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cumulative distribution function (CDF) for a random variable x , the probability that x is less than or equal to some value x , denoted $F_x(x)$. $F_x(-\infty)$ is zero and increases monotonically to $F_x(+\infty) = 1$. For a continuous probability density function $p(x)$, the CDF is $F_x(x) = \int_{-\infty}^x p(t) dt$. The CDF is used in image processing to carry out histogram equalization. See histogram equalization, probability density function.

cumulatively compounded a compound-wound DC machine in which the flux produced by the MMF of the shunt field winding and the flux produced by the MMF of the series field winding are in the same direction.

Curie temperature the temperature above which a material ceases to be magnetic; at this temperature a ferromagnetic material becomes paramagnetic.

current the flow of charge, measured in amperes (1 ampere = 1 coulomb/s).

current density vector field the field (commonly denoted J) that is related to the electric field intensity vector field by the conductivity of the medium that the fields are located in. One of the quantities found on the right side of Ampere's Law. The units are (amperes/square meter).

current distribution factor in economic dispatch studies, the proportion of a power line's total current which is contributed by a particular generating plant.

current fed inverter an inverter in which the current is switched instead of the voltage to create AC current from a DC source. A large inductor is used to maintain a nearly constant current on the DC side which is then directed to the load in an alternating fashion by the use of switching elements.

current feedback op-amp an op-amp in which the output voltage is controlled by the current in the input stage, rather than the voltage. The advantage of the current feedback op-amp is that (to first order) its closed-loop performance is not subject to the gain-bandwidth tradeoff that affects voltage feedback op-amps.

current gain short-circuit current gain that helps describe the physical operation of the transistor. The current gain is the dimensionless ratio of the peak RF output current ($I_{out.pk}$) to the peak incident RF current ($I_{incident.pk}$). Hence, current gain, G_I is

$$G_I = \frac{I_{out.pk}}{I_{incident.pk}}$$

current limiting the output current is limited to a preset level even under a shorted output condition. This can be accomplished by reducing the output voltage to prevent the current limit from being exceeded.

current limiting fuse a fuse that limits the level of fault current from that which is available. It operates by developing a substantial voltage across the fuse following the melting of the fuse element.

current mirror a configuration of two matched transistors in which the output is a current that is ideally equal to the input current. In the case of a BJT current mirror, the collector of the first transistor is forced to carry the input current. This establishes a corresponding base-emitter voltage, which is applied to the second transistor. If the two devices are matched, then the collector current of the second transistor will equal that of the first transistor, thus "mirroring" the input current. This is a commonly used configuration in integrated circuits, which can take advantage of the inherent matching available by fabricating the two transistors in close proximity to each other.

current regulator a device used to control the magnitude and phase of the current in DC, AC

or other electrical variable speed drives. May use different control strategies like hysteresis current control or ramp comparison current control.

current source amplifier the most common group of amplifiers is made up of current sourcing amplifiers, in which the active device acts as a modulated current source. All class A, B, A-B, and C amplifiers fit into this general group. Parameters such as device characteristics, quiescent bias point, RF load line, and amplitude and waveform of the applied signal should be included with the class definition, thus defining the major contributors to the physical actions taking place in one of these amplifiers.

current source inverter See current fed inverter.

current source region region of the I-V curve(s) of a device in which the output current is relatively constant (slope near zero) for changing output voltage.

current transducer a device used to measure current in a variety of applications including variable speed drives. May give out a current proportional to the measured current or a voltage proportional to the measured current. Electrical isolation may be obtained by using a current transformer (cannot be used at DC) or a hall effect transducer that can be used down to DC.

current transformer (CT) (1) a transformer that is employed to provide a secondary current proportional to primary current flowing. The primary "winding" is often created by passing the system conductor or bus bar through an opening in the device and the secondary is typically rated at a standard value to match common meters and display units. Current transformers are used in current measurement, protective relays, and power metering applications. The load (meter) on a CT should never be removed without first shorting the

secondary of the CT, otherwise dangerous voltage levels may result when the load is removed.

(2) a device which measures the instantaneous current through a conductor of an electric power line and transmits a signal proportional to this current to the power system's instrumentation.

current unit a protective relay that monitors the magnitude of a power transmission line's current flow.

current withstand rating the current withstand rating of a device is the maximum short term current that can flow in the device without causing damage. See ampacity.

current-controlled multivibrator a multivibrator with oscillation period controlled by the current that is charging and discharging a timing capacitor. Most of the circuits are based on two symmetric controlled current sources connected by a timing capacitor, and a steering circuit (connected between power supply voltage and this capacitor), which includes two switches. The switches take turns providing the conducting path for the current sources, and the current in the timing capacitor changes direction each half of the period. If the current sources are controlled by an external voltage, the circuit becomes a voltage-controlled multivibrator. Current- and voltage controlled multivibrators are a vital part of phase-locked loops and frequency synthesizers.

current-limiting device when operating within its current-limiting range, a current-limiting device is open in 0.25 cycle or less and limits the maximum short-circuit current to a magnitude substantially less than the short-circuit current available at the fault point.

current-mode control the inductor current is sensed to control the pulse width. The switch is turned on by a constant frequency clock and turned off when the inductor current reaches the control reference. This method produces subharmonic oscillations if the steady-state duty ratio is greater

the system state. The regular form is useful in control design.

regularization a procedure to add a constraint term in the optimization process that has a stabilizing effect on the solution.

regulation the change in voltage from no-load to full-load expressed as a percentage of full-load voltage.

regulator a controller designed to maintain the state of the controlled variable at a constant value, despite fluctuations of the load.

reinforcement learning learning on the basis of a signal that tells the learning system whether its actions in response to an input (or series of inputs) are good or bad. The signal is usually a scalar, indicating how good or bad the actions are, but may be binary.

rejection criteria criteria such as poor surface texture, existence of scratch marks, out-of-tolerance distance measures, which constitute reasonable grounds for rejecting a product from a product line.

related color color perceived to belong to an area of object seen in relation to other colors. *See* unrelated color.

relational model a logical data structure based on a set of tables having common keys that allows the relationship between data items to be defined without considering the physical database organization.

relative addressing an addressing mechanism for machine instructions in which the address of the target location is given by the contents of a specific register and an offset held as a constant in the instruction added together. *See also* PC-relative addressing, index register, base address.

relative-address coding in facsimile coding, represents the transition between levels on a particular scan line relative to transitions on the preceding scan line. A relative-address coding system has a pass mode codeword for indicating where a pair of transitions on the previous line does not have corresponding transitions on the current line, and a runlength coding mode applied when there is no nearby suitable transition on the previous line. CCITT Group IV facsimile uses a form of relative-address coding.

relative controllability a dynamical system with delays in which for a given time interval $[0, t_1]$ if for any initial condition $(x(0), x_0)$ and any final vector $x_1 \in R^n$ there exists an admissible control $u(t)$, $t \in [0, t_1]$, such that the corresponding trajectory satisfies the condition

$$x(t_1, x(0), x_0, u) = x_1$$

relative entropy information theoretic quantity representing the "distance" between two probability distribution functions. Also known as the Kullback-Liebler distance. For two probability mass functions $p(x)$ and $q(x)$, the relative entropy $D(p||q)$ is given by

$$D(p||q) = \sum p(x) \log \frac{p(x)}{q(x)}.$$

This quantity is only a pseudo-distance, as $D(p||q) \neq D(q||p)$.

relative intensity noise noise resulting from undesirable fluctuations of the optical power detected in an optical communication system.

relative permeability the complex permeability of a material divided by the permeability of free space: $\mu_r = \mu/\mu_0$.

relative permittivity the complex permittivity of a material divided by the permittivity of free space: $\epsilon_r = \epsilon/\epsilon_0$.