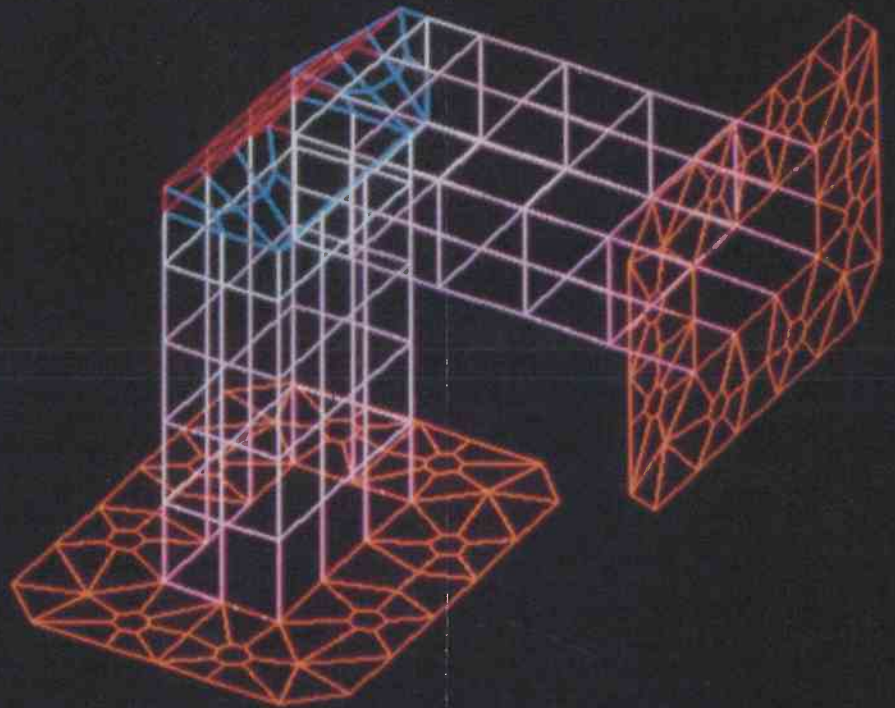


McGraw-Hill Dictionary of

**MECHANICAL
AND DESIGN
ENGINEERING**



On the cover: A computer-generated graphical representation of a waveguide divided into finite elements for structural analysis. (Courtesy of Peter Marks, Design Insight, Milford, Ohio)

McGRAW-HILL DICTIONARY OF MECHANICAL AND DESIGN ENGINEERING

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ISBN 0-07-045414-0

Library of Congress Cataloging in Publication Data

McGraw-Hill dictionary of mechanical and design engineering.

1. Mechanical engineering—Dictionaries.
2. Engineering design—Dictionaries. I. Parker, Sybil P. II. McGraw-Hill Book Company. III. Title: Dictionary of mechanical and design engineering. TJ9.M395 1984 620.1'003'21 84-28853 ISBN 0-07-045414-0 (pbk.)

- second pilot** [AERO ENG] A pilot, not necessarily qualified on type, who is responsible for assisting the first pilot to fly the aircraft and is authorized as second pilot.
- sectional conveyor** [MECH ENG] A belt conveyor that can be lengthened or shortened by the addition or the removal of interchangeable sections.
- sectional core barrel** [DES ENG] A core barrel whose length can be increased by coupling unit sections together.
- sectional header boiler** [MECH ENG] A horizontal boiler in which tubes are assembled in sections into front and rear headers; the latter, in turn, are connected to the boiler drum by vertical tubes.
- section modulus** [MECH] The ratio of the moment of inertia of the cross section of a beam undergoing flexure to the greatest distance of an element of the beam from the neutral axis.
- sector gear** [DES ENG] 1. A toothed device resembling a portion of a gear wheel containing the center bearing and a part of the rim with its teeth. 2. A gear having such a device as its chief essential feature. [MECH ENG] A gear system employing such a gear as a principal part.
- seepage** [FL MECH] The slow movement of water or other fluid through a porous medium.
- segment saw** [MECH ENG] A saw consisting of steel segments attached around the edge of a flange and used for cutting veneer.
- seiche** [FL MECH] An oscillation of a fluid body in response to the disturbing force having the same frequency as the natural frequency of the fluid system.
- selective transmission** [MECH ENG] A gear transmission with a single lever for changing from one gear ratio to another; used in automotive vehicles.
- selector** [MECH ENG] 1. The part of the gearshift in an automotive transmission that selects the required gearshift bar. 2. The lever with which a driver operates an automatic gearshift.
- self-centering chuck** [MECH ENG] A drill chuck that, when closed, automatically positions the drill rod in the center of the drive rod of a diamond-drill swivel head.
- self-energizing brake** [MECH ENG] A brake designed to reinforce the power applied to it, such as a hand brake.
- self-excited vibration** See self-induced vibration.
- self-induced vibration** [MECH] The vibration of a mechanical system resulting from conversion, within the system, of nonoscillatory excitation to oscillatory excitation. Also known as self-excited vibration.
- self-locking nut** [DES ENG] A nut having an inherent locking action, so that it cannot readily be loosened by vibration.
- self-organizing function** [CONT SYS] That level in the functional decomposition of a large-scale control system which modifies the modes of control action or the structure of the control system in response to changes in system objectives, contingency events, and so forth.
- self-propelled** [MECH ENG] Pertaining to a vehicle given motion by means of a self-contained motor.
- self-starter** [MECH ENG] An attachment for automatically starting an internal combustion engine.
- self-tapping screw** [DES ENG] A screw with a specially hardened thread that makes it possible for the screw to form its own internal thread in sheet metal and soft materials when driven into a hole. Also known as sheet-metal screw; tapping screw.

- self-tuning regulator** [CONT SYS] A type of adaptive control system composed of two loops, an inner loop which consists of the process and an ordinary linear feedback regulator, and an outer loop which is composed of a recursive parameter estimator and a design calculation, and which adjusts the parameters of the regulator. Abbreviated STR.
- sellers hob** [MECH ENG] A hob that turns on the centers of a lathe, the work being fed to it by the lathe carriage.
- Selwood engine** [MECH ENG] A revolving-block engine in which two curved pistons opposed 180° run in toroidal tracks, forcing the entire engine block to rotate.
- semiautomatic transmission** [MECH ENG] An automobile transmission that assists the driver to shift from one gear to another.
- semiclosed-cycle gas turbine** [MECH ENG] A heat engine in which a portion of the expanded gas is recirculated.
- semidiesel engine** [MECH ENG] 1. An internal combustion engine of a type resembling the diesel engine in using heavy oil as fuel but employing a lower compression pressure and spraying it under pressure, against a hot (uncooled) surface or spot, or igniting it by the precombustion or supercompression of a portion of the charge in a separate member or uncooled portion of the combustion chamber. 2. A true diesel engine that uses a means other than compressed air for fuel injection.
- semifloating axle** [MECH ENG] A supporting member in motor vehicles which carries torque and wheel loads at its outer end.
- semimonocoque** [AERO ENG] A fuselage structure in which longitudinal members (stringers) as well as rings or frames which run circumferentially around the fuselage reinforce the skin and help carry the stress. Also known as stiffened-shell fuselage.
- sems** [DES ENG] A preassembled screw and washer combination.
- sensible heat** *See* enthalpy.
- sensible-heat factor** [THERMO] The ratio of space sensible heat to space total heat; used for air-conditioning calculations. Abbreviated SHF.
- sensible-heat flow** [THERMO] The heat given up or absorbed by a body upon being cooled or heated, as the result of the body's ability to hold heat; excludes latent heats of fusion and vaporization.
- sensitivity function** [CONT SYS] The ratio of the fractional change in the system response of a feedback-compensated feedback control system to the fractional change in an open-loop parameter, for some specified parameter variation.
- separation** [AERO ENG] The action of a fallaway section or companion body as it casts off from the remaining body of a vehicle, or the action of the remaining body as it leaves a fallaway section behind it.
- separation theorem** [CONT SYS] A theorem in optimal control theory which states that the solution to the linear quadratic Gaussian problem separates into the optimal deterministic controller (that is, the optimal controller for the corresponding problem without noise) in which the state used is obtained as the output of an optimal state estimator.
- separator** *See* cage.
- sepatrix** [CONT SYS] A curve in the phase plane of a control system representing the solution to the equations of motion of the system which would cause the system to move to an unstable point.
- series compensation** *See* cascade compensation.
- service brake** [MECH ENG] The brake used for ordinary driving in an automotive vehicle; usually foot-operated.

- suspended tray conveyor** [MECH ENG] A vertical conveyor having pendant trays or other carriers on one or more endless chains.
- suspension system** [MECH ENG] A system of springs, shock absorbers, and other devices supporting the upper part of a motor vehicle on its running gear.
- sustained oscillation** [CONT SYS] Continued oscillation due to insufficient attenuation in the feedback path.
- sustainer rocket engine** [AERO ENG] A rocket engine that maintains the velocity of a rocket vehicle once it has achieved its programmed velocity by use of a booster or other engine.
- sverdrup** [FL MECH] A unit of volume transport equal to 1,000,000 cubic meters per second.
- swage bolt** [DES ENG] A bolt having indentations with which it can be gripped in masonry.
- swamp buggy** [MECH ENG] A wheeled vehicle that runs on land, mud, or through shallow water; used especially in swamps.
- swash-plate pump** [MECH ENG] A rotary pump in which the angle between the drive shaft and the plunger-carrying body is varied.
- sweat cooling** [AERO ENG] A technique for cooling combustion chambers or aerodynamically heated surfaces by forcing a coolant through a porous wall, resulting in film cooling at the interface. Also known as transpiration cooling.
- sweepback** [AERO ENG] 1. The backward slant of a leading or trailing edge of an airfoil.
2. The amount of this slant, expressed as the angle between a line perpendicular to the plane of symmetry and a reference line in the airfoil.
- swell diameter** [AERO ENG] In a body of revolution having an ogival portion, such as a projectile, the swell diameter is in the diameter of the maximum transverse section of the geometrical ogive.
- sweptback wing** [AERO ENG] An airplane wing on which both the leading and trailing edges have sweepback, the trailing edge forming an acute angle with the longitudinal axis of the airplane aft of the root. Also known as swept wing.
- swept wing** See sweptback wing.
- swing-around trajectory** [AERO ENG] A planetary round-trip trajectory which requires minimal propulsion at the destination planet, but instead uses the planet's gravitational field to effect the bulk of the necessary orbit change to return to earth.
- swing-frame grinder** [MECH ENG] A grinding machine hanging by a chain so that it may swing in all directions for surface grinding heavy work.
- swing joint** [DES ENG] A pipe joint in which the parts may be rotated relative to each other.
- Swiss pattern file** [DES ENG] A type of fine file used for precision filing of jewelry, instrument parts, and dies.
- switchblade knife** [DES ENG] A knife in which the blade is restrained by a spring and swings open when released by a pushbutton.
- switching surface** [CONT SYS] In feedback control systems employing bang-bang control laws, the surface in state space which separates a region of maximum control effort from one of minimum control effort.
- swivel** [DES ENG] A part that oscillates freely on a headed bolt or pin.
- swivel block** [DES ENG] A block with a swivel attached to its hook or shackle permitting it to revolve.

swivel coupling [MECH ENG] A coupling that gives complete rotary freedom to a deflecting wedge-setting assembly.

swivel head [MECH ENG] The assembly of a spindle, chuck, feed nut, and feed gears on a diamond-drill machine that surrounds, rotates, and advances the drill rods and drilling stem; on a hydraulic-feed drill the feed gears are replaced by a hydraulically actuated piston assembly.

swivel hook [DES ENG] A hook with a swivel connection to its base or eye.

swivel joint [DES ENG] A joint with a packed swivel that allows one part to move relative to the other.

swivel neck *See* water swivel.

swivel pin *See* kingpin.

symmetry axis *See* axis of symmetry.

synchromesh [MECH ENG] An automobile transmission device that minimizes clashing; acts as a friction clutch, bringing gears approximately to correct speed just before meshing.

synchronized shifting [MECH ENG] Changing speed gears, with the gears being brought to the same speed before the change can be made.

synchronous orbit [AERO ENG] 1. An orbit in which a satellite makes a limited number of equatorial crossing points which are then repeated in synchronism with some defined reference (usually earth or sun). 2. Commonly, the equatorial, circular, 24-hour case in which the satellite appears to hover over a specific point of the earth.

synchronous satellite *See* geostationary satellite.

Syncom [AERO ENG] One of a series of communication satellites placed in synchronous equatorial orbit; used for relaying television and radio communications over long distances.

synergic curve [AERO ENG] A curve plotted for the ascent of a rocket, space-air vehicle, or space vehicle, calculated to give optimum fuel economy and optimum velocity.

synoptic correlation *See* Eulerian correlation.

synthesis *See* system design.

system analysis [CONT SYS] The use of mathematics to determine how a set of interconnected components whose individual characteristics are known will behave in response to a given input or set of inputs.

system bandwidth [CONT SYS] The difference between the frequencies at which the gain of a system is $\sqrt{2}/2$ (that is, 0.707) times its peak value.

system design [CONT SYS] A technique of constructing a system that performs in a specified manner, making use of available components. Also known as synthesis.

system response *See* response.