Garage Door Systems

- Creating an Annual Garage Door Maintenance Calendar
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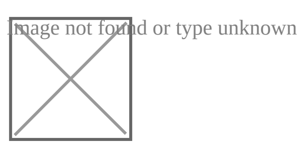
Sensor Alignment Procedures for Reliable Safety

Sensor alignment procedures are critical in ensuring the reliability and safety of systems that depend on accurate sensor data, from autonomous vehicles to industrial machinery. These procedures ensure that sensors are correctly positioned to capture the necessary information with precision, thus preventing potential malfunctions or accidents due to misaligned readings. This essay explores the importance of sensor alignment, the typical steps involved in these procedures, and the impact of proper alignment on system performance.

The importance of sensor alignment cannot be overstated. In environments where safety is paramount, such as in aviation or autonomous driving, even a minor misalignment can lead to catastrophic failures. For instance, in an autonomous vehicle, a lidar sensor misaligned by just a few degrees could fail to detect a pedestrian or an obstacle, leading to a collision. Similarly, in industrial settings, sensors that monitor machine health must be perfectly aligned to detect vibrations accurately; any deviation might result in false negatives or positives regarding equipment condition.



The process of aligning sensors typically begins with a thorough understanding of the operational environment. Technicians must know where sensors are supposed to direct their detection fields for optimal performance. First, they establish a baseline by measuring current sensor positions against design specifications using tools like laser levels or alignment jigs. This step is crucial as it identifies any existing discrepancies.

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Once discrepancies are noted, adjustments follow. This might involve physically moving the sensor or adjusting its mounting brackets. Precision tools like micrometers or digital inclinometers often assist here to ensure minute adjustments are accurate. For optical sensors like cameras or lidars, calibration involves not just physical alignment but also software adjustments where pixel-level corrections might be necessary to align the visual field with real-world coordinates.

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After adjustment comes verification. Here, technicians use known reference points or test patterns within the sensors range to confirm that alignments have been made correctly. For example, in automotive applications, this could mean running through predefined test courses where known objects at specific distances should trigger predictable responses from the vehicles sensors.

The impact of proper sensor alignment extends beyond immediate operational safety; it also affects long-term system reliability and maintenance costs. Properly aligned sensors reduce wear and tear because they operate within their intended parameters without unnecessary strain from trying to compensate for misalignment errors. Moreover, well-aligned systems require less frequent recalibration since they maintain their accuracy over time unless disturbed by external forces.

In conclusion, while the technical nature of sensor alignment might seem mundane compared to other aspects of system design and operation, its role is pivotal in ensuring safety and efficiency. Procedures for aligning sensors must be meticulously followed and regularly reviewed as technology evolves and new challenges arise. The human element-technicians skilled in precision work-remains indispensable as they bring not just technical expertise but also judgment based on experience when fine-tuning these critical components. Ensuring reliable safety through proper sensor alignment is thus both a science and an art form that demands attention at every stage from design through maintenance in our increasingly automated world.

Manual Release Functions Every Owner Should Know

About Spring (device)

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Helical coil springs designed for tension

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A heavy-duty coil spring designed for compression and tension

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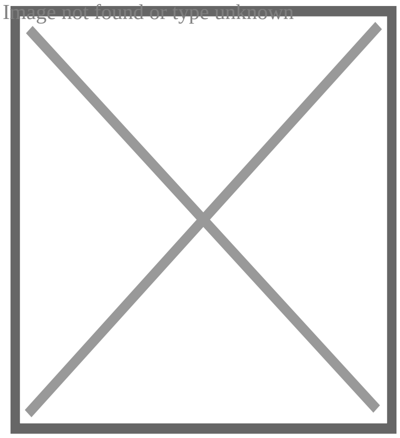
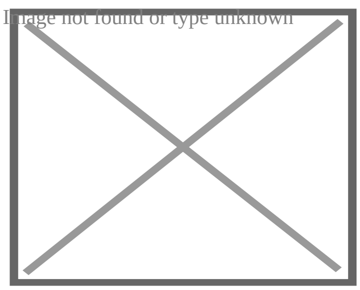
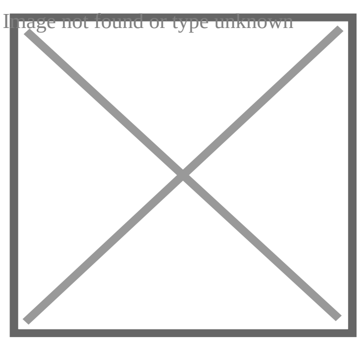
The English longbow – a simple but very powerful spring made of yew, measuring 2 m (6 ft 7 in) long, with a 470 N (105 lbf) draw weight, with each limb functionally a cantilever spring.



Force (F) vs extension (s).[*citation needed*] Spring characteristics: (1) progressive, (2) linear, (3) degressive, (4) almost constant, (5) progressive with knee



A machined spring incorporates several features into one piece of bar stock



Military booby trap firing device from USSR (normally connected to a tripwire) showing spring-loaded firing pin

A **spring** is a device consisting of an elastic but largely rigid material (typically metal) bent or molded into a form (especially a coil) that can return into shape after being compressed or extended.[1] Springs can store energy when compressed. In everyday use, the term most often refers to coil springs, but there are many different spring designs. Modern springs are typically manufactured from spring steel. An example of a non-metallic spring is the bow, made traditionally of flexible yew wood, which when drawn stores energy to propel an arrow.

When a conventional spring, without stiffness variability features, is compressed or stretched from its resting position, it exerts an opposing force approximately proportional to its change in length (this approximation breaks down for larger deflections). The *rate* or *spring constant* of a spring is the change in the force it exerts, divided by the change in deflection of the spring. That is, it is the gradient of the force versus deflection curve. An extension or compression spring's rate is expressed in units of force divided by distance, for example or N/m or lbf/in. A torsion spring is a spring that works by twisting; when it is twisted about its axis by an angle, it produces a torque proportional to the angle. A torsion spring's rate is in units of torque divided by angle, such as N·m/rad or ft·lbf/degree. The inverse of spring rate is compliance, that is: if a spring has a rate of 10 N/mm, it has a compliance of 0.1 mm/N. The stiffness (or rate) of springs in parallel is additive, as is the compliance of springs in series.

Springs are made from a variety of elastic materials, the most common being spring steel. Small springs can be wound from pre-hardened stock, while larger ones are made from annealed steel and hardened after manufacture. Some non-ferrous metals are also used, including phosphor bronze and titanium for parts requiring corrosion resistance, and low-resistance beryllium copper for springs carrying electric current.

History

[edit]

Simple non-coiled springs have been used throughout human history, e.g. the bow (and arrow). In the Bronze Age more sophisticated spring devices were used, as shown by the spread of tweezers in many cultures. Ctesibius of Alexandria developed a method for making springs out of an alloy of bronze with an increased proportion of tin, hardened by hammering after it was cast.

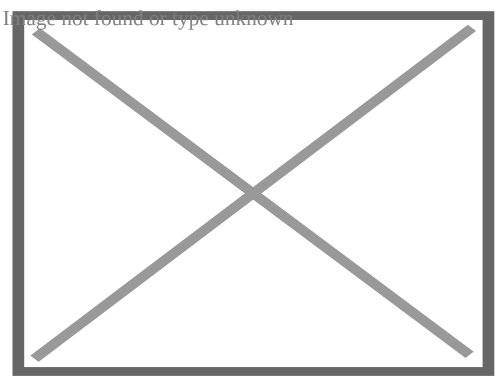
Coiled springs appeared early in the 15th century,[2] in door locks.[3] The first spring powered-clocks appeared in that century[3][4][5] and evolved into the first large watches by the 16th century.

In 1676 British physicist Robert Hooke postulated Hooke's law, which states that the force a spring exerts is proportional to its extension.

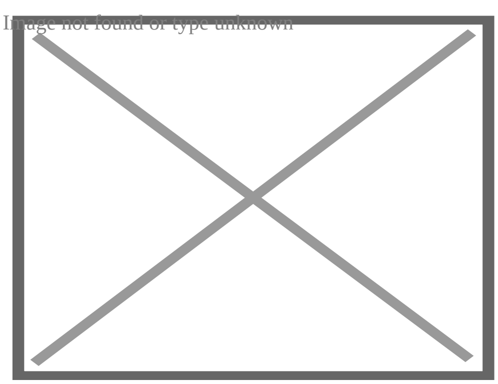
On March 8, 1850, John Evans, Founder of John Evans' Sons, Incorporated, opened his business in New Haven, Connecticut, manufacturing flat springs for carriages and other vehicles, as well as the machinery to manufacture the springs. Evans was a Welsh blacksmith and springmaker who emigrated to the United States in 1847, John Evans' Sons became "America's oldest springmaker" which continues to operate today. [6]

Types

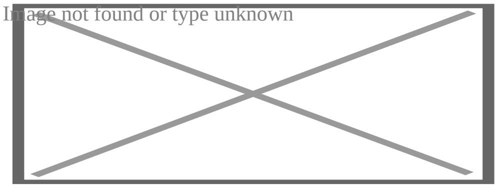
[edit]



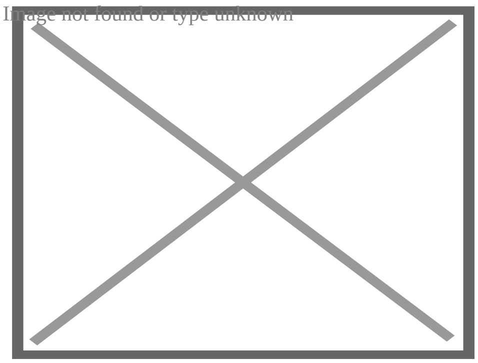
A spiral torsion spring, or hairspring, in an alarm clock.



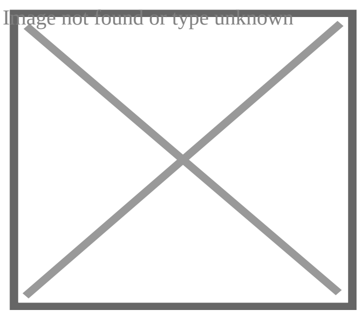
Battery contacts often have a variable spring



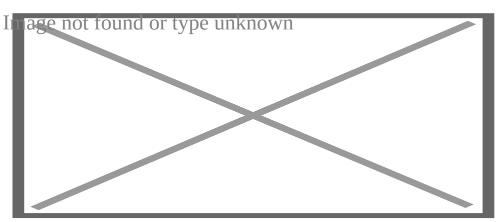
A volute spring. Under compression the coils slide over each other, so affording longer travel.



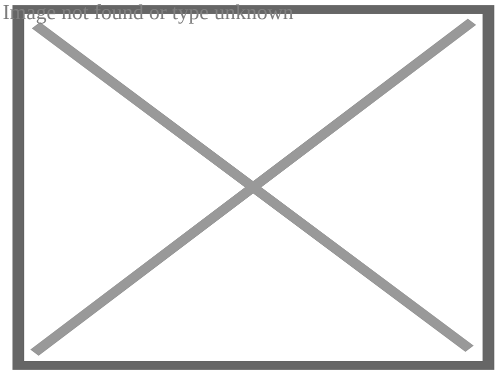
Vertical volute springs of Stuart tank



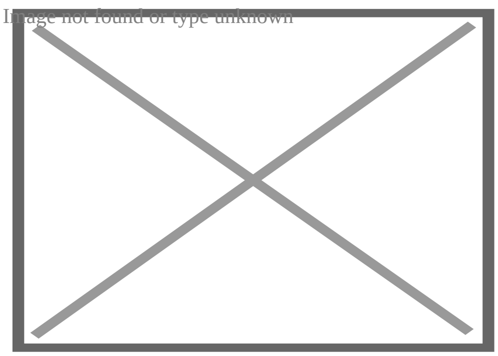
Selection of various arc springs and arc spring systems (systems consisting of inner and outer arc springs).



Tension springs in a folded line reverberation device.



A torsion bar twisted under load



Leaf spring on a truck

Classification

[edit]

Springs can be classified depending on how the load force is applied to them:

Tension/extension spring
: The spring is designed to operate with a tension load, so the spring stretches as the load is applied to it.

Compression spring
: Designed to operate with a compression load, so the spring gets shorter as the load is applied to it.

Torsion spring
: Unlike the above types in which the load is an axial force, the load applied to a torsion spring is a torque or twisting force, and the end of the spring rotates through an angle as the load is applied.

Constant spring

Supported load remains the same throughout deflection cycle[7]

Variable spring

Resistance of the coil to load varies during compression[8]

Variable stiffness spring

Resistance of the coil to load can be dynamically varied for example by the control system, some types of these springs also vary their length thereby providing actuation capability as well [9]

They can also be classified based on their shape:

Flat spring

Made of a flat spring steel.

Machined spring

Manufactured by machining bar stock with a lathe and/or milling operation rather than a coiling operation. Since it is machined, the spring may incorporate features in addition to the elastic element. Machined springs can be made in the typical load cases of compression/extension, torsion, etc.

Serpentine spring

A zig-zag of thick wire, often used in modern upholstery/furniture.

Garter spring

A coiled steel spring that is connected at each end to create a circular shape.

Common types

[edit]

The most common types of spring are:

Cantilever spring

A flat spring fixed only at one end like a cantilever, while the free-hanging end takes the load.

Coil spring

Also known as a helical spring. A spring (made by winding a wire around a cylinder) is of two types:

- *Tension* or *extension springs* are designed to become longer under load. Their turns (loops) are normally touching in the unloaded position, and they have a hook, eye or some other means of attachment at each end.
- *Compression springs* are designed to become shorter when loaded. Their turns (loops) are not touching in the unloaded position, and they need no attachment points.
- *Hollow tubing springs* can be either extension springs or compression springs. Hollow tubing is filled with oil and the means of changing hydrostatic pressure inside the tubing such as a membrane or miniature piston etc. to harden or relax the spring, much like it happens with water pressure inside a garden hose. Alternatively tubing's cross-section is chosen of a shape that it changes its area when tubing is subjected to torsional deformation: change of the cross-section area translates into change of tubing's inside volume and the flow of oil in/out of the spring that can be controlled by valve thereby controlling stiffness. There are many other designs of springs of hollow tubing which can change stiffness with any desired frequency, change stiffness by a multiple or move like a linear actuator in addition to its spring qualities.

Arc spring

A pre-curved or arc-shaped helical compression spring, which is able to transmit a torque around an axis.

Volute spring

A compression coil spring in the form of a cone so that under compression the coils are not forced against each other, thus permitting longer travel.

Balance spring

Also known as a hairspring. A delicate spiral spring used in watches, galvanometers, and places where electricity must be carried to partially rotating devices such as steering wheels without hindering the rotation.

Leaf spring

A flat spring used in vehicle suspensions, electrical switches, and bows.

V-spring

Used in antique firearm mechanisms such as the wheellock, flintlock and percussion cap locks. Also door-lock spring, as used in antique door latch mechanisms.[10]

Other types

[edit]

Other types include:

Belleville washer

A disc shaped spring commonly used to apply tension to a bolt (and also in the initiation mechanism of pressure-activated landmines)

Constant-force spring

A tightly rolled ribbon that exerts a nearly constant force as it is unrolled

Gas spring

A volume of compressed gas.

Ideal spring

An idealised perfect spring with no weight, mass, damping losses, or limits, a concept used in physics. The force an ideal spring would exert is exactly proportional to its extension or compression.[11]

Mainspring

A spiral ribbon-shaped spring used as a power store of clockwork mechanisms: watches, clocks, music boxes, windup toys, and mechanically powered flashlights

Negator spring

A thin metal band slightly concave in cross-section. When coiled it adopts a flat cross-section but when unrolled it returns to its former curve, thus producing a constant force throughout the displacement and *negating* any tendency to re-wind. The most common application is the retracting steel tape rule.[12]

Progressive rate coil springs

A coil spring with a variable rate, usually achieved by having unequal distance between turns so that as the spring is compressed one or more coils rests against its neighbour.

Rubber band

A tension spring where energy is stored by stretching the material.

Spring washer

Used to apply a constant tensile force along the axis of a fastener.

Torsion spring

Any spring designed to be twisted rather than compressed or extended.[13] Used in torsion bar vehicle suspension systems.

Wave spring

various types of spring made compact by using waves to give a spring effect.

Main article: Wave spring

Physics

[edit]

Hooke's law

[edit]

Main article: Hooke's law

An ideal spring acts in accordance with Hooke's law, which states that the force with which the spring pushes back is linearly proportional to the distance from its equilibrium length:

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$$\displaystyle F=-kx$$

where

Image not found or type unknown $\displaystyle x$ is the displacement vector – the distance from its equilibrium length.

Image not found or type unknown $\displaystyle F$ is the resulting force vector – the magnitude and direction of the restoring force the spring exerts

$\displaystyle k$ is the **rate, spring constant** or **force constant** of the spring, a constant that depends on the spring's material and construction. The negative sign indicates that the force the spring exerts is in the opposite direction from its displacement

Most real springs approximately follow Hooke's law if not stretched or compressed beyond their elastic limit.

Coil springs and other common springs typically obey Hooke's law. There are useful springs that don't: springs based on beam bending can for example produce forces that vary nonlinearly with displacement.

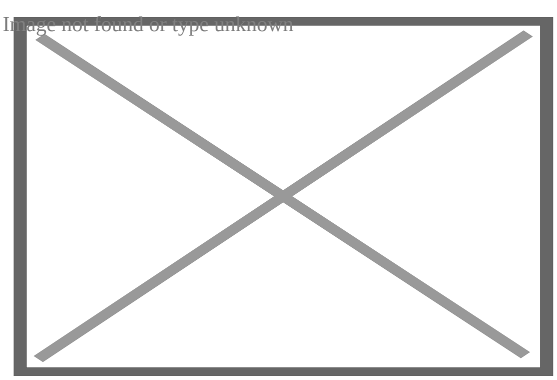
If made with constant pitch (wire thickness), conical springs have a variable rate. However, a conical spring can be made to have a constant rate by creating the spring with a variable pitch. A larger pitch in the larger-diameter coils and a smaller pitch in the smaller-diameter coils forces the spring to collapse or extend all the coils at the same rate when deformed.

Simple harmonic motion

[edit]
Main article: Harmonic oscillator

Since force is equal to mass, *m*, times acceleration, *a*, the force equation for a spring obeying Hooke's law looks like:

$$\displaystyle F=ma\quad \Rightarrow \quad -kx=ma.\,$$



The displacement, *x*, as a function of time. The amount of time that passes between peaks is called the period.

The mass of the spring is small in comparison to the mass of the attached mass and is ignored. Since acceleration is simply the second derivative of x with respect to time,

$$\displaystyle -kx=m\frac d^2xdt^2.\,$$

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This is a second order linear differential equation for the displacement $\displaystyle x$ as a function of time. Rearranging:

$$\displaystyle \frac d^2xdt^2+\frac kmx=0,\,$$

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the solution of which is the sum of a sine and cosine:

$$\displaystyle x(t)=A\sin \left(t\sqrt \frac km\right)+B\cos \left(t\sqrt \frac km\right).\,$$

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$\displaystyle A$ and $\displaystyle B$ are arbitrary constants that may be found by considering the initial displacement and velocity of the mass. The graph of this function with $\displaystyle B=0$ (zero initial position with some positive initial velocity) is displayed in the image on the right.

Energy dynamics

[edit]

In simple harmonic motion of a spring-mass system, energy will fluctuate between kinetic energy and potential energy, but the total energy of the system remains the same. A spring that obeys Hooke's law with spring constant *k* will have a total system energy *E* of:[14]

$$\displaystyle E=\left(\frac 12\right)kA^2$$

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Here, A is the amplitude of the wave-like motion that is produced by the oscillating behavior of the spring.

The potential energy *U* of such a system can be determined through the spring constant *k* and its displacement *x*:[14]

$$\displaystyle U=\left(\frac 12\right)kx^2$$

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The kinetic energy *K* of an object in simple harmonic motion can be found using the mass of the attached object *m* and the velocity at which the object oscillates *v*:[14]

$$\displaystyle K=\left(\frac 12\right)mv^2$$

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Since there is no energy loss in such a system, energy is always conserved and thus: [14]

$$\displaystyle E=K+U$$

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Frequency & period

[edit]

The angular frequency ω of an object in simple harmonic motion, given in radians per second, is found using the spring constant *k* and the mass of the oscillating object *m*[15]*:*

$$\displaystyle \omega =\sqrt \frac km$$

Image not found or type unknown [14]

The period *T*, the amount of time for the spring-mass system to complete one full cycle, of such harmonic motion is given by:[16]

$$\displaystyle T=\frac 2\pi \omega =2\pi \sqrt \frac mk$$

Image not found or type unknown[14]

The frequency *f*, the number of oscillations per unit time, of something in simple harmonic motion is found by taking the inverse of the period:[14]

\displaystyle f=\frac 1T=\frac \omega 2\pi =\frac 12\pi \sqrt \frac km

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Theory

[edit]

In classical physics, a spring can be seen as a device that stores potential energy, specifically elastic potential energy, by straining the bonds between the atoms of an elastic material.

Hooke's law of elasticity states that the extension of an elastic rod (its distended length minus its relaxed length) is linearly proportional to its tension, the force used to stretch it. Similarly, the contraction (negative extension) is proportional to the compression (negative tension).

This law actually holds only approximately, and only when the deformation (extension or contraction) is small compared to the rod's overall length. For deformations beyond the elastic limit, atomic bonds get broken or rearranged, and a spring may snap, buckle, or permanently deform. Many materials have no clearly defined elastic limit, and Hooke's law can not be meaningfully applied to these materials. Moreover, for the superelastic materials, the linear relationship between force and displacement is appropriate only in the low-strain region.

Hooke's law is a mathematical consequence of the fact that the potential energy of the rod is a minimum when it has its relaxed length. Any smooth function of one variable approximates a quadratic function when examined near enough to its minimum point as can be seen by examining the Taylor series. Therefore, the force – which is the derivative of energy with respect to displacement – approximates a linear function.

The force of a fully compressed spring is:

\displaystyle F_max=\frac Ed^4(L-nd)16(1+\nu)(D-d)^3n\

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where

- E – Young's modulus
- d – spring wire diameter
- L – free length of spring
- n – number of active windings
- Image not found or type unknown \displaystyle \nu – Poisson ratio
- D – spring outer diameter.

Zero-length springs

[edit]

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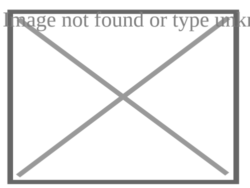

Simplified LaCoste suspension using a zero-length spring

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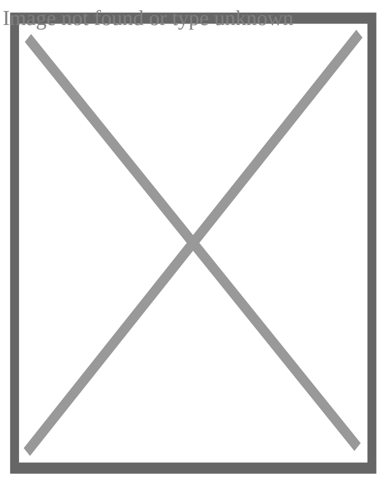

Spring length *L* vs force *F* graph of ordinary (+), zero-length (0) and negative-length (−) springs with the same minimum length L_0 and spring constant

Zero-length spring is a term for a specially designed coil spring that would exert zero force if it had zero length. That is, in a line graph of the spring's force versus its length, the line passes through the origin. A real coil spring will not contract to zero length because at some point the coils touch each other. "Length" here is defined as the distance between the axes of the pivots at each end of the spring, regardless of any inelastic portion in-between.

Zero-length springs are made by manufacturing a coil spring with built-in tension (A twist is introduced into the wire as it is coiled during manufacture; this works because a coiled spring *unwinds* as it stretches), so if it *could* contract further, the equilibrium point of the spring, the point at which its restoring force is zero, occurs at a length of zero. In practice, the manufacture of springs is typically not accurate enough to produce springs with tension consistent enough for applications that use zero length springs, so they are made by combining a *negative length* spring, made with even more tension so its equilibrium point would be at a *negative* length, with a piece of inelastic material of the proper length so the zero force point would occur at zero length.

A zero-length spring can be attached to a mass on a hinged boom in such a way that the force on the mass is almost exactly balanced by the vertical component of the force from the spring, whatever the position of the boom. This creates a horizontal pendulum with very long oscillation period. Long-period pendulums enable seismometers to sense the slowest waves from earthquakes. The LaCoste suspension with zero-length springs is also used in gravimeters because it is very sensitive to changes in gravity. Springs for closing doors are often made to have roughly zero length, so that they exert force even when the door is almost closed, so they can hold it closed firmly.

Uses

[edit]

- Airsoft gun
- Aerospace
- Retractable ballpoint pens
- Buckling spring keyboards
- Clockwork clocks, watches, and other things

- Firearms
- Forward or aft spring, a method of mooring a vessel to a shore fixture
- Gravimeters
- Industrial Equipment
- Jewelry: Clasp mechanisms
- Most folding knives, and switchblades
- Lock mechanisms: Key-recognition and for coordinating the movements of various parts of the lock.
- Spring mattresses
- Medical Devices[17]
- Pogo Stick
- Pop-open devices: CD players, tape recorders, toasters, etc.
- Spring reverb
- Toys; the Slinky toy is just a spring
- Trampoline
- Upholstery coil springs
- Vehicle suspension, Leaf springs

See also

[edit]

- Shock absorber
- Slinky, helical spring toy
- Volute spring

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External links

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Wikimedia Commons has media related to ***Spring (device)***.

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- Smart Springs and their Combinations (patent)

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Machines

Classical simple machines

- Inclined plane
- Lever
- Pulley
- Screw
- Wedge
- Wheel and axle

Clocks

- Atomic clock
- Chronometer
- Pendulum clock
- Quartz clock

Compressors and pumps

- Archimedes' screw
- Eductor-jet pump
- Hydraulic ram
- Pump
- Trompe
- Vacuum pump

External combustion engines

- Steam engine
- Stirling engine

Internal combustion engines

- Gas turbine
- Reciprocating engine
- Rotary engine
- Nutating disc engine

Linkages	○ Pantograph ○ Peaucellier-Lipkin
Turbine	○ Gas turbine ○ Jet engine ○ Steam turbine ○ Water turbine ○ Wind generator ○ Windmill
Aerofoil	○ Sail ○ Wing ○ Rudder ○ Flap ○ Propeller
Electronics	○ Vacuum tube ○ Transistor ○ Diode ○ Resistor ○ Capacitor ○ Inductor
Vehicles	○ Automobile

Miscellaneous	◦ Mecha ◦ Robot ◦ Agricultural ◦ Seed-counting machine ◦ Vending machine ◦ Wind tunnel ◦ Check weighing machines ◦ Riveting machines
Springs	◦ Spring (device)

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International	◦ FAST
National	◦ Germany ◦ United States ◦ France ◦ BnF data ◦ Japan ◦ Czech Republic ◦ Israel

About Remote control

A remote control, also known informally as a remote or clicker, is a digital tool made use of to run one more gadget from a range, generally wirelessly. In consumer electronic devices, a remote can be made use of to run gadgets such as a television set, DVD player or various other electronic home media appliance. A remote can enable operation of tools that run out practical reach for direct operation of controls. They operate best when made use of from a brief range. This is largely a benefit attribute for the customer. In many cases, remotes permit an individual to run a device that they otherwise would certainly not have the ability to get to, as when a garage door opener is activated from outside. Early tv remotes (1956--- 1977) utilized ultrasonic tones. Present-day remote controls are frequently customer infrared devices which send digitally coded pulses of infrared radiation. They control features such as power, volume, networks, playback, track adjustment, power, follower speed, and numerous other features. Remote controls for these gadgets are normally little cordless handheld things with a selection of switches. They are used to adjust numerous settings such as television channel, track number, and quantity. The push-button control code, and therefore the called for remote gadget, is generally details to a product line. Nonetheless, there are global remotes, which imitate the push-button control produced many significant brand tools. Push-button controls in the 2000s include Bluetooth or Wi-Fi connection, movement sensor-enabled capacities and voice control. Push-button controls for 2010s forward Smart TVs might feature a standalone key-board on the rear side to facilitate keying, and be functional as a pointing gadget.

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About Lake County

Driving Directions in Lake County

Driving Directions From 41.366510327857, -87.3408646 to

Driving Directions From 41.408057240601, -87.343798613815 to

Driving Directions From 41.391735468419, -87.318200587644 to

Driving Directions From 41.428981281465, -87.421575428085 to

Driving Directions From 41.453568220733, -87.320568421442 to

Driving Directions From 41.443437503917, -87.311638642998 to

Driving Directions From 41.466348423063, -87.291394997875 to

Driving Directions From 41.387196050936, -87.400947816503 to

Driving Directions From 41.382799094677, -87.347560275608 to

Driving Directions From 41.450223110903, -87.428508635102 to

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- Sensor Alignment Procedures for Reliable Safety
- Cleaning Tracks for Smooth Door Travel
- Tightening Hardware to Reduce Door Noise

Higgins Overhead Door

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State : IN

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