Glossary
Table of Contents

0-9
1/3 octave band ........................................... 4

A
Abrasion [mm³] ........................................... 4
Airborne noise ........................................... 4
Ambient temperature [°C] ................................ 4
Amplitude ................................................. 4
Amplitude dependence .................................... 4
Amplitude of vibration .................................... 4
Angle of loss δ [degrees] ................................. 4

B
Bedding modulus [N/mm³] ............................... 4

C
Center of gravity ........................................... 4
Coefficient of friction .................................... 5
Complex e-modulus [N/mm²] .............................. 5
Compression [%] ........................................... 5
Compression set [%] ........................................ 5
Crest factor ................................................... 5

D
Damping ....................................................... 5
Damping coefficient [1/s] ................................. 5
Damping ratio D ............................................ 5
Decade ....................................................... 5
Decibel [dB] .................................................. 6
Deflection [mm] ............................................. 6
Deformation energy [Nm] ................................. 6
Degree of freedom ........................................ 6
Degree of transmission [dB] .............................. 6
Density [kg/m²] ............................................. 6
Design load [N/mm²] ...................................... 6
Design value of resistance [N/mm²] ................. 6
Disturbing frequency [Hz] ............................... 6
Dynamic load .............................................. 6
Dynamic range of use .................................... 6

E
Elastic force [N] .............................................. 7
Elasticity ...................................................... 7
Elongation at rupture under tensile stress [%] .... 7
Elongation at tear [%] ...................................... 7
Emission isolation .......................................... 7
Energy absorption [Nm] ................................... 7
Energy dissipation [Nm] ................................... 7
Energy equivalent mean level .......................... 7
Evaluation level [dB] ....................................... 7
Excitation frequency [Hz] .............................. 7

F
Fatigue test .................................................... 7
Finite Elements Method (FEM) ......................... 7
Footfall noise level [dB] .................................. 7
Form factor q ............................................... 7
Frequency [Hz] ............................................ 8

H
Hooke’s Law .................................................. 8

I
Immission isolation ......................................... 8
Impact noise level [dB] .................................... 8
Impact ......................................................... 8
Impedance [Ns/m] .......................................... 8
Insertion loss .............................................. 8
Insertion loss [dB] ......................................... 8
Isolating vibration ......................................... 8
Isolation ...................................................... 8
Isolation efficiency ........................................ 8
Isolation factor ............................................ 9
Isolation of impact noise [dB] ......................... 9
| L | Level [dB] | 9 |
|   | Load deflection curve | 9 |
|   | Load peaks [N/mm²] | 9 |
|   | Loss factor $\eta$ | 9 |
|   | Loss modulus | 9 |
| M | Mass-spring system | 9 |
|   | Mechanical loss factor | 9 |
|   | Modal analysis | 9 |
|   | Modulus of elasticity [N/mm²] | 9 |
|   | Multiple mass oscillator | 9 |
| N | Natural frequency [Hz] | 10 |
|   | Natural mode | 10 |
|   | Noise emission | 10 |
|   | Noise immission | 10 |
|   | Noise pollution | 10 |
| O | Octave | 10 |
| P | Periodic duration [s] | 10 |
|   | Plasticity | 10 |
|   | Poisson Number $\nu$ | 10 |
|   | Polyurethane | 10 |
|   | Pre-load [N] | 10 |
| Q | Quasi-static deformation | 10 |
|   | Quasi-static load deflection curve | 11 |
| R | Resistance to strain [N/mm²] | 11 |
|   | Resistance to tear propagation [N/mm] | 11 |
|   | Resonance | 11 |
|   | Resonant frequency [Hz] | 11 |
| S | Secant modulus [N/mm²] | 11 |
|   | Secant stiffness [kN/mm] | 11 |
|   | Shear modulus [N/mm²] | 11 |
|   | Shearing stress [N/mm²] | 11 |
|   | Shock | 12 |
|   | Shock absorbing elements | 12 |
|   | Shock absorption | 12 |
|   | Shock isolation | 12 |
|   | Shore hardness | 12 |
|   | Single-mass oscillator | 12 |
|   | Sound | 12 |
|   | Sound isolation [dB] | 12 |
|   | Specific load [N/mm²] | 13 |
|   | Spectrum | 13 |
|   | Spring deflection [mm] | 13 |
|   | Static range of use [N/mm²] | 13 |
|   | Static creep behaviour [%] | 13 |
|   | Stationary loading | 13 |
|   | Stiffening factor | 13 |
|   | Stiffness [kN/mm] | 14 |
|   | Storage modulus | 14 |
|   | Structure-borne noise | 14 |
|   | Structure-borne noise isolation [dB] | 14 |
|   | Sum level $L_{tot}$ | 14 |
| T | Tangent modulus [N/mm²] | 14 |
|   | Tangent stiffness [kN/mm] | 14 |
|   | Tensile strength [N/mm²] | 14 |
|   | Tensile stress at rupture [N/mm²] | 14 |
|   | Thermal conductivity [W/mK] | 14 |
|   | Transmission function | 14 |
|   | Tuned mass damper | 14 |
|   | Tuning frequency [Hz] | 14 |
|   | Tuning ratio | 15 |
| U | Ultimate limit states | 15 |
| V | Velocity level [dB] | 15 |
|   | Vibration isolation | 15 |
|   | Vibrations | 15 |
|   | Volume resistivity [Ωcm] | 15 |
1/3 octave band
The range (bandwidth) between two frequencies, which are at a ratio of roughly 4:5, to be more precise $f_2 = \sqrt[3]{2}f_1$; in a logarithmic representation the width of a 1/3 octave band is one-third of the width of an octave.

Abrasion [mm$^3$]
Parameter for the assessment of abrasion (abrasive wear) against abrasive loss; abrasion is the loss in volume in mm$^3$ of a defined testing body on a test emery surface with a defined attack strength, defined contact pressure over a pre-defined path.

Abrasion only reflects actual wear behavior under field conditions to a limited extent.

Airborne noise
Sound propagated in the air in the form of sound waves, as opposed to sound transmission through liquids or solid bodies.

Ambient temperature [°C]
The working temperature for elastomers manufactured by Getzner is between -30 °C and +70 °C. The data listed in the material data sheets is valid for room temperature. The mechanical properties of elastomers are dependent on the temperature.

At temperatures above the maximum limit permanent damage can occur to the elastomer, and at temperatures below the minimum limit the elastomer may freeze.

The maximum working temperature limit denotes the maximum temperature at which the material can be used without beginning to age, i.e. without an excessive loss of elastic properties.

Minimum working temperature: low temperatures reduce the mobility of the molecular chains, causing the elastomer to lose elasticity (this process is reversible for Sylomer® and Sylodyn®).

Amplitude
A quantity characterizing a vibration; it is the maximum magnitude of variation of a physical quantity from its zero value to a positive or negative value; amplitude refers to a physical quantity (e.g. force, displacement).

Amplitude dependence
Amplitude dependence describes the dependence of the dynamic stiffness on the amplitude of vibration.

This characteristic is highly specific to the particular material. Sylomer® and Sylodyn® materials exhibit a negligible amplitude dependence. The dynamic stiffness of other elastic materials, such as compact, foamed and bonded rubber products (rubber granule), however, is significantly dependent on the amplitude of excitation.

Amplitude of vibration
See amplitude.

Angle of loss $\delta$ [degrees]
The angle of loss $\delta$ indicates the phase difference between the stress and strain in an oscillatory test and can be used as a measurement of material damping.

The relation between the mechanical loss factor $\eta$ and the angle of loss $\delta$ is characterized by $\eta = \tan(\delta)$.

Bedding modulus [N/mm$^3$]
Also: Surface stiffness; ratio of the specific load to the resulting deflection; a distinction is made between the secant modulus and the tangent modulus.

Center of gravity
The point to which the entire mass of a system can be reduced; the center of gravity is extremely important for the design of elastic equipment bearings.
Coefficient of friction

The coefficient of friction represents the relationship between frictional resistance to normal forces.

The coefficient of friction of an elastomer can be determined for materials such as steel, concrete, wood, etc.

A distinction is made between static friction and sliding friction; in the material data sheets the values are stated for sliding friction.

Complex e-modulus [N/mm²]

Describes the properties of “spring” and “damping” in a complex notation \( E^* = E (1 + i \cdot \eta) \); the real portion of the complex \( e\)-modulus modulus is referred to as the storage modulus \( E \) (spring component), while the imaginary portion is referred to as the loss modulus \( i \cdot E \cdot \eta \), damping component).

Compression [%]

The ratio of deformation of the elastomer under load to the unloaded thickness of the elastomer.

Compression set [%]

Measures the recovery capacity of an elastomer; ratio of the sample body height before and after compression; testing procedure as per EN ISO 1856; test conditions: deformation to 50% at 23°C, duration of load 72 h and measurement 30 min after load removal.

Crest factor

Ratio of the crest value to the effective value of a vibration. For sinusoidal vibrations it is \( \sqrt{2} = 1.41 \).

Damping

Transformation of kinetic energy into another form of energy which is no longer relevant (reusable) for the oscillatory system (e.g. heat via abrasion, plastic deformation,...); damping (dissipation of energy) takes energy out of the mechanical system.

In order to limit resonant vibration to an acceptable range, a mechanical system requires adequate damping. Vibration damping and vibration isolation are two different measures for isolating vibrations.

See also loss factor, damping ratio.

Damping coefficient [1/s]

Unit for characterizing the damping of a free oscillator with speed-proportionate damping; it is calculated as time-related amount of damping; "\( \delta \)" describes the (exponential) time-related damping of an oscillation from the initial value "\( A_0 \)" (t = 0) to the value "\( A \)" at the time "t" \( A = A_0 \cdot e^{-\delta t} \)

Note: not the same as spatial damping coefficients \( \alpha \) (e.g. degree of absorption in acoustics).

Damping ratio D

Unit of measurement for characterizing the damping of a free oscillator with a speed-proportionate damping; also known as the degree of damping.

The damping ratio D is directly related to the loss factor \( \eta \) by the equation

\[
D = \frac{\eta}{2}
\]

Decade

The interval at which the upper interval limit is 10 times higher than the lower limit; decades are used for time and also for frequencies. For example, an interval of 100 to 1000 has a bandwidth of one decade, while an interval of 50 to 5000 has a bandwidth of two decades.
Decibel [dB]
Unit for expressing the ratio against some physical quantity in terms of the base 10 logarithm of that ratio $10 \cdot \log(v_1/v_2)$. Logarithmic ratios are described as levels or amounts, e.g. velocity level, insertion loss, etc. For example, sound pressure levels are usually put in ratio as a square equation. The 2 of the square equation in the Log will be set in front of the same becoming $20 \log (...)$. 

Example: the velocity level:
$L_v = 10 \cdot \log(v^2/v_0^2) = 10 \cdot \log(v/v_0)^2 = 20 \cdot \log(v/v_0)\text{dB}$.

Degree of transmission [dB]
In respect of vibration isolation characterizes the isolation efficiency as a ratio of input and response forces and/or input and output amplitudes.

Disturbing frequency [Hz]
Frequency applied to excite an oscillatory system, e.g. cyclical forces generated by a machine.

Dynamic load
The elastomer is subject to a forced sinusoidal vibration. The test parameters are frequency, pre-load and amplitude.

Based on the force and deformation result, the dynamic stiffness, the dynamic modulus of elasticity or dynamic bedding modulus and the mechanical loss factor can be derived.

The data sheets usually use the frequencies 10 and 30 Hz with a velocity level of 100 dBv. Testing procedures similar to DIN 53513.

Dynamic range of use
This is the load range for an elastomer bearing, which includes both the static loads and the dynamic loads; static loads should be lower than the upper limit of the static load range of use; dynamic loads should fall in the range between the maximum static load limit and the maximum dynamic load limit.

Elastomer bearings are particularly elastic in this range, i.e. the vibration...
Energy absorption [Nm]
The energy absorption is defined as the dissipated kinetic energy during impact or intense dynamic load. The elastic material is able to convert a large part of the kinetic input energy into inelastic energy by inner damping mechanism, which is an irreversible process. See also shock isolation.

Energy dissipation [Nm]
The energy dissipation is the loss of energy per cycle of motion in an oscillatory test due to the conversion of mechanical energy into thermal energy (area of displacement-force hysteresis loop). See also loss factor.

Energy equivalent mean level
An energy equivalent mean level depicts the temporally different noise events in an individual numeric value. The energy equivalent mean level includes the strength and duration of each individual sound during the evaluation period.

Evaluation level [dB]
The energy equivalent mean level is frequently used to describe and evaluate immission situations; the energy equivalent mean level is calculated averaging the individual frequency and periodic levels for a defined reference period (evaluation period). The evaluation level is compared to certain reference values as a basis for evaluating the noise situation.

Excitation frequency [Hz]
See disturbing frequency.

Fatigue test
A method of testing the long-term behavior of an elastomer by subjecting it to a static and simultaneous dynamic load; for rail applications up to 12.5 million load cycles (oscillations) are usually necessary.

Finite Elements Method (FEM)
The Finite Elements Method is a method for numerical modeling of problems in various physical disciplines, in particular strains and deformations of all kinds in elastic and plastic spaces.

Form factor q
Form factor is a geometric measurement for the form of an elastomer bearing and is defined as the quotient of the loaded surface to the exterior housing surface of the bearing. An elastomer with a form factor of greater than 6 can be characterized as a plane.
Cellular materials, such as Sylomer® SR11, SR18 and SR28, are volume compressible and hence the influence of the form factor on stiffness can be neglected.

By contrast, the form factor plays an increasingly important role as the compactness of the elastomer increases, because in such cases a compression load can lead to bulging of the elastomer resulting in transverse forces in the elastomer. This in turn can mean that the force or the compression required to deform the elastomer can vary, depending on the form factor.

### Frequency [Hz]

Number of oscillations per second in a periodic signal.

### Hooke's Law

Describes the linear relationship between specific load and strain; valid for Sylomer® and Sylodyn® in the linear range of the load deflection curve.

### Impact noise level [dB]

Measurement of disturbing noise from structure-borne noise generation in ceilings, indicated in dB; in this respect it should be noted that high values represent a lower level of protection against impact noise.

**Impact**

See shock.

### Impedance [Ns/m]

Also known as ‘characteristic acoustic impedance’. The greater the difference between the characteristic acoustic impedances of two media, the more sound energy will be reflected at the boundary surface between the two media, i.e. less sound energy is transmitted.

Conversely, this also represents better vibration isolation; For good damping there is a so-called ‘jump in impedance’, i.e. a significant difference between the characteristic acoustic impedance of the two media involved.

### Insertion loss [dB]

10 base decade logarithm of insertion loss. Core quantity for characterizing the efficiency of measures to reduce structure-borne noise.

Insertion loss can be measured as the difference between the level of structure-borne noise with and without resilient mounting. Insertion loss is frequency dependent.

### Isolating vibration

See vibration isolation.

### Isolation

See vibration isolation.

### Isolation efficiency

See isolation factor.
Loss factor $\eta$

The mechanical loss factor $\eta$ is a measure of mechanical damping of viscoelastic materials. With respect to harmonic loads, the mechanical loss factor $\eta$ can be calculated by the dissipated energy per cycle (hysteresis) related to stored energy during loading by the following formula $\eta = \frac{\text{dissipated energy}}{2 \cdot \pi \cdot \text{stored energy}}$.

Furthermore the mechanical loss factor $\eta$ can be derived by measuring the angle of loss $\delta$, when harmonic loads are applied. The tangent of angle of loss $\delta$, when harmonic loads are applied. The tangent of angle of loss $\delta$ corresponds to the mechanical loss factor $\eta (\eta = \tan(\delta))$. Test methods in accordance to DIN 53513; see also $\text{damping ratio, angle of loss.}$

Modal analysis

A method to experimentally determine modal quantities such as $\text{natural frequencies}$ and natural damping of a complex $\text{multiple mass oscillator}$ (oscillating system); the quasi-numerical counterpart of modal analysis is $\text{FEM analysis}$ (Finite Elements Method).

Modulus of elasticity $[\text{N/mm}^2]$

The modulus of elasticity (e-modulus) is a material property and describes the relationship between $\text{specific load}$ and $\text{strain}$ (Hooke’s Law). The e-modulus is dependent on the $\text{specific load}$ and load acceleration.

A distinction is made between static e-modulus ($\text{quasi-static deformation}$) and the dynamic e-modulus ($\text{dynamic load}$). Testing procedures similar to DIN 53513. See also $\text{complex e-modulus.}$

Multiple mass oscillator

An oscillatory system consisting of several linked oscillating sub-systems with various masses and springs, whereby each sub-system consists of a mass and a spring ($\text{single mass oscillator}$); a multiple mass oscillatory system has as many $\text{natural frequencies}$ as it does sub-systems.
Natural frequency [Hz]

Frequency of a system’s free vibration after one excitation; the period of the vibration is dependent on the damping.

Natural mode

Vibratory systems have natural modes, which can be described by natural frequency, natural damping and vibratory form. A system can have natural modes in the form of translation, rotation or bending as well.

Noise emission

Noise emission refers to structure-borne noise or airborne noise emitted by a sound source; the sound source is located at the emission location.

Noise immission

Noise immission is the structure-borne noise or airborne noise striking a recipient, regardless of the location of the noise emission (source of the structure-borne or airborne noise).

The location of the recipient is referred to as the immission location and the level of sound measured there is known as the immission level.

Noise pollution

Noise is defined as airborne sound, which may be disturbing, annoying, hazardous or damaging. Perception of sounds and noise depends to a great degree on the individual and is thus subjective.

Octave

An octave is the range (frequency band) between a frequency and twice or one-half of that frequency, i.e. \( f_o = 2 \cdot f \) bzw. \( f_o = 1/2 \cdot f \).

For example, one octave above and below the frequency 1000 Hz is covered by the intervals to 2000 Hz and 500 Hz. In acoustic measurements, standardized mean octave frequencies \( f_m \) are usually used (\( f_m = 16, 31.5, 63, 125, 250, 500, 1000, 2000 \) Hz).

Periodic duration [s]

Time duration of one whole harmonic oscillation; the reciprocal value is frequency.

Plasticity

Material property which leaves an elastomer in a deformed state following deformation.

Poisson Number \( \nu \)

Ratio of the lateral deformation to the axial deformation; for elastomers the Poisson number (also: Poisson’s ratio) depends to a great degree on the cellular structure and load.

Polyurethane

Abbreviation: PUR. Polyurethanes are manufactured by poly addition of isocyanates and polyalcohols and can be produced with cellular structures or compact structures. A distinction is made between polyether urethanes and polyester urethanes.

Pre-load [N]

Static load which is applied to an elastomer before the application of a dynamic load.

Quasi-static deformation

One time application of a load onto an elastomer, whereby the time period for application of the maximum load is 20 s; see quasi-static load deflection curve.
When the disturbing frequency of a system is equal to the natural frequency of the system, resonance occurs. Occurrence of resonance can lead to the destruction of the entire oscillating system.

By damping the vibratory system it is possible to limit resonance vibrations to an acceptable degree. Flexibility to a changing force is particularly strong with the resonance range.

Resonant frequency [Hz]
Frequency, at which resonance occurs.

Secant modulus [N/mm$^3$]
Denotes the surface-related stiffness of an elastomer bearing; a secant is drawn through the interface points of two defined secant points (forces) with the load deflection curve; the rise in the secant is referred to as the secant stiffness.

Shear modulus [N/mm$^2$]
Elastomer bearings are able to absorb shearing forces and shearing stress.

Shearing stress [N/mm$^2$]
The ratio between shearing stress and horizontal deflection of the elastomer is referred to as the shear modulus.

Shearing stress [N/mm$^2$]
Shearing force per unit of surface area of the elastomer.
Shock
Sudden occurred impact force between two or more bodies; the impact force is defined by the shock duration, maximum impact force and the impact shape (half-sine, triangle, rectangle, trapezoidal,...). See also shock isolation.

Shock absorbing elements
Components which are used to reduce the force, path or delay associated with individual or repetitive shock pulses and to transform the impact energy of the impacting mass into heat and additional deformation energy.

Shock absorption
See shock isolation.

Shock isolation
Shock isolation is a special case of the vibration isolation, where the transmission of sudden impact forces (see shock) is reduced by the installation of elastic components; the short impact force with a relatively high force peak gets transformed into a longer-term pulse with lower forces.

The energy absorption is defined as the dissipated kinetic energy during impact or intense dynamic load. The elastic material is able to convert a large part of the kinetic input energy into inelastic energy by inner damping mechanism, which is an irreversible process. See energy absorption.

Shore hardness
Shore hardness is a measurement for the hardness of rubbers for example and can only be used to a limited degree with foamed elastomers. The measurement of Shore hardness is the resistance to indentation of a body of defined shape with force applied by a calibrated spring.

There are two hardness scales: the “Shore A” scale for soft (rubbery) materials and the “Shore D” scale for harder materials. The measurement for the hardness or elasticity of foamed elastomers is the modulus of elasticity.

Sound
Smallest pressure and density oscillations in an elastic medium in the audible range of humans from approximately 16 Hz to 20,000 Hz, e.g. airborne sound, structure-borne noise, sound transmitted through liquids.

Lower frequencies are referred to as infrasound and higher frequencies as ultrasound.

Sound isolation [dB]
The level of sound isolation is defined as the 10 base logarithm of the ratio of the sound energy striking a component (exterior) (power: $W_1$) to the amount of sound energy transmitted by the components (power: $W_2$).

$$R = 10 \cdot \log(W_1/W_2)$$

Sound pressure [Pa]
Changes in the static air pressure due to oscillation of the air molecules in a sound field.

Sound pressure level [dB]
is twenty times the 10 base logarithm of the ratio of the instantaneous sound pressure to the reference sound pressure (audible threshold); For practical applications in noise abatement and evaluation, the frequency sensitivity of the ear is realized via the so-called “A-weighting”, and reference is made to the “A-weighted sound level (also known as “sound level in dB[A]”).
In addition to this frequency weighting, there are also three different time averaging options that can be selected in the measurements.

These three options are: Fast: Rise duration = 125 ms; Decay duration = 125 ms; Slow: Rise duration = 1.0 s; Decay duration = 1.0 s; and impulse: Rise duration = 35 ms; Decay duration = 1.5 s; it is particularly important to indicate the time averaging for impulse and burst sound events.

Specific load [N/mm²]
Force per unit of surface area.

Spectrum
Graphic representation of a physical quantity (ordinate) as a function of frequency (abscissa). A pure sinusoidal vibration, for example, is represented as a line in a line spectrum.

Naturally occurring vibrations are rarely pure sinusoidal vibrations; therefore, in order to determine the frequencies comprising the largest portion of the vibration it is expedient and/or necessary to represent it graphically as a spectrum. The largest portions are visible at the natural frequencies.

Spring deflection [mm]
See deflection.

Static range of use [N/mm²]
The maximum compression stress for stationary loads up to which the elastomer will retain its elastic properties; resilient bearings are generally designed for the upper limit of the static range of use in order to achieve maximum vibration isolation.

Static creep behaviour [%]
Increase in deformation under steady, long-term load. When Sylomer® and Sylodyn® are subjected to loads as stated in the static range of use, the deformation is lower than 20% even after 10 years. Deformations of this order of magnitude have also been observed in elastomer bridge bearings. Testing procedure as per DIN ISO 8013.

Stationary loading
The elastomer is subject to a static load which does not vary over time. If the specific load and the resulting deflection are known, it is possible to determine the static stiffness, the static modulus of elasticity or the static bedding modulus. Normally, elastomers begin to experience creep after a load is applied.

Stiffening factor
The spring deflection properties of elastomers depend on the acceleration of deformation. The ratio between the dynamic and static stiffness is referred to as the stiffness factor (or ratio of dynamic to static).
Stiffness [kN/mm]

Describes the elasticity of an elastomer to deformation; can be determined using force-displacement measurement; the steepness of the force-displacement curve (see *load deflection curve*) represents the stiffness; stiffness is dependent on load acceleration (quasi-static or dynamic).

A distinction is drawn between *secant stiffness* and *tangent stiffness*.

Storage modulus
See *complex e-modulus*.

Structure-borne noise

Are *vibrations* transmitted via solid or liquid bodies.

Structure-borne noise isolation [dB]

Structure-borne noise isolation involves the prevention of the propagation of *structure-borne noise* by reflection at an impedance jump, in practice usually at an elastic layer. In general, it can be stated that the softer the elastic layer, i.e. the lower the *impedance* (in relation to the impedance of the adjacent media), the greater the isolation of the structure-borne noise.

Thermal conductivity [W/mK]

Is determined by the thermal conductivity in watts through a 1 meter thick flat layer of a material with a surface area of 1 m², when the temperature difference of the surface in the direction of conductivity is one Kelvin, testing procedure as per DIN IEC 60093.

Transmission function

In respect of *vibration isolation* the isolation efficiency as a ratio of input and response forces and/or input and output amplitudes.

Tuned mass damper

A method of vibration reduction involving the removal of energy from an oscillatory system by the attachment of an vibration dampener; the dampener consists of an oscillatory system (e.g. mass, spring and damper) and vibrates at its resonance.

Tuning frequency [Hz]

Lowest vertical *natural frequency* of an elastically-mounted system (ma-
A velocity level of 100 dBv at a frequency of 10 Hz represents an oscillation amplitude (crest value) of approximately 0.1 mm, or at a frequency of 100 Hz of approximately 0.01 mm.

**Tuning ratio**

Ratio of the disturbing frequency to the tuning frequency of an elastically-mounted system; also known as frequency ratio; the disturbing frequency and the tuning frequency must be separated by at least a factor of \( \sqrt{2} \) to achieve isolation of the system.

**Ultimate limit states**

Structural safety as well as the durable integrity of a construction must be given. Therefor the ultimate bearing capacity needs to be verified with design loads on the action side \( E_d \) smaller-equal than the design value of resistance \( R_d \). This method bases on the semi-probabilistic safety concept according to EN 1990.

**Velocity level [dBv]**

Used in acoustics to denote vibration velocity in the form of a level (logarithmic ratio); it is defined as twenty times the logarithm of the ratio of the effective vibration velocity to the reference velocity of \( 5 \cdot 10^{-8} \, \text{m/s} \).

**Vibration isolation**

Reduction of the transmission of mechanical vibrations by the installation of elastic components; a distinction is drawn between the reduction of vibration transmission from a source of vibration into the surroundings (reduction of emissions, isolation of the emission source) and the shielding of an object from the impact of vibrations from the surroundings (reduction of immissions, isolation of an object). See also immission isolation and emission isolation.

**Vibrations**

Vibrations are processes in which a physical quantity changes periodically depending on time; these physical quantities can be displacements, accelerations, forces, momentum.

**Volume resistivity [Ωcm]**

Is determined by resistance of an elastomer which is placed between two electrodes with a defined voltage, multiplied by the thickness of the elastomer and the distance between the two electrodes; specific volume resistance depends strongly on temperature and humidity. Testing procedures similar to DIN IEC 93.