) cage sideband frequencies will typically surround the primary inner race frequency and related harmonics

d) Outer race sideband frequencies will typically surround the primary inner race frequency and related harmonics

For a direct online 50Hz AC induction motor rated at 1480 rev/min, which of the following defines the correct number of poles and slip frequency?

a) 4 poles, slip frequency 0.33Hz

b) 8 poles, slip frequency 25Hz

c) 6 Poles, slip frequency 0.33Hz

d) 2 Poles, slip frequency 20cpm

Which of the following characterises aerodynamic stall in an industrial fan?

a) very dominant 1x & 2x vibration

b) low amplitude running harmonics with a once-per-rev impact in the time waveform

c) high amplitude blade pass frequency and related harmonics

d) frequency is dominated by sub-synchronous vibration

Which of the following combination of tests is particularly useful for the identification of resonance frequencies?

a) cascade, bode/Nyquist, modal, bump test

b) envelope, bump test, shock pulse testing

c) synchronous order tracking, shock pulse testing, bode/Nyquist

d) negative averaging, shock pulse testing, run-up/run down test

When measuring shock pulse a decrease in the dbc & dbm levels indicates what?

a) misalignment

b) a reduction of the lubricant thickness

c) unbalance

d) increased clearance within the bearing

In terms of harmonic motion $\frac{dx}{dt}$ represents?

a) acceleration

b) jerk

c) displacement

d) velocity

In terms of calculating the primary "V belt" frequency, which one of the following correctly contains the information which needs to be known?

a) both pitch diameters and belt length

b) both pulley speeds and the belt length

c) one pulley pitch diameter, its shaft speed and the belt length

d) both pulley pitch diameters and one shaft speed

The bearing wear pattern appearance below is commonly caused by?



a) Fatigue wear

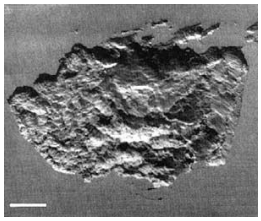
b) Pitting wear

c) Electrical damage

d) Spalling wear

The bearing wear pattern appearance below is commonly caused by?





a) Fatigue wear

b) Pitting wear

c) Electrical damage

d) Spalling wear

A time waveform that is clipped both top and bottom will produce what frequency content in the spectrum?

a) sine wave

b) modulation

c) beat frequencies

d) odd harmonics

Gear misalignment generally effects which frequency or frequencies in the FFT?

a) 2x rev/min

b) Only 1x gear mesh frequency

c) 1x & 2x rev/min

d) 1x, 2x & 3x gear mesh frequency

The equation $f_n = (1/2\pi) \sqrt{(k/m)}$ would be used to calculate which one of the following?

Where: k = stiffness factor

m = mass

a) Undamped natural frequency in a system with a single degree of freedom

b) Damped natural frequency in a multi degree of freedom system

c) Overdamp natural frequency in a system with multi degrees of freedom

d) Undamped natural frequency in a multi degree of freedom system

The equation $f_n = (1/2\pi) \sqrt{(k/m - c^2/4m^2)}$ would be used to calculate which one of the following?

Where: k = stiffness

m = mass

c = damping coefficient

a) Undamped natural frequency in a system with single degree of freedom

b) Damped natural frequency in a single of freedom system

c) Overdamp natural frequency in a system with multi degrees of freedom

d) Undamped natural frequency in a multi degree of freedom system

Assuming displacement is in millimeters, which of the following equations correctly defines the peak acceleration of a single component sinusoidal vibration signal?

a) $$\frac{2.(\pi.f)^2.\mathrm{D}_{\text{peak to peak}}}{1000.g}$$

b) $$\frac{2.\pi.f.D_{rms}}{1000.g}$$

c) $$\frac{1000.g.D_{rms}}{2.\pi.f}$$

d) $$\frac{\pi.f.D_{peaktopeak}}{1000.g}$$

In wear debris analysis what does the term morphology represent?

a) the chemical make-up of the oil

b) a particle shape

c) the molecular make of the oil

d) quantity of particles

A time separated burst emission signal applies to which of the following techniques?

a) Periodic noise signal

b) Random noise signals

c) Acoustic emission

d) Noise emission

Which one of the following defines prognostics?

a) The analysis of the symptoms of faults to predict future condition and remaining life

b) The analysis and diagnoses of a problem to confirm its actual fault source

c) The analysis and diagnoses of a problem to confirm its actual cause

d) The analysis and diagnoses of a problem to confirm its actual symptoms, fault and cause

If a resonant frequency is measured at 80Hz and the half power points are at +/- 0.5Hz, what is the Q factor which describes the damping?

a) 80 / 2π.(80.5-79.5)

b) (80.5-79.5) / 80

c) 2π.80 / (80.5-79.5)

d) 80 / (80.5-79.5)

During an *in-situ* single-plane trim balance, a temporary trial mass of 50g in line with the trigger changes the 1x vibration vector from 8 mm/s@0° to 4 mm/s@90° (lag). What is the influence coefficient for this fan?

a) 5.6g per mm/s @30˚(lag)

b) 5.6 mm/s per g @30˚(lag)

c) 56 mm/s per g @30˚(lead)

d) 56g per mm/s @30˚(lead)

During an *in-situ* single-plane trim balance on a centrifugal fan, the effect of a second trial mass does not agree with the influence coefficient calculated from the first trial. Which of the following is least likely to be a cause?

a) Thermal distortion of the fan

b) A motor bearing defect

c) Change in fan speed

d) Change in damper settings (i.e.: aerodynamic instabilities)

During an *in-situ* single-plane balancing exercise, a temporary trial mass at 90° (lag) from the trigger changes the 1x vibration vector from the 4 mm/s at 90° (lag) to 8 mm/s at 0°. Using the polar plot provided, determine the approximate total correction mass and at what angle?

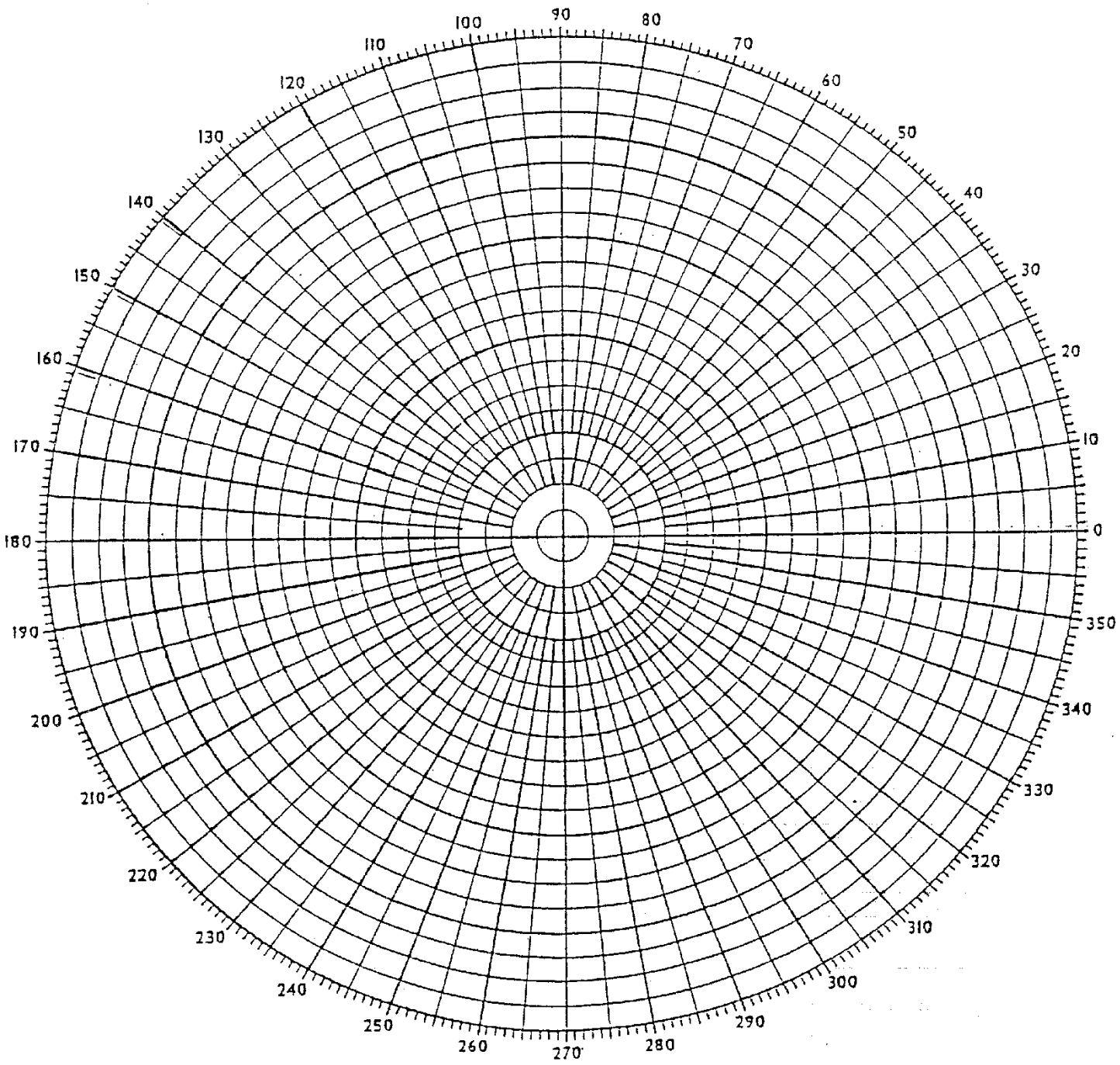
a) 50g at 90° (lag)

b) 45g at 60° (lag)

c) 45g at 30° (lag)

d) 50g at 0°

POLAR DIAGRAM



Vibration Analysis Answers

Category 1

A vibration velocity is measured to be 5mm/s pk-pk. What is the equivalent value in pk?

a) 2 mm/s

b) 2.5 mm/s

c) 3 mm/s

d) 3.5 mm/s

Which of the following is the MOST common vibration amplitude parameter used for general plant machines with rolling element bearings running at speeds between 750 and 2950 rev/min?

a) displacement

b) velocity

c) acceleration

d) cycles

A single measurement point on a machine shows an abnormally high vibration level of 100mm/sec RMS in one direction only, whereas all other readings measured in the same, and other directions are all less than 1.00 mm/sec rms. Which of the following would be the MOST LIKELY cause of the high vibration reading?

a) all bearings are defective

b) poor data collection methods

c) coupling misalignment

d) poor bearing lubrication

What type of data is seen in a vibration spectrum plot?

a) amplitude and frequency

b) amplitude and time

c) amplitude and phase

d) amplitude only

When is off-line vibration monitoring carried out?

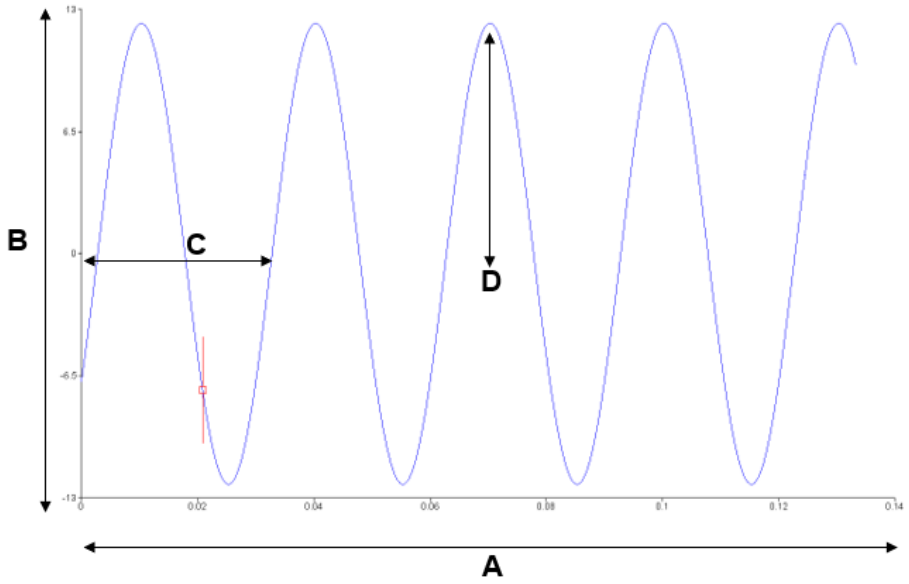
a) when the machine is switched off

b) only when the machine is noisy

c) periodically

d) continuously

In the figure below, what is represented by B?



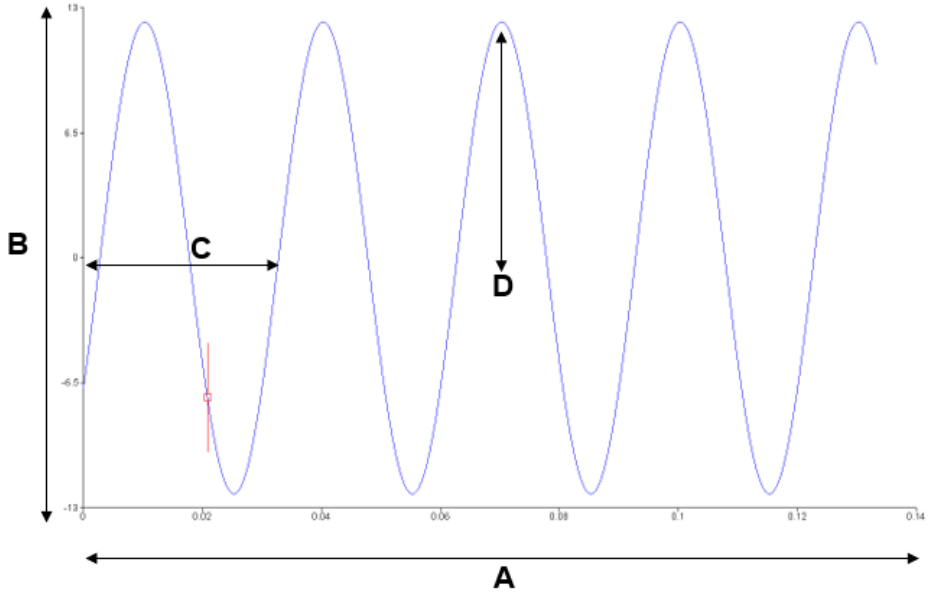
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by A?



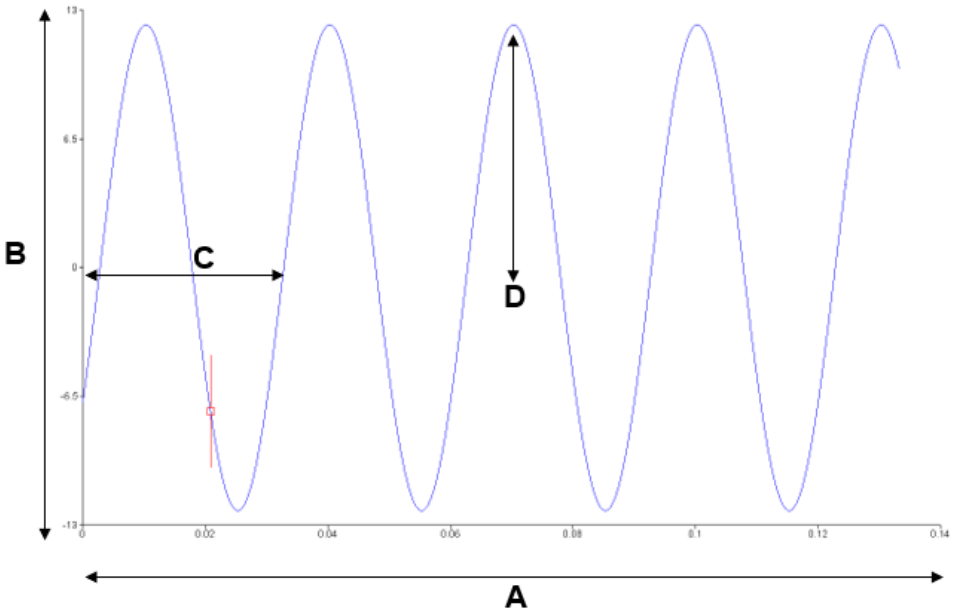
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by C?



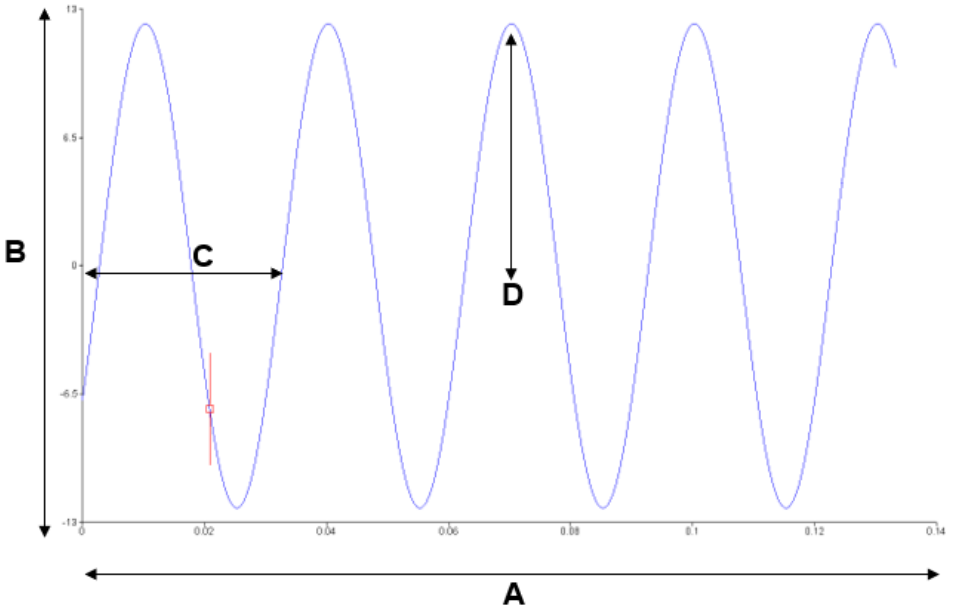
a) period

b) amplitude axis

c) frequency

d) time

In the figure below, what is represented by D?



a) period

b) amplitude axis

c) frequency

d) peak amplitude

What is the principal axis of a single axis accelerometer?

a) 90º to the sensitive axis

b) 45º to the sensitive axis

c) the direction in which the sensor is placed

d) the axial direction only

Regarding condition monitoring of a fan running at 1480 rev/min, which of the following monitoring parameters would best detect an unbalanced rotor?

a) shock pulse

b) vibration velocity

c) oil analysis

d) ultrasonic

Which of the following technologies CANNOT be used as the basis for non-intrusive condition monitoring of an electric motor?

a) vibration analysis

b) motor resistance analysis

c) infrared thermography

d) acoustic emissions

Which Condition Monitoring technology involves tribology?

a) vibration

b) thermography

c) oil analysis

d) acoustic emission

Shock pulse is measured as a function of?

a) speed only

b) viscosity of the lubricant

c) rotational speed (rev/min) and shaft size

d) displacement level and rotational speed

Where should a vibration reading ideally be taken on a machine?

a) as close to the loaded zone of a bearing housing as possible

b) in the middle of the motor frame

c) on the motor fan cowl (cover)

d) on the supporting baseplate

When a bearing has been running in perfect condition for 6 months the dB_m/dB_c values drop considerably and generate an alarm, what has happened?

a) the normal clearance within the bearing has been lost

b) unbalance has occurred

c) a soft foot condition has developed

d) a misalignment has occurred

High frequency vibration parameters such as Shock Pulse, HFD and Spike Energy are best used for:

a) diagnosing a misalignment

b) diagnosing a structural looseness problem

c) diagnosing an unbalance

d) early warning of bearing and lubrication problems

Category 2

Which unit is most appropriate for detecting high frequency vibration components (>1kHz)

a) acceleration

b) velocity

c) displacement

d) speed

Which is the characteristic fault frequency of an AC induction motor with a soft foot condition?

a) 2x electrical supply frequency

b) 1x electrical supply frequency

c) 1x rotational frequency

d) 2x rotational frequency

For a rigid rotor producing a sinusoidal vibration due to an unbalance, which one of the following applies?

a) the unbalance force will reduce in proportion to the cube of the speed

b) the unbalance force will increase in proportion to the square of the speed

c) the unbalance will remain constant regardless of the speed

d) the unbalance force will be proportional to half the speed

Vibration spectra were originally collected from 0 to 500Hz with 800 lines of resolution and 4 averages. For the same Fmax and averages, decreasing the number of lines to 400 will:

a) increase the amount of time to collect the reading

b) make no difference to the time to collect the reading

c) decrease the amount of time to collect the reading

d) require more data collector memory

Which one of the following would define the ratio of the minimum and maximum range of a vibration signal?

a) average amplitude range

b) dynamic range

c) frequency range

d) average frequency range

What can commonly cause artificially amplified vibration at the lower end of a velocity spectrum where the frequency range has been set according to expected frequencies?

a) a misalignment problem at 2xRPM

b) a unbalance problem at 1xRPM

c) badly collected data

d) a bearing cage defect

Which of the following <u>IS NOT</u> a form of averaging?

a) phase

b) linear

c) time synchronous

d) rms

Which of the following describes a bandpass filter?

a) it passes frequencies between a specified lower and upper range

b) it passes frequencies only above a specified range

c) it rejects frequencies between a specified lower and upper range

d) it passes frequencies only below a specified range

Which of the following <u>IS NOT</u> a filter used for vibration analysis?

a) low pass filter

b) high pass filter

c) bandpass filter

d) band exchange filter

Which of the following is generally an indication of a resonance condition on a centre-hung fan?

a) vibration will be significantly high is all three directions

b) vibration will be significantly high and equal in all three directions

c) vibration will be significantly low in both radial directions

d) vibration will be significantly higher in one direction

For a 4 pole AC motor on a 50 Hz supply, with a 1x vibration of 5 mm/s rms, what is the peak-to-peak displacement (approximately)?

a) 45 µm pk-pk

b) 90 µm pk-pk

c) 0.3 µm pk-pk

d) 30 µm pk-pk

Which of the following is likely to generate a beat frequency?

a) on a belt driven motor fan unit with a pulley ratio of approximately 1:1

b) on a direct driven motor fan unit that varies in speed

c) on a direct driven motor fan unit that is a fixed speed machine

d) on a belt driven motor fan unit with a pulley ratio of exactly 1:1

Which of the following would cause asynchronous vibration on a centrifugal pump?

a) large unbalance

b) damaged outer race

c) primary belt defect

d) raised blade pass

The Nyquist Criterion states that a signal should be sampled at?

a) exactly at the highest frequency of interest

b) greater than 2.0 times the highest frequency of interest

c) greater than 0.5 times the highest frequency of interest

d) 1.5 times the highest frequency of interest

Which of the following is correct in terms of time synchronous sampling?

a) a speed signal is sampled in conjunction with many time domain averages (i.e. 100), producing a frequency spectrum that contains only synchronous energy

b) a speed signal is sampled in conjunction with many frequency domain averages (i.e. 100), producing a frequency spectrum that contains only synchronous energy

c) a speed signal is sampled in conjunction with many time domain averages (i.e. 100), producing a frequency spectrum that contains only asynchronous energy

d) a signal can be collected with a single channel vibration analyser without any other inputs and many time domain averages (i.e. 100) producing a resultant frequency spectrum that contains only synchronous energy

What is an alias frequency?

a) a frequency that occurs when two frequencies are close together

b) a frequency that occurs when you have a bearing inner race defect due to the modulating characteristics of the defect entering the bearing load zone

c) a frequency created by sampling a signal with a sampling rate that is too low

d) a component defect frequency from within the machine

When sampling a signal, which of the following ensures that the frequency spectrum contains genuine frequencies?

a) using 4 to 6 averages

b) setting the Fmax in accordance with ISO 10816 / 20816

c) use of an anti-aliasing filter

d) using good resolution

Which of the following would define the total duration of a time waveform?

a) Fmax divided by number of lines

b) 2.5 x Fmax divided by number of lines

c) Fmax minus number of lines

d) number of lines divided by Fmax

What is a cascade (or waterfall) diagram used for?

a) identification of a bearing defect on a rolling element bearing

b) confirmation of a bearing defect on a rolling element bearing

c) identification of resonance frequency

d) confirmation of a structural looseness

Which of the following conditions would result in a change of 1x vector on a centrifugal fan?

a) aerodynamic vibration

b) rotor unbalance

c) bearing defect

d) Rotating stall

What is the following expression a function of?

$\int v\,dt$

a) acceleration

b) displacement

c) phase

d) velocity

What is the following expression a function of?

dv/dt

a) phase

b) displacement

c) acceleration

d) velocity

What is the dynamic range of an A to D converter with 12-bit resolution?

a) 90 db

b) 16 dB

c) 66 dB

d) 160 dB

Which of the following <u>WOULD NOT</u> be used for resonance testing and assessment?

a) impact testing

b) bode plot

c) shock pulse

d) modal testing

Which of the following <u>DOES NOT</u> influence the length of a sample required for an FFT?

a) number of lines

b) dynamic range

c) frequency range

d) number of samples

If an 800-line FFT is required to have a maximum span (F_{max}) of 1000 Hz how long must the time waveform sample be?

a) 1.25 seconds

b) 1.6 seconds

c) 2.5 seconds

d) 0.8 seconds

If a 1600-line FFT is required to have a maximum span (F_{max}) of 108,000 CPM, what would be the approximate bin width?

a) 6.8 Hz

b) 2.5 Hz

c) 1.1 Hz

d) 0.2 Hz

Which of the following would you use to assess a motor and pump unit with rolling element bearings for an acceptance test?

a) capture shaft rider measurements in the vertical, horizontal and axial directions at all bearing locations

b) capture casing measurements in the vertical, horizontal and axial directions at all bearing locations

c) capture shaft probe measurements in the vertical, horizontal and axial directions at all bearing locations

d) capture casing measurements in the vertical, horizontal and axial directions at one bearing only on each component

When monitoring a sleeve bearing, which of the following is the most appropriate parameter to measure?

a) displacement

b) acceleration

c) shock pulse

d) jerk

Which of the following faults would benefit from synchronous sampling?

a) spalled bearing race

b) resonance

c) chipped gear tooth

d) poorly lubricated bearing

For which of the following defects would an FFT zoom analysis be most appropriate to use?

a) unbalance

b) mechanical looseness

c) chipped gear tooth

d) rotor bar problem

Category 3

A peak in a velocity spectrum appears to be a multiple of the running speed of the motor. Which of the following should be used to confirm if the frequency is related to shaft speed?

a) vary the instantaneous sampling rate

b) time synchronous averaging

c) linear averaging with a low pass filter set below the running speed

d) orbit of sub synchronous harmonics

What does dynamic range in a digital systems relate to?

a) the frequency resolution within the FFT

b) the number of samples with the time range

c) the amplitude resolution

d) the highest maximum frequency that the digital analyser can measure to

Which of the following should be used to understand the average shaft centerline position within a sleeve bearing?

a) monitoring the A.C. voltage from a proximity probe

b) Adjust the sensitivity of a proximity probe as the machine runs up

c) monitoring the D.C. gap voltage from a proximity probe

d) monitoring the A.C. voltage from an accelerometer

The appearance of rolling element bearing fault frequencies within an enveloped vibration spectrum:

a) does not mean anything as rolling element bearings always generate fault frequencies

b) always means that bearing replacement is required

c) indicates early stage defect to one or more of the components of the bearing is present

d) indicates that the natural frequencies of the machine are being excited

When conducting an ODS study on a motor/pump assembly with a dual channel vibration analyser, what is most important regarding the position of the sensors?

a) the reference sensor must not be moved

b) the roving sensor is placed only on anti-node points

c) the roving sensor is not placed on node points

d) a different phase reference is used for each reading

What is the dynamic range of a 12 bit A/D convertor?

a) 96db

b) 90db

c) 66db

d) 138db

Which one of the following applies to a Hanning window?

a) it offers improved frequency resolution versus a flat top window

b) it offers improved amplitude resolution versus a flat top window

c) it would only be used when calibrating a sensor mounted to a shaker table

d) it would only be used when conducting a bump test

What name is given to the plot that represents the average shaft position both on run-up and steady state running conditions?

a) centerline plot

b) cascade/waterfall diagram

c) bode plot

d) spectrogram

Which one of the following situations would cause rotating aerodynamic stall in a centrifugal fan?

a) where a fan balance is well under residual unbalance limits

b) where a mechanical unbalance of the fan exists

c) where flow is not freely dissipated between blades

d) where a fan is operating on its design curve

For which one of the following defects would time synchronous averaging be applicable?

a) outer race bearing defect

b) rotating stall

c) inner race bearing defect

d) chipped gear tooth

If a machine running at 1200 rev/min exhibits a 1x vibration of 4 mm/s rms, what (approximately) is the peak-to-peak displacement?

a) 18 µm pk-pk

b) 180 µm pk-pk

c) 90 µm pk-pk

d) 9 µm pk-pk

If a machine running at 1200 rev/min exhibits a 1x vibration of 50 µm pk-pk, what (approximately) is the rms velocity?

a) 4 mm/s rms

b) 2 mm/s rms (actually 2.2mm/sec)

c) 15 mm/s rms

d) 10 mm/s rms

In the equation for forced harmonic oscillation, which term represents stiffness?

$$m\frac{\mathrm{d}^2x}{\mathrm{d}t^2} + c\frac{\mathrm{d}x}{\mathrm{d}t} + kx = F_0e^{i\omega t}$$

a) m

b) c

c) x

d) k

In what frequency range would you normally detect symptoms of oil whirl?

a) asynchronous

b) synchronous

c) sub-synchronous

d) across all the above frequency ranges

When carrying out a balancing exercise on a rigid rotor where weight is being added to a single balance place, what is the minimum number of runs that will be required to achieve a residual balance state (assuming the influence coefficients are unknown)?

a) 4

b) 3

c) 2

d) 1

The tribo-electric effect can be caused by which one of the following?

a) an overloaded accelerometer signal

b) damaged displacement probe tip

c) a non-powered velocity sensor

d) movement or bending of cables

Which of the following would contribute to non-vibration run-out when measuring vibration on a rotating shaft with proximity probes?

a) Seismic casing measurements

b) Hydrodynamic oil films

c) Incorrect oil viscosity

d) Local residual magnetism

In terms of machine reliability what does MTBF represent?

a) mean time before failure

b) mean time before fixing

c) mean time between failure

d) maximum time to failure

Which of the following is most likely to be seen in the event of rolling element bearing inner race fault (where the inner race is fixed and the outer race rotates)?

a) running speed sideband frequencies will typically surround the primary inner race frequency and related harmonics

b) only the running speed and related harmonics will be present

c) cage sideband frequencies will typically surround the primary inner race frequency and related harmonics

d) Outer race sideband frequencies will typically surround the primary inner race frequency and related harmonics

For a direct online 50Hz AC induction motor rated at 1480 rev/min, which of the following defines the correct number of poles and slip frequency?

a) 4 poles, slip frequency 0.33Hz

b) 8 poles, slip frequency 25Hz

c) 6 Poles, slip frequency 0.33Hz

d) 2 Poles, slip frequency 20cpm

Which of the following characterises aerodynamic stall in an industrial fan?

a) very dominant 1x & 2x vibration

b) low amplitude running harmonics with a once-per-rev impact in the time waveform

c) high amplitude blade pass frequency and related harmonics

d) frequency is dominated by sub-synchronous vibration

Which of the following combination of tests is particularly useful for the identification of resonance frequencies?

a) cascade, bode/Nyquist, modal, bump test

b) envelope, bump test, shock pulse testing

c) synchronous order tracking, shock pulse testing, bode/Nyquist

d) negative averaging, shock pulse testing, run-up/run down test

When measuring shock pulse a decrease in the dbc & dbm levels indicates what?

a) misalignment

b) a reduction of the lubricant thickness

c) unbalance

d) increased clearance within the bearing

In terms of harmonic motion $\frac{dx}{dt}$ represents?

a) acceleration

b) jerk

c) displacement

d) velocity

In terms of calculating the primary "V belt" frequency, which one of the following correctly contains the information which needs to be known?

a) both pitch diameters and belt length

b) both pulley speeds and the belt length

c) one pulley pitch diameter, its shaft speed and the belt length

d) both pulley pitch diameters and one shaft speed

The bearing wear pattern appearance below is commonly caused by?



a) Fatigue wear

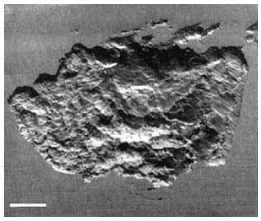
b) Pitting wear

c) Electrical damage

d) Spalling wear

The bearing wear pattern appearance below is commonly caused by?





a) Fatigue wear

b) Pitting wear

c) Electrical damage

d) Spalling wear

A time waveform that is clipped both top and bottom will produce what frequency content in the spectrum?

a) sine wave

b) modulation

c) beat frequencies

d) odd harmonics

Gear misalignment generally effects which frequency or frequencies in the FFT?

a) 2x rev/min

b) Only 1x gear mesh frequency

c) 1x & 2x rev/min

d) 1x, 2x & 3x gear mesh frequency

The equation $f_n = (1/2\pi) \sqrt{(k/m)}$ would be used to calculate which one of the following?

Where: k = stiffness factor

m = mass

a) Undamped natural frequency in a system with a single degree of freedom

b) Damped natural frequency in a multi degree of freedom system

c) Overdamp natural frequency in a system with multi degrees of freedom

d) Undamped natural frequency in a multi degree of freedom system

The equation $f_n = (1/2\pi) \sqrt{(k/m - c^2/4m^2)}$ would be used to calculate which one of the following?

Where: k = stiffness

m = mass

c = damping coefficient

a) Undamped natural frequency in a system with single degree of freedom

b) Damped natural frequency in a single of freedom system

c) Overdamp natural frequency in a system with multi degrees of freedom

d) Undamped natural frequency in a multi degree of freedom system

Assuming displacement is in millimeters, which of the following equations correctly defines the peak acceleration of a single component sinusoidal vibration signal?

a) $$\frac{2.(\pi.f)^2.\mathrm{D}_{\text{peak topeak}}}{1000.g}$$

b) $$\frac{2.\pi.f.D_{rms}}{1000.g}$$

c) $$\frac{1000.g.D_{rms}}{2.\pi.f}$$

d) $$\frac{\pi.f.D_{peaktopeak}}{1000.g}$$

In wear debris analysis what does the term morphology represent?

a) the chemical make-up of the oil

b) a particle shape

c) the molecular make of the oil

d) quantity of particles

A time separated burst emission signal applies to which of the following techniques?

a) Periodic noise signal

b) Random noise signals

c) Acoustic emission

d) Noise emission

Which one of the following defines prognostics?

a) The analysis of the symptoms of faults to predict future condition and remaining life

b) The analysis and diagnoses of a problem to confirm its actual fault source

c) The analysis and diagnoses of a problem to confirm its actual cause

d) The analysis and diagnoses of a problem to confirm its actual symptoms, fault and cause

If a resonant frequency is measured at 80Hz and the half power points are at +/- 0.5Hz, what is the Q factor which describes the damping?

a) 80 / 2π.(80.5-79.5)

b) (80.5-79.5) / 80

c) 2π.80 / (80.5-79.5)

d) 80 / (80.5-79.5)

During an *in-situ* single-plane trim balance, a temporary trial mass of 50g in line with the trigger changes the 1x vibration vector from 8 mm/s@0° to 4 mm/s@90° (lag). What is the influence coefficient for this fan?

a) 5.6g per mm/s @30˚(lag)

b) 5.6 mm/s per g @30˚(lag)

c) 56 mm/s per g @30˚(lead)

d) 56g per mm/s @30˚(lead)

During an *in-situ* single-plane trim balance on a centrifugal fan, the effect of a second trial mass does not agree with the influence coefficient calculated from the first trial. Which of the following is least likely to be a cause?

a) Thermal distortion of the fan

b) A motor bearing defect

c) Change in fan speed

d) Change in damper settings (i.e.: aerodynamic instabilities)

During an *in-situ* single-plane balancing exercise, a temporary trial mass at 90° (lag) from the trigger changes the 1x vibration vector from the 4 mm/s at 90° (lag) to 8 mm/s at 0°. Using the polar plot provided, determine the approximate total correction mass and at what angle?

a) 50g at 90° (lag)

b) 45g at 60° (lag)

c) 45g at 30° (lag)

d) 50g at 0°

Análisis de vibraciones

Categoría 1

Se mide una velocidad de vibración de 5 mm / s p-p. ¿Cuál es el valor equivalente en 0-p?

a) 2 mm/s

b) 2.5 mm/s

c) 3 mm/s

d) 3.5 mm/s

¿Cuál de los siguientes es el parámetro de amplitud de vibración MÁS común utilizado para máquinas de la planta general con rodamientos de elementos rodantes que funcionan a velocidades entre 750 y 2950 rev / min?

a) desplazamiento

b) velocidad

c) aceleración

d) ciclos

Un único punto de medición en una máquina muestra un nivel de vibración anormalmente alto de 100 mm / seg. RMS en una dirección solamente, mientras que todas las demás lecturas medidas en la misma y en otras direcciones son todas menores de 1,00 mm / seg rms. ¿Cuál de las siguientes sería la causa más probable de la lectura de alta vibración?

a) todos los cojinetes son defectuosos

b) pobres métodos de recopilación de datos

c) desalineación del acoplamiento

d) mala lubricación del cojinete

¿Qué tipo de datos se ven en un diagrama de espectro de vibración?

a) amplitud y frecuencia

b) amplitud y tiempo

c) amplitud y fase

d) solo amplitud

¿Cuándo se lleva a cabo la monitorización de vibraciones fuera de línea?

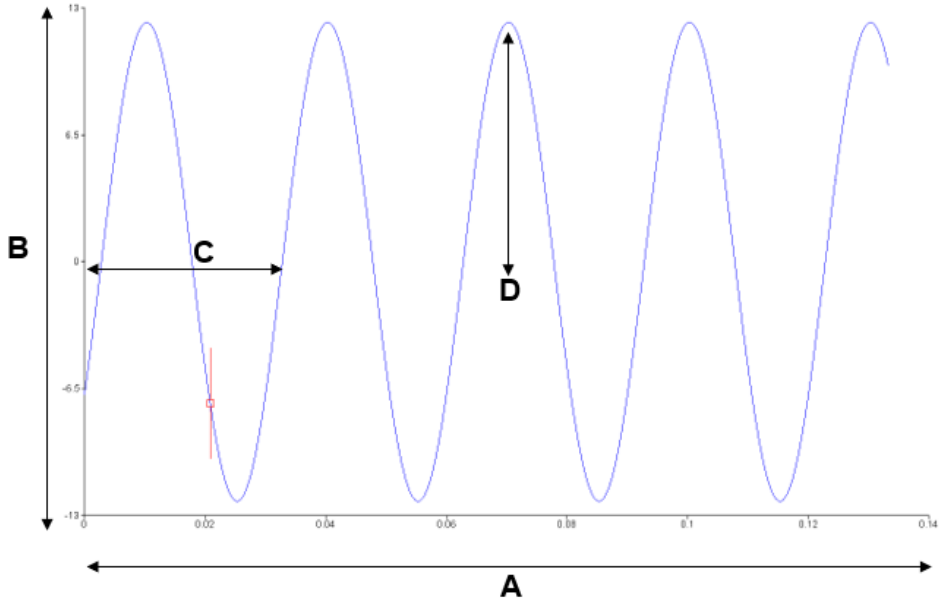
a) cuando la máquina está apagada

b) solo cuando la máquina es ruidosa

c) periódicamente

d) continuously

En la figura a continuación, ¿qué representa B?



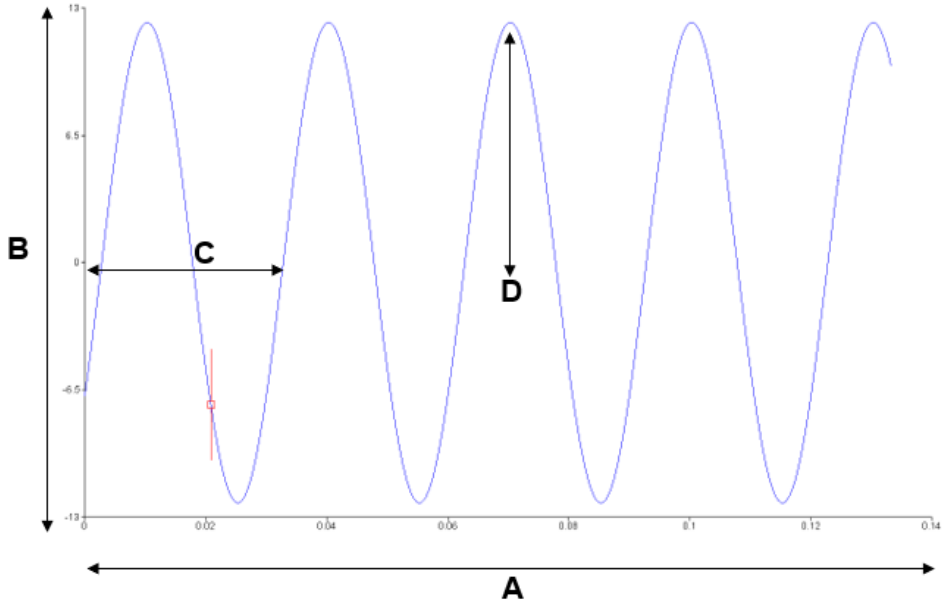
a) período

b) eje de amplitud

c) frecuencia

d) hora

En la figura a continuación, ¿qué representa A?



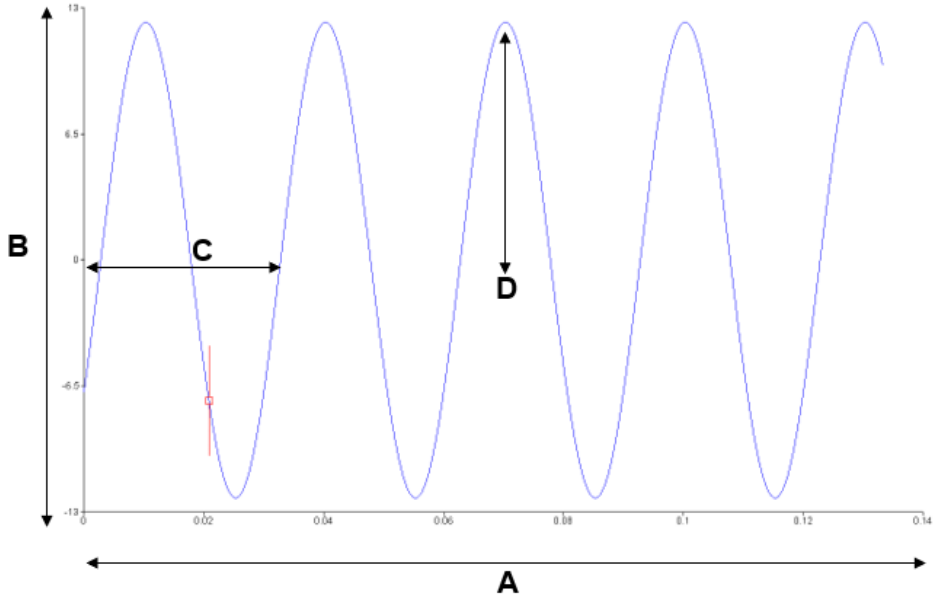
a) período

b) eje de amplitud

c) frecuencia

d) hora

En la figura a continuación, ¿qué representa C?



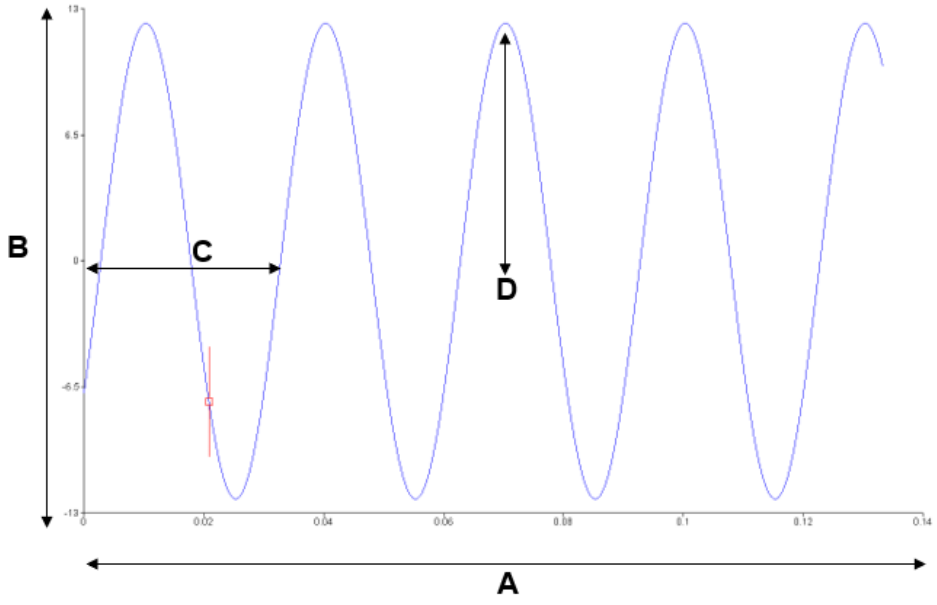
a) período

b) eje de amplitud

c) frecuencia

d) hora

En la figura a continuación, ¿qué representa D?



a) período

b) eje de amplitud

c) frecuencia

d) peak amplitude

¿Cuál es el eje principal de un acelerómetro de eje único?

a) 90º al eje sensible

b) 45º al eje sensible

c) la dirección en que se coloca el sensor

d) solo la dirección axial

Con respecto a la monitorización del estado de un ventilador funcionando a 1480 rev / min, ¿cuál de los siguientes parámetros de monitorización detectaría mejor un rotor desbalanceado?

a) pulso de choque

b) velocidad de vibración

c) análisis de aceite

d) ultrasonidos

¿Cuál de las siguientes tecnologías <u>NO PUEDE</u> utilizarse como base para la supervisión de condiciones no intrusivas de un motor eléctrico?

a) análisis de vibración

b) análisis de resistencia del motor

c) termografía infrarroja

d) emisiones acústicas

¿Qué tecnología de supervisión de condiciones implica tribología?

a) vibración

b) termografía

c) análisis de aceite

d) emisión acústica

El impulso de choque se mide como una función de?

a) solo velocidad

b) viscosidad del lubricante

c) velocidad de rotación (rev / min) y tamaño del eje

d) nivel de desplazamiento y velocidad de rotación

¿Dónde debería idealmente tomarse una lectura de vibración en una máquina?

a) tan cerca de la zona cargada de una carcasa de cojinete como sea posible

b) en el medio del marco del motor

c) en la cubierta del ventilador del motor (cubierta)

d) en la placa base de soporte

Cuando un rodamiento se ha estado ejecutando en perfectas condiciones durante 6 meses, los valores de dBm / dBc disminuyen considerablemente y generan una alarma, ¿qué ha sucedido?

a) la distancia normal dentro del rodamiento se ha perdido

b) desequilibrio ha ocurrido

c) una condición de pie suave ha desarrollado

d) una desalineación ha ocurrido

Los parámetros de vibración de alta frecuencia como Shock Pulse, HFD y Spike Energy se utilizan mejor para:

a) diagnosticando una desalineación

b) diagnosticar un problema de holgura estructural

c) diagnosticar un desequilibrio

d) alerta temprana de problemas de cojinetes y lubricación

Categoría 2

Qué unidad es la más adecuada para detectar componentes de vibración de alta frecuencia (> 1 kHz)

a) aceleración

b) velocidad

c) desplazamiento

d) velocidad

¿Cuál es la frecuencia de falla característica de un motor de inducción de CA con una condición de pie suave?

a) 2x frecuencia de suministro eléctrico

b) 1x frecuencia de suministro eléctrico

c) 1x frecuencia de rotación

d) 2x frecuencia de rotación

Para un rotor rígido que produce una vibración sinusoidal debido a un desequilibrio, ¿cuál de las siguientes opciones aplica?

a) la fuerza de desequilibrio se reducirá por el cuadrado de la velocidad

b) la fuerza de desequilibrio aumentará por el cuadrado de la velocidad

c) el desequilibrio se mantendrá constante independientemente de la velocidad

d) la fuerza de desequilibrio será proporcional a la mitad de la velocidad

Los espectros de vibración se recogieron originalmente de 0 a 500 Hz con 800 líneas de resolución y 4 promedios. Para el mismo Fmax y promedios, disminuir el número de líneas a 400:

a) aumentar la cantidad de tiempo para recolectar la lectura

b) no hace diferencia en el momento de recoger la lectura

c) disminuir la cantidad de tiempo para recolectar la lectura

d) requiere más memoria del recopilador de datos

¿Cuál de las siguientes opciones definiría la relación del rango mínimo y máximo de una señal de vibración?

a) rango de amplitud promedio

b) gama dinámica

c) rango de frecuencia

d) rango de frecuencia promedio

¿Qué puede causar comúnmente una vibración amplificada artificialmente al comienzo de un espectro de velocidad donde el rango de frecuencia se ha establecido de acuerdo con las frecuencias esperadas?

a) un problema de desalineación en 2xRPM

b) un problema de desequilibrio en 1xRPM

c) datos mal recolectados debido a un tiempo incorrecto de ajuste del sensor

d) un defecto en la jaula de rodamientos

¿Cuál de los siguientes <u>NO</u> es una forma de promediar?

a) fase

b) lineal

c) tiempo síncrono

d) rms

¿Cuál de los siguientes describe un filtro de paso de banda?

a) pasa frecuencias entre un rango bajo y alto especificado

b) pasa frecuencias solo por encima de un rango especificado

c) rechaza frecuencias entre un rango bajo y alto especificado

d) pasa frecuencias solo debajo de un rango especificado

¿Cuál de los siguientes <u>NO</u> es un filtro utilizado para el análisis de vibración?

a) filtro de paso bajo

b) filtro de paso alto

c) filtro de paso de banda

d) filtro de intercambio de banda

¿Cuál de los siguientes es generalmente una indicación de una condición de resonancia en un ventilador colgado centralmente?

a) la vibración será significativamente alta en las tres direcciones

b) la vibración será significativamente alta e igual en las tres direcciones

c) la vibración será significativamente baja en ambas direcciones radiales

d) la vibración será significativamente más alta en una dirección

Para un motor de CA de 4 polos en un suministro de 50 Hz, con una vibración 1x de 5 mm / s rms, ¿cuál es el desplazamiento pico a pico (aproximadamente)?

a) 50 µm pk-pk

b) 90 µm pk-pk

c) 0.3 µm pk-pk

d) 30 µm pk-pk

¿Cuál de los siguientes es probable que genere una frecuencia de tiempo?

a) en una unidad de ventilador de motor accionada por correa con una relación de polea es aproximadamente 1:1

b) en una unidad de ventilador de motor de accionamiento directo que varía en velocidad

c) en una unidad de ventilador de motor de accionamiento directo que es una máquina de velocidad fija

d) en una unidad de ventilador de motor de accionamiento directo de velocidad fija que está desequilibrada

¿Cuál de los siguientes causaría una vibración asíncrona en una bomba centrífuga?

a) gran desequilibrio

b) raza externa dañada

c) defecto primario de la correa

d) paso elevado de la cuchilla

El criterio de Nyquist establece que una señal debe ser muestreada en?

a) exactamente a la frecuencia más alta de interés

b) más de 2.0 veces la frecuencia más alta de interés

c) mayor que 0.5 veces la frecuencia más alta de interés

d) 1.5 veces la frecuencia más alta de interés

¿Cuál de los siguientes es correcto en términos de muestreo sincrónico de tiempo?

a) una señal de velocidad se muestrea junto con muchos promedios de dominio de tiempo (es decir, 100), produciendo un espectro de frecuencia que contiene solo energía síncrona

b) una señal de velocidad se muestrea junto con muchos promedios de dominio de frecuencia (es decir, 100), produciendo un espectro de frecuencia que contiene solo energía síncrona

c) una señal de velocidad se muestrea junto con muchos promedios de dominio de tiempo (es decir, 100), produciendo un espectro de frecuencia que contiene solo energía asíncrona

d) se puede recoger una señal con un analizador de vibración de canal único sin ninguna otra entrada y muchos promedios de dominio de tiempo (es decir, 100) produciendo un espectro de frecuencia resultante que contiene solo energía síncrona

¿Qué es una frecuencia de alias?

a) una frecuencia que ocurre cuando dos frecuencias están muy juntas

b) una frecuencia que ocurre cuando tiene un defecto en la carrera interna del rodamiento debido a las características de modulación del defecto que entra en la zona de carga del rodamiento

c) una frecuencia creada al muestrear una señal con una frecuencia de muestreo demasiado baja

d) una frecuencia de defecto componente desde el interior de la máquina

Al muestrear una señal, ¿cuál de las siguientes opciones asegura que el espectro de frecuencia contiene frecuencias reales?

a) usando 4 a 6 promedios

b) configurar el Fmax de acuerdo con ISO 10816/20816

c) uso de un filtro anti-aliasing

d) usando buena resolución

¿Cuál de las siguientes opciones definiría la duración total de una forma de onda de tiempo?

a) Fmax dividido por el número de líneas

b) 2.5 x Fmax dividido por el número de líneas

c) Fmax menos el número de líneas

d) número de líneas divididas por Fmax

¿Para qué se usa un diagrama en cascada (o cascada)?

a) identificación de un defecto del cojinete en un rodamiento

b) confirmación de un defecto de cojinete en un elemento rodante que lleva

c) identificación de la frecuencia de resonancia

d) confirmación de una holgura estructural

¿Cuál de las siguientes condiciones daría como resultado un cambio de vector 1x en un ventilador centrífugo?

a) vibración aerodinámica

b) desequilibrio del rotor

c) defecto de rodamiento

d) Puesto giratorio

¿Cuál es la siguiente expresión en función?

$$\int v\,dt$$

a) aceleración

b) desplazamiento

c) fase

d) velocidad

¿Cuál es la siguiente expresión en función?

dv/dt

a) fase

b) desplazamiento

c) aceleración

d) velocidad

¿Cuál es el rango dinámico de un convertidor A a D con resolución de 12 bits?

a) 90 db

b) 16 dB

c) 66 dB

d) 160 dB

¿Cuál de los siguientes <u>NO SERÍA</u> usado para la prueba y evaluación de resonancia?

a) prueba de impacto

b) diagrama de Bode

c) pulso de choque

d) prueba modal

¿Cuál de los siguientes <u>NO</u> influye en la longitud de una muestra requerida para una FFT?

a) número de líneas

b) gama dinámica

c) rango de frecuencia

d) número de muestras

Si se requiere una FFT de 800 líneas para tener un alcance máximo (Fmax) de 1000 Hz, ¿cuánto tiempo debe durar la muestra de forma de onda de tiempo?

a) 1.25 segundos

b) 1.6 segundos

c) 2.5 segundos

d) 0.8 segundos

Si se requiere una FFT de 1600 líneas para tener un tramo máximo (Fmax) de 108,000 CPM, ¿cuál sería el ancho aproximado del contenedor?

a) 6.75 Hz

b) 2.5 Hz

c) 1.1 Hz

d) 0.2 Hz

¿Cuál de los siguientes utilizaría para evaluar un motor y una unidad de bomba con cojinetes de elementos rodantes para una prueba de aceptación?

a) capturar las mediciones del jinete del eje en las direcciones vertical, horizontal y axial en todas las ubicaciones de los rodamientos

b) capture las medidas de la carcasa en las direcciones vertical, horizontal y axial en todas las ubicaciones de rodamiento

c) capturar las mediciones de la sonda del eje en las direcciones vertical, horizontal y axial en todas las ubicaciones de los rodamientos

d) capturar las medidas de la carcasa en las direcciones vertical, horizontal y axial en un solo rodamiento en cada componente

Al monitorear un cojinete de manguito, ¿cuál de los siguientes es el parámetro más apropiado para medir?

a) desplazamiento

b) aceleración

c) pulso de choque

d) imbécil

¿Cuál de las siguientes fallas se beneficiaría del muestreo sincrónico?

a) carrera de rodamiento descascarillado

b) resonancia

c) diente del engranaje astillado

d) cojinete mal lubricado

¿Para cuál de los siguientes defectos sería más apropiado usar un análisis de zoom FFT?

a) desequilibrar

b) soltura mecánica

c) diente del engranaje astillado

d) problema de la barra del rotor

Schwingungsanalyse

Kategorie 1

Eine Schwingungsgeschwindigkeit wird mit 5mm/s p-p gemessen. Was ist der Gegenwert in 0-p?

a) 2 mm/s

b) 2,5 mm/s

c) 3 mm/s

d) 3,5 mm/s

Welcher der folgenden Parameter ist der <u>GEBRÄLICHSTE</u> Schwingungsamplitudenparameter, der für allgemeine Maschinen mit Wälzlagern mit Drehzahlen zwischen 750 und 2950 U/min verwendet wird?

a) Verschiebung

b) Geschwindigkeit

c) Beschleunigung

d) Zyklen

Ein einzelner Messpunkt an einer Maschine zeigt einen ungewöhnlich hohen Schwingungspegel von 100 mm/s RMS nur in eine Richtung, während alle anderen Messwerte, die in derselben und anderen Richtungen gemessen werden, alle weniger als 1,00 mm/sec RMS betragen. Welche der folgenden Ursachen wäre die <u>WAHRSCHEINLICHSTE</u> Ursache für die hohe Schwingungsmessung?

a) alle Lager defekt sind

b) Schlechte Datenerhebungsmethoden

c) Kupplungsfehlausrichtung

d) schlechte Lagerschmierung

Welche Art von Daten werden in einem Schwingungsspektrumdiagramm angezeigt?

a) Amplitude und Frequenz

b) Amplitude und Zeit

c) Amplitude und Phase

d) Nur Amplitude

Wann wird eine Offline-Schwingungsüberwachung durchgeführt?

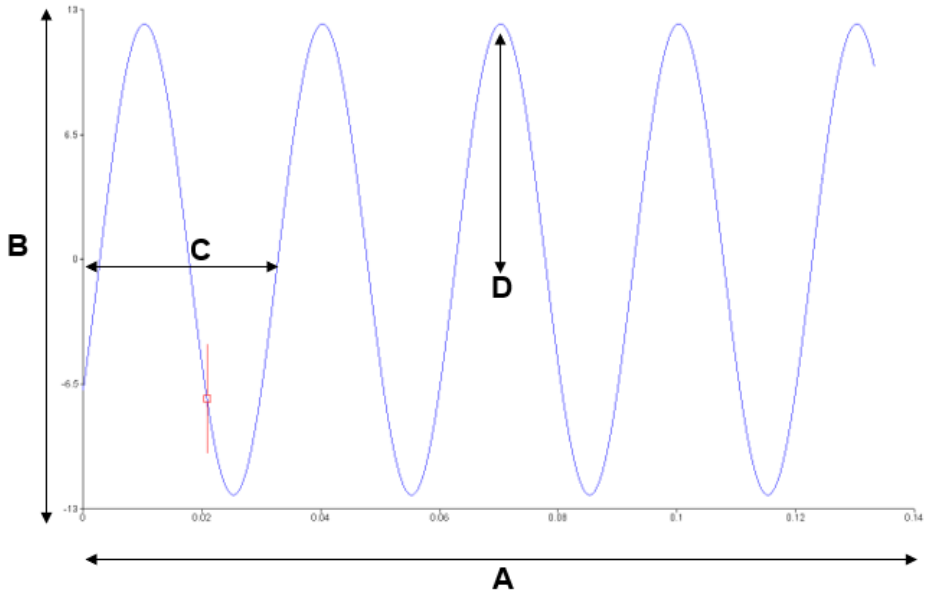
a) Wenn die Maschine ausgeschaltet ist

b) nur wenn die Maschine laut ist

c) regelmäßig

d) ununterbrochen

Was wird in der folgenden Abbildung durch B dargestellt?



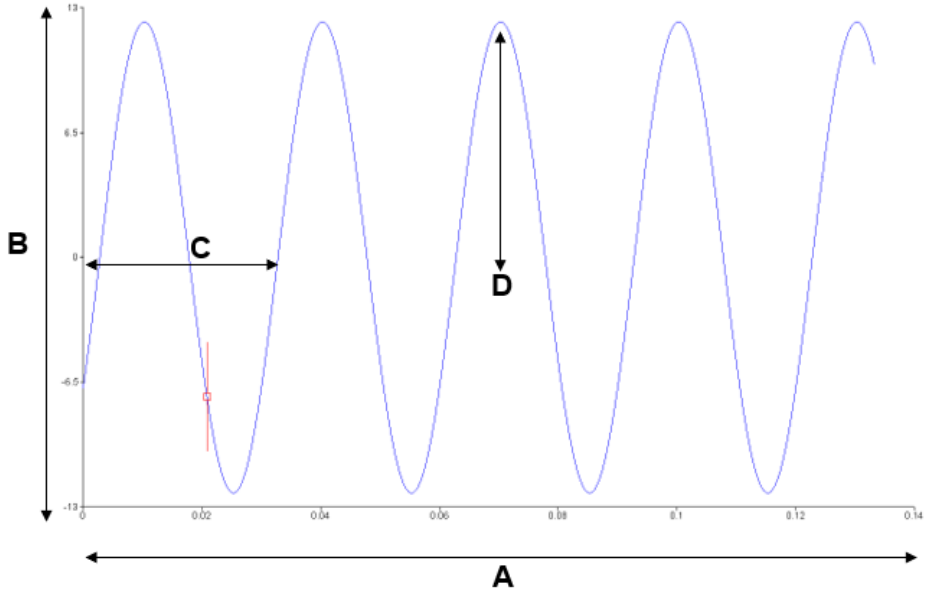
a) Periode

b) Amplitudenachse

c) Frequenz

d) Zeit

Was wird in der folgenden Abbildung durch A dargestellt?



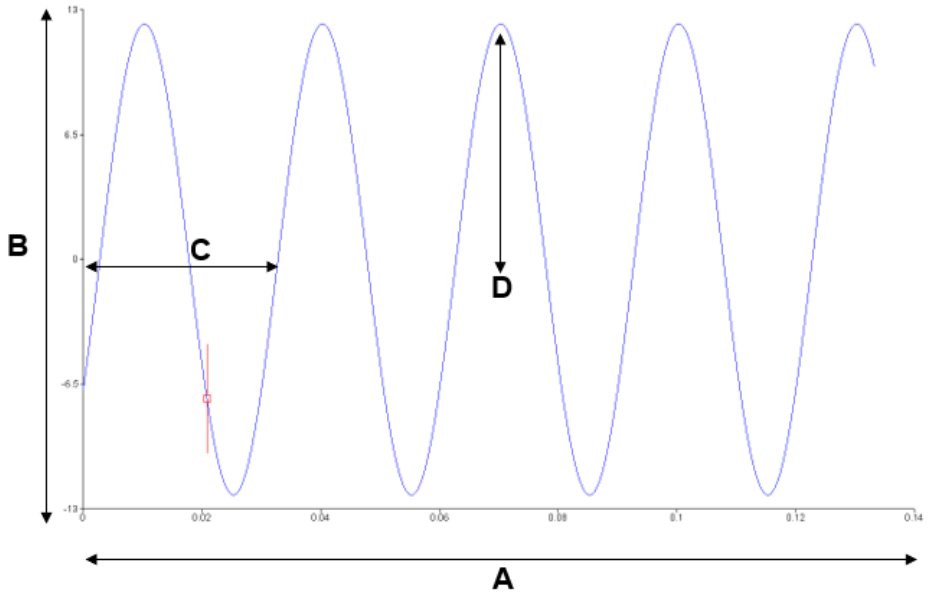
a) Periode

b) Amplitudenachse

c) Frequenz

d) Zeit

Was wird in der folgenden Abbildung durch C dargestellt?



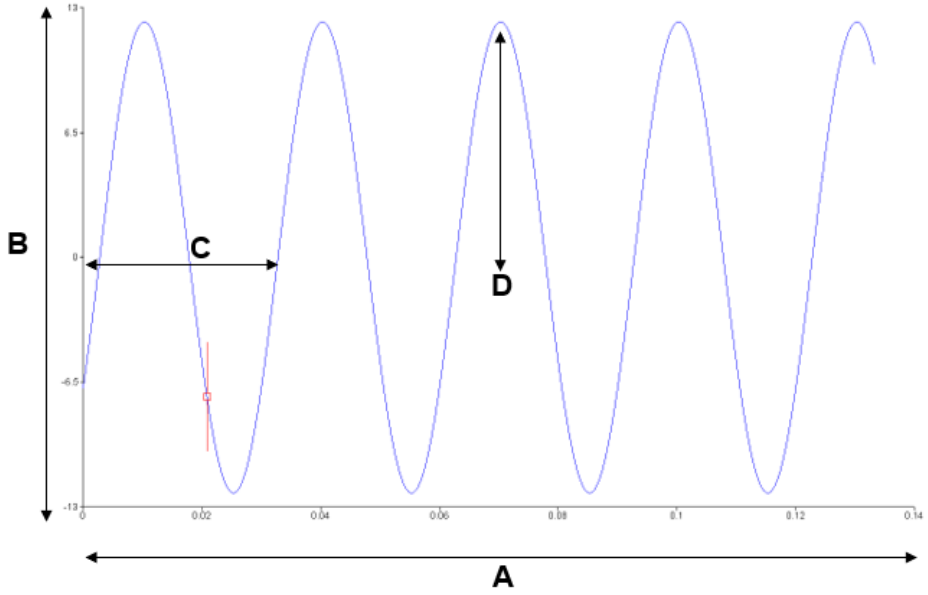
a) Periode

b) Amplitudenachse

c) Frequenz

d) Zeit

Was wird in der folgenden Abbildung durch D dargestellt?



a) Periode

b) Amplitudenachse

c) Frequenz

d) Spitzenamplitude

Was ist die Hauptachse eines einachsigen Beschleunigungsmessers?

a) 90º zur empfindlichen Achse

b) 45º zur empfindlichen Achse

c) die Richtung, in der der Sensor platziert ist

d) nur die axiale Richtung

In Bezug auf die Zustandsüberwachung eines Lüfters, der mit 1480 U / min läuft, welcher der folgenden Überwachungsparameter würde einen unsymmetrischen Rotor am besten erkennen?

a) Schockimpuls

b) Schwingungsgeschwindigkeit

c) Ölanalyse

d) Ultraschall

Welche der folgenden Technologien <u>KÖNNEN NICHT</u> als Grundlage für die nicht-intrusive Zustandsüberwachung eines Elektromotors verwendet werden?

a) Schwingungsanalyse

b) Motorwiderstandsanalyse

c) Infrarot-Thermografie

d) akustische Emissionen

Welche Condition Monitoring Technologie beinhaltet Tribologie?

a) Schwingung

b) Thermographie

c) Ölanalyse

d) Schallemission

Wird der Stoßimpuls in Abhängigkeit von gemessen?

a) Nur Geschwindigkeit

b) Viskosität des Schmierstoffs

c) Drehzahl (Drehzahl/min) und Wellengröße

d) Verdrängungsniveau und Drehzahl

Wo sollte idealerweise ein Vibrationsmesswert an einer Maschine gemessen werden?

a) so nah wie möglich an der belasteten Zone eines Lagergehäuses

b) in der Mitte des Motorrahmens

c) an der Motorlüfterverkleidung (Abdeckung)

d) auf der tragenden Grundplatte

Wenn ein Lager 6 Monate lang in einwandfreiem Zustand läuft, sinken die dB_m/dB c-Werte erheblich und erzeugen einen Alarm, was ist passiert?

a) das normale Spiel innerhalb des Lagers ist verloren gegangen

b) Ungleichgewicht aufgetreten ist

c) eine weiche Fußerkrankung hat sich entwickelt

d) eine Fehlausrichtung aufgetreten ist

Hochfrequente Schwingungsparameter wie Shock Pulse, HFD und Spike Energy werden am besten verwendet für:

a) Diagnose einer Fehlausrichtung

b) Diagnose eines strukturellen Lockerheitsproblems

c) Diagnose eines Ungleichgewichts

d) frühzeitige Warnung vor Lager- und Schmierproblemen

Kategorie 2

Welches Gerät eignet sich am besten für die Erkennung hochfrequenter Schwingungskomponenten (>1kHz)

a) Beschleunigung

b) Geschwindigkeit

c) Verschiebung

d) Geschwindigkeit

Was ist die charakteristische Fehlerfrequenz eines AC-Induktionsmotors mit einem weichen Fußzustand?

a) 2x elektrische Versorgungsfrequenz

b) 1x elektrische Versorgungsfrequenz

c) 1x Rotationsfrequenz

d) 2x Rotationsfrequenz

Für einen starren Rotor, der aufgrund einer Unwucht eine sinusförmige Schwingung erzeugt, welcher der folgenden Punkte trifft zu?

a) Die Unwuchtkraft verringert sich um das Quadrat der Geschwindigkeit

b) Die Unwuchtkraft erhöht sich um das Quadrat der Geschwindigkeit

c) Die Unwucht bleibt unabhängig von der Geschwindigkeit konstant

d) Die Unwuchtkraft ist proportional zur Hälfte der Geschwindigkeit

Schwingungsspektren wurden ursprünglich von 0 bis 500 Hz mit 800 Zeilen Auflösung und 4 Mittelwerten gesammelt. Für die gleichen Fmax und Durchschnittswerte bedeutet das Verringern der Anzahl der Zeilen auf 400:

a) Erhöhen Sie die Zeit, um den Messwert zu sammeln

b) Machen Sie keinen Unterschied für die Zeit, um den Messwert zu sammeln

c) Verringern Sie die Zeit, um den Messwert zu sammeln

d) Benötigen Sie mehr Datensammlerspeicher

Welches der folgenden Elemente würde das Verhältnis von minimalem und maximalem Bereich eines Schwingungssignals definieren?

a) mittlerer Amplitudenbereich

b) dynamikbereich

c) frequenzbereich

d) Durchschnittlicher Frequenzbereich

Was kann häufig zu Beginn eines Geschwindigkeitsspektrums künstlich verstärkte Schwingungen verursachen, bei denen der Frequenzbereich entsprechend den erwarteten Frequenzen eingestellt wurde?

a) ein Fehlausrichtungsproblem bei 2xRPM

b) ein Unwuchtproblem bei 1xRPM

c) Schlecht erfasste Daten aufgrund falscher Einschwingzeit des Sensors

d) ein Lagerkäfigdefekt

Welche der folgenden <u>IST KEINE</u> Form der Mittelwertbildung?

a) Phase

b) linear

c) zeitsynchron

d) Rms

Welcher der folgenden Punkte beschreibt einen Bandpassfilter?

a) Es übergibt Frequenzen zwischen einem bestimmten niedrigen und oberen Bereich

b) Es übergibt Frequenzen nur oberhalb eines bestimmten Bereichs

c) Es lehnt Frequenzen zwischen einem bestimmten niedrigen und oberen Bereich ab

d) Es übergibt Frequenzen nur unterhalb eines bestimmten Bereichs

Welcher der folgenden <u>FILTER WIRD NICHT</u> für die Schwingungsanalyse verwendet?

a) Tiefpassfilter

b) Hochpassfilter

c) Bandfilter

d) Bandaustauschfilter

Welcher der folgenden Punkte ist im Allgemeinen ein Hinweis auf einen Resonanzzustand an einem mittig hängenden Lüfter?

a) Die Vibration wird in allen drei Richtungen signifikant hoch sein

b) Die Schwingung wird in allen drei Richtungen signifikant hoch und gleich sein

c) Die Vibration ist in beiden radialen Richtungen deutlich gering

d) Vibration wird in einer Richtung deutlich höher sein

Was ist für einen 4-poligen AC-Motor mit einer 50-Hz-Versorgung mit einer 1-fachen Vibration von 5 mm / s rms die Spitze-zu-Spitzen-Verschiebung (ungefähr)?

a) 50 µm pk-pk

b) 90 µm pk-pk

c) 0,3 µm pk-pk

d) 30 µm pk-pk

Welcher der folgenden Punkte wird wahrscheinlich eine Beat-Frequenz erzeugen?

a) bei einem riemengetriebenen Motor ist die Lüftereinheit mit einem Riemenscheibenverhältnis ca. 1:1

b) an einer direkt angetriebenen Motorlüftereinheit, die in der Drehzahl variiert

c) an einer direkt angetriebenen Motorlüftereinheit, bei der es sich um eine Maschine mit fester Drehzahl handelt

d) an einer direkt angetriebenen Motorlüftereinheit mit fester Drehzahl, die aus dem Gleichgewicht geraten ist

Welche der folgenden Faktoren würden asynchrone Vibrationen an einer Kreiselpumpe verursachen?

a) großes Ungleichgewicht

b) beschädigte äußere Rasse

c) Primärer Banddefekt

d) erhöhter Klingenpass

Das Nyquist-Kriterium besagt, dass ein Signal abgetastet werden soll bei?

a) genau bei höchster Interessenfrequenz

b) mehr als das 2,0-fache der höchsten Zinsfrequenz

c) mehr als das 0,5-fache der höchsten Zinsfrequenz

d) 1,5-fache der höchsten Frequenz des Interesses

Welches der folgenden Punkte ist in Bezug auf die zeitsynchrone Probenahme korrekt?

a) Ein Geschwindigkeitssignal wird in Verbindung mit vielen Zeitbereichsmittelwerten (z. B. 100) abgetastet, wodurch ein Frequenzspektrum erzeugt wird, das nur synchrone Energie enthält

b) Ein Geschwindigkeitssignal wird in Verbindung mit vielen Frequenzbereichsmittelwerten (z. B. 100) abgetastet, wodurch ein Frequenzspektrum erzeugt wird, das nur synchrone Energie enthält

c) Ein Geschwindigkeitssignal wird in Verbindung mit vielen Zeitbereichsmittelwerten (z. B. 100) abgetastet, wodurch ein Frequenzspektrum erzeugt wird, das nur asynchrone Energie enthält

d) Ein Signal kann mit einem einkanaligen Schwingungsanalysator ohne weitere Eingänge und viele Zeitbereichsdurchschnitte (z. B. 100) erfasst werden, wodurch ein resultierendes Frequenzspektrum erzeugt wird, das nur synchrone Energie enthält

Was ist eine Alias-Frequenz?

a) Eine Frequenz, die auftritt, wenn zwei Frequenzen nahe beieinander liegen

b) eine Frequenz, die auftritt, wenn Sie einen Lagerinnenringdefekt aufgrund der modulierenden Eigenschaften des Fehlers haben, der in die Lagerlastzone eintritt

c) eine Frequenz, die durch Abtastung eines Signals mit einer zu niedrigen Abtastrate erzeugt wird

d) eine Bauteildefekthäufigkeit aus der Maschine heraus

Welches der folgenden Signale stellt bei der Abtastung eines Signals sicher, dass das Frequenzspektrum echte Frequenzen enthält?

a) mit 4 bis 6 Durchschnittswerten

b) Einstellung der Fmax nach ISO 10816 / 20816

c) Verwendung eines Anti-Aliasing-Filters

d) Verwenden einer guten Auflösung

Welcher der folgenden Punkte würde die Gesamtdauer einer Zeitwellenform definieren?

a) Fmax geteilt durch die Anzahl der Zeilen

b) 2,5 x Fmax geteilt durch die Anzahl der Zeilen

c) Fmax minus Anzahl der Zeilen

d) Anzahl der Zeilen geteilt durch Fmax

Wofür wird ein Kaskadendiagramm (oder Wasserfalldiagramm) verwendet?

a) Identifizierung eines Lagerdefekts an einem Wälzlagerlager

b) Bestätigung eines Lagerdefekts an einem Wälzlagerlager

c) Identifikation der Resonanzfrequenz

d) Bestätigung einer strukturellen Lockerheit

Welche der folgenden Bedingungen würde zu einer Änderung des 1x-Vektors an einem Radialventilator führen?

a) aerodynamische Vibration

b) Rotorunwucht

c) Lagerdefekt

d) Drehbarer Stall

Wozu dient der folgende Ausdruck?

$\int v\,dt$

a) Beschleunigung

b) Verschiebung

c) Phase

d) Geschwindigkeit

Wozu dient der folgende Ausdruck?

dv/dt

a) Phase

b) Verschiebung

c) Beschleunigung

d) Geschwindigkeit

Wie groß ist der Dynamikumfang eines A-zu-D-Wandlers mit 12-Bit-Auflösung?

a) 90 dB

b) 16 dB

c) 66 dB

d) 160 dB

Welcher der folgenden <u>PUNKTE WÜRDE NICHT</u> für Resonanztests und -bewertungen verwendet werden?

a) Wirkungsprüfung

b) Bode Grundstück

c) Schockimpuls

d) Modale Tests

Welcher der folgenden Punkte <u>HAT KEINEN</u> Einfluss auf die Länge einer Probe, die für eine FFT erforderlich ist?

a) Anzahl der Zeilen

b) dynamikbereich

c) frequenzbereich

d) Anzahl der Proben

Wenn eine FFT mit 800 Zeilen eine maximale Spannweite (F_{max}) von 1000 Hz haben muss, wie lang muss die Zeitwellenformprobe sein?

a) 1,25 Sekunden

b) 1,6 Sekunden

c) 2,5 Sekunden

d) 0,8 Sekunden

Wenn eine FFT mit 1600 Zeilen eine maximale Spannweite (F_{max}) von 108.000 CPM haben muss, wie hoch wäre dann die ungefähre Fächerbreite?

a) 6,75 Hz

b) 2,5 Hz

c) 1,1 Hz

d) 0,2 Hz

Welche der folgenden Optionen würden Sie verwenden, um eine Motor- und Pumpeneinheit mit Wälzlagern für eine Abnahmeprüfung zu bewerten?

a) Erfassung von Wellenreitermessungen in vertikaler, horizontaler und axialer Richtung an allen Lagerstandorten

b) Erfassung von Gehäusemessungen in vertikaler, horizontaler und axialer Richtung an allen Lagerstandorten

c) Erfassung von Wellensondenmessungen in vertikaler, horizontaler und axialer Richtung an allen Lagerstandorten

d) Erfassung von Gehäusemessungen in vertikaler, horizontaler und axialer Richtung bei nur einem Lager auf jeder Komponente

Welcher der folgenden Parameter ist bei der Überwachung eines Gleitlagers der am besten geeignete zu messende Parameter?

a) Verschiebung

b) Beschleunigung

c) Schockimpuls

d) Ruck

Welcher der folgenden Fehler würde von einer synchronen Probenahme profitieren?

a) Spalled Bearing Rennen

b) Resonanz

c) abgebrochener Zahnradzahn

d) schlecht geschmiertes Lager

Für welchen der folgenden Fehler wäre eine FFT-Zoomanalyse am besten geeignet?

a) unwucht

b) mechanische Lockerheit

c) abgebrochener Zahnradzahn

d) Problem mit der Rotorstange

振动分析

第1类通用理论问题

测得振动速度为5mm / s p-p。 0-p中的等效值是多少？

a) 2毫米/秒 (2 mm/s)

b) 2.5毫米/秒 (2.5mm/s)

c) 3毫米/秒 (3 mm/s)

d) 3.5毫米/秒 (3.5 mm/s)

以下哪项是最常用的振动幅度参数，用于滚动轴承以750至2950转/分的速度运行的一般设备机器？

a) 移位

b) 速度

c) 促进

d) 周期

机器上的单个测量点仅在一个方向上显示100mm / sec RMS的异常高振动水平，而在相同方向和其他方向上测量的所有其他读数均小于1.00 mm / sec rms。 以下哪项是高振动读数的最可能原因？

a) 所有轴承都有缺陷

b) 数据收集方法差

c) 耦合错位

d) 轴承润滑不良

在振动谱图中可以看到什么类型的数据？

a) 幅度和频率

b) 幅度和时间

c) 幅度和相位

d) 只有幅度

何时进行离线振动监测？

a) **当机器关**闭时

b) **只有当机器嘈**杂时

c) **定期**

d) **一直**

高频振动参数（如冲击脉冲，HFD和尖峰能量）最适用于：

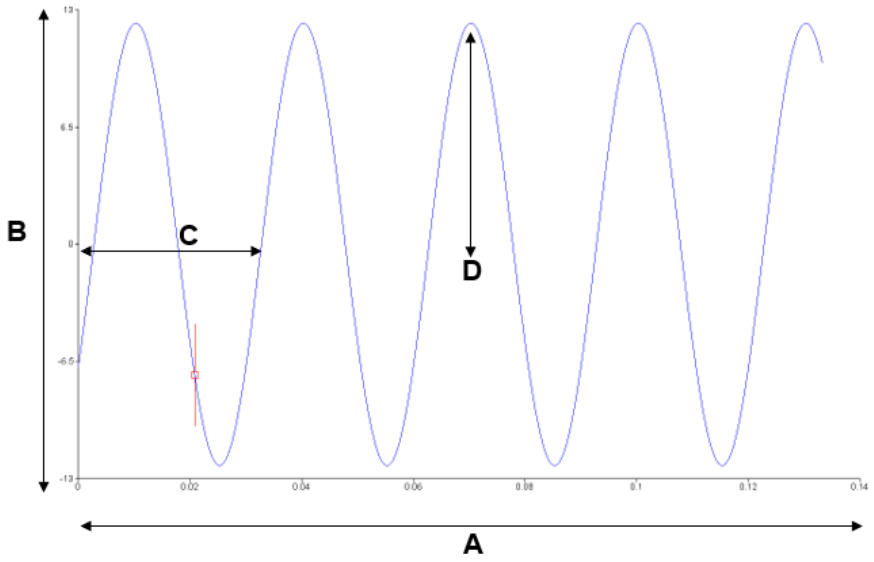
a) 诊断错位

b) 诊断结构松动问题

c) 诊断不平衡

d) 轴承和润滑问题的早期预警

在下图中，“B”代表什么？



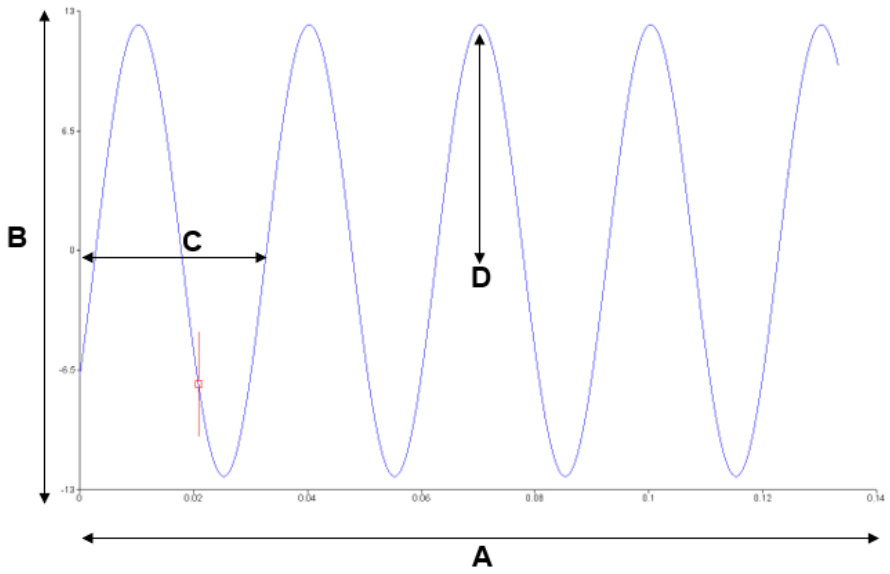
a) **期**

b) **振幅**轴

c) 频率

d) 时间

在下图中，“A”代表什么？



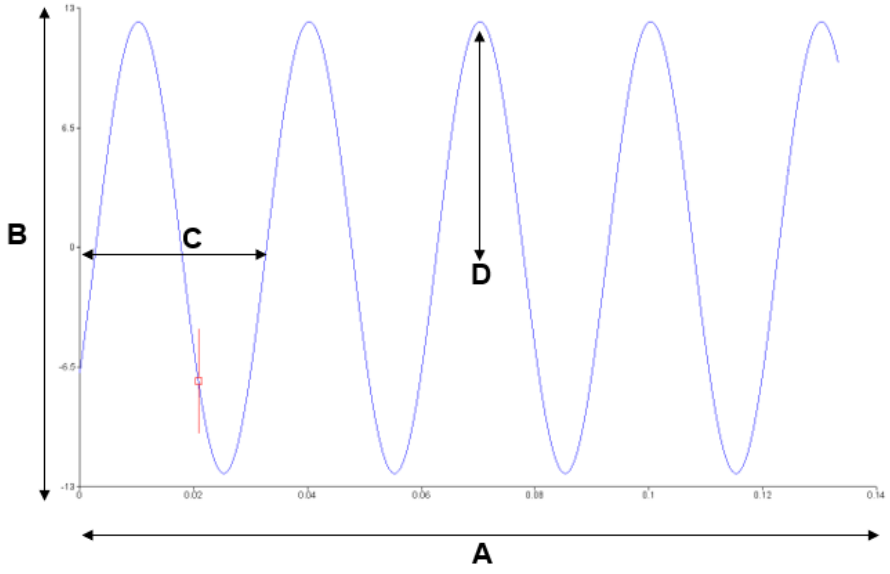
a) **期**

b) **振幅**轴

c) 频率

d) 时间

在下图中，“C”代表什么？



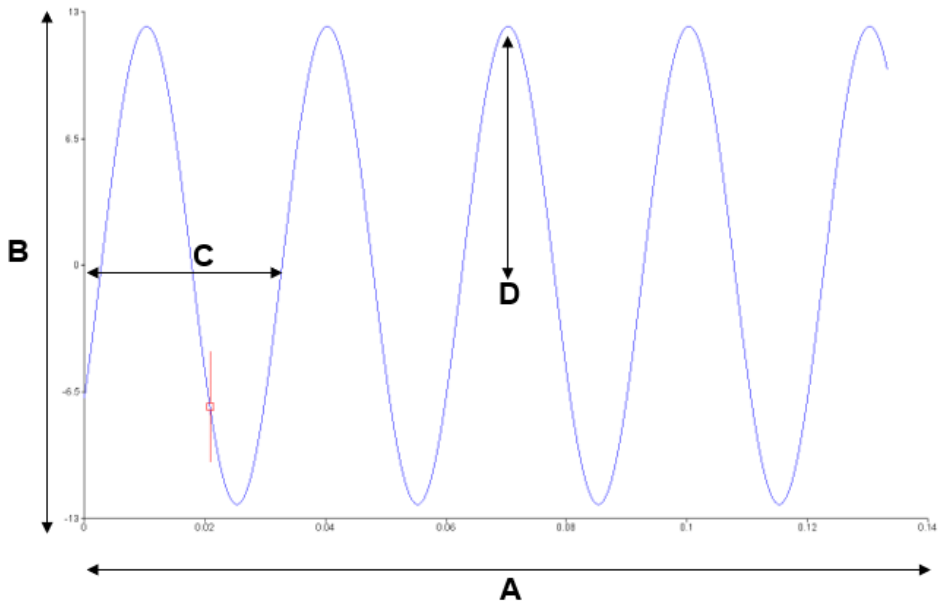
a) **期**

b) **振幅**轴

c) 频率

d) 时间

在下图中，“D”代表什么？



a) 期

b) 振幅轴

c) 频率

d) 峰值幅度

什么是单轴加速度计的主轴？

a) 敏感轴90º

b) 45º到敏感轴

c) 传感器放置的方向

d) 只有轴向

关于以1480转/分钟运行的风扇的状态监测，以下哪个监测参数最能检测到不平衡转子？

a) 冲击脉冲

b) 振动速度

c) 石油分析

d) 超声学

下列哪些技术不能用作电动机非侵入状态监测的基础？

a) 振动分析

b) 电机电阻分析

c) 红外热像仪

d) 声发射

哪种状态监测技术涉及摩擦学？

a) 振动

b) 热成像

c) 石油分析

d) 声发射

测量冲击脉冲的函数是？

a) 只有速度

b) 润滑剂的粘度

c) 转速（转/分钟）和轴尺寸

d) 位移水平和转速

理想情况下应该在机器上读取振动读数在哪里？

a) 尽可能靠近轴承箱的加载区

b) 在电机架的中间

c) 在电机风扇罩（盖）上

d) 在支撑底板上

如果轴承运行状况良好，持续6个月，dBm / dBc值会大幅下降并产生警报，发生了什么？

a) 轴承内的正常间隙已经丢失

b) 出现不平衡

c) 一种柔软的足部状况已经发展

d) 发生错位

第2类通用理论问题

哪个单位最适合检测高频振动分量（> 1kHz）

a) 促进

b) 速度

c) 移位

d) 速度

具有软脚条件的交流感应电机的特征故障频率是多少？

a) 2x电源频率

b) 1x电源频率

c) 1x倍旋转频率

d) 2x旋转频率

对于由于不平衡而产生正弦振动的刚性转子，以下哪一项适用？

a) **不平衡力会减小速度的平方**

b) **不平衡力会以速度的平方增加**

c) **不管速度如何，失衡将保持不**变

d) **不平衡力将与速度的一半成正比**

振动频谱最初从0到500Hz采集，800行分辨率和4次平均值。 对于相同的Fmax和平均值，将行数减少到400将会：

a) **增加收集**阅读的时间量

b) 对收集阅读的时间没有任何影响

c) **减少收集**读数的时间量

d) **需要更多数据收集器内存**

以下哪一项可以定义振动信号的最小和最大范围的比率？

a) **平均幅度范**围

b) 动态范围

c) 频率范围

d) **平均**频率范围

在根据预期频率设定频率范围的速度谱开始时，通常会引起人工放大的振动？

a) 2xRPM”**的**错位问题

b) “1xRPM”**的不平衡**问题

c) **由于**传感器建立时间不正确而收集的数据严重不足

d) 轴承保持架缺陷

以下哪一项不是平均形式？

a) **相**

b) 线性

c) 时间同步

d) rms

以下哪项描述了带通滤波器？

a) **它通**过指定的低频和高频之间的频率

b) **它只通**过指定范围以上的频率

c) **它拒**绝指定的低频和高频之间的频率

d) **它只通**过指定范围以下的频率

以下哪一项不是用于振动分析的过滤器？

a) **低通**滤波器

b) **高通**滤波器

c) 带通滤波器

d) 带交换过滤器

以下哪一项通常表示中央风扇的共振状况？

a) **所有三个方向的振**动将明显增高

b) **在所有三个方向上振**动将显着高且相等

c) **振**动将在两个径向方向上显着降低

d) 单向振动会明显增加

对于采用50 Hz电源的4极交流电机，1x振动为5 mm / s rms，峰 - 峰位移（大约）是多少？

a) 50 µm pk-pk

b) 90 µm pk-pk

c) 0.3 µm pk-pk

d) 30 µm pk-pk

以下哪一种可能会产生拍频？

a) **皮**带驱动的电机风扇单元与皮带轮的比例大约为1：1

b) **在速度不同的直接**驱动电机风扇单元上

c) **在直接**驱动的电机风扇单元上，该单元是一台定速机器

d) **在一个不平衡的定速直**驱电机风扇单元上

以下哪项会导致离心泵发生异步振动？

a) **大失衡**

b) **外圈受**损

c) **主**带缺陷

d) **凸起的刀片通**过

奈奎斯特准则规定信号应该在？

a) 正好在感兴趣的最高频率

b) 大于最高兴趣频率的2.0倍

c) 大于感兴趣的最高频率的0.5倍

d) 1.5倍的利息最高频率

以下哪一项在时间同步采样方面是正确的？

a) 结合许多时域平均值（即100）对速度信号进行采样，产生仅包含同步能量的频谱

b) 结合许多频域平均值（即100）对速度信号进行采样，产生仅包含同步能量的频谱

c) 结合许多时域平均值（即100）对速度信号进行采样，产生仅包含异步能量的频谱

d) **可以用**单通道振动分析器收集信号，而不用任何其他输入和许多时域平均值（即100）产生仅包含同步能量的结**果**频谱

什么是别名频率？

a) **当两个**频率靠近时发生的频率

b) **由于缺陷**进入轴承载荷区域的调制特性导致轴承内圈缺陷时发生的频率

c) **通**过对采样率过低的信号进行采样而产生的频率

d) **机器内部的部件故障**频率

在对信号进行采样时，以下哪一项可确保频谱包含实际频率？

a) 使用4到6个平均值

b) 根据ISO 10816/20816设置Fmax

c) 使用抗混叠滤波器

d) 使用好的分辨率

以下哪一项可以定义时间波形的总持续时间？

a) Fmax除以行数

b) 2.5×Fmax除以行数

c) Fmax减去行数

d) 行数除以Fmax

什么是级联（或瀑布）图用于？

a) 滚动轴承上轴承缺陷的识别

b) 确认滚动轴承上的轴承缺陷

c) 共振频率的识别

d) 确认结构松动

下列哪种情况会导致离心风扇上的1x矢量变化？

a) 气动振动

b) 转子不平衡

c) 轴承缺陷

d) 旋转失速

以下表达式的作用是什么？

$\int v\,dt$

a) 促进

b) 移位

c) 相

d) 速度

以下表达式的作用是什么？

dv/dt

a) 相

b) 移位

c) 促进

d) 速度

什么是12位分辨率的A / D转换器的动态范围？

a) 90 db

b) 16 dB

c) 66 dB

d) 160 dB

以下哪项不会用于共振测试和评估？

a) **冲**击测试

b) **波德**图

c) **冲**击脉冲

d) **模**态测试

以下哪项不会影响FFT所需的采样长度？

a) 行数

b) 动态范围

c) 频率范围

d) 样本数量

如果要求800线FFT具有1000Hz的最大跨度（Fmax），则时间波形采样必须多长时间？

a) 1.25秒

b) 1.6秒

c) 2.5秒

d) 0.8秒

如果要求1600线FFT具有108,000 CPM的最大跨度（Fmax），那么近似箱宽度是多少？

a) 6.75 Hz

b) 2.5 Hz

c) 1.1 Hz

d) 0.2 Hz

您将使用以下哪种方法来评估带滚动轴承的电机和泵单元的验收测试？

a) 在所有轴承位置在垂直，水平和轴向方向上捕获轴杆驾驶员测量结果

b) 捕获所有轴承位置的垂直，水平和轴向方向的套管测量值

c) 在所有轴承位置在垂直，水平和轴向方向上采集轴探头测量值

d) 仅在每个部件上的一个轴承上捕获垂直，水平和轴向方向的套管测量值

在监测套筒轴承时，以下哪一项是最适合测量的参数？

a) 移位

b) 促进

c) 冲击脉冲

d) 混蛋

以下哪些故障可以从同步采样中受益？

a) **裂开的**轴承竞赛

b) 谐振

c) **切**齿齿

d) 润滑不良的轴承

FFT缩放分析最适合使用以下哪些缺陷？

a) **不平衡**

b) **机械松**动

c) **切**齿齿

d) 转子棒问题