“Book/Definitions”
Electrical Engineering Dictionary.
Ed. Phillip A. Laplante
Boca Raton: CRC Press LLC, 2000

Special Symbols

α**-level set** a crisp set of elements belonging to a fuzzy set A at least to a degree α

$$A_\alpha = \{x \in X \mid \mu_A(x) \geq \alpha\}$$

See also crisp set, fuzzy set.

Δf common symbol for bandwidth, in hertz.

$\epsilon_{\mathbf{rGaAs}}$ common symbol for gallium arsenide relative dielectric constant. $\epsilon_{\mathbf{rGaAs}} = 12.8$.

$\epsilon_{\mathbf{rSi}}$ common symbol for silicon relative dielectric constant. $\epsilon_{\mathbf{rSi}} = 11.8$.

ϵ_0 symbol for permitivity of free space. $\epsilon_0 = 8.849 \times 10^{-12}$ farad/meter.

ϵ_r common symbol for relative dielectric constant.

$\eta_{\mathbf{DC}}$ common symbol for DC to RF conversion efficiency. Expressed as a percentage.

η_a common symbol for power added efficiency. Expressed as a percentage.

η_t common symbol for total or true efficiency. Expressed as a percentage.

$\Gamma_{\mathbf{opt}}$ common symbol for source reflection coefficient for optimum noise performance.

μ_0 common symbol for permeability of free space constant. $\mu_0 = 1.257 \times 10^{-16}$ henrys/meter.

μ_r common symbol for relative permeability.

ω common symbol for radian frequency in radians/second. $\omega = 2 \cdot \pi \cdot$ frequency.

θ_+ common symbol for positive transition angle in degrees.

θ_- common symbol for negative transition angle in degrees.

$\theta_{\mathbf{cond}}$ common symbol for conduction angle in degrees.

$\theta_{\mathbf{sat}}$ common symbol for saturation angle in degrees.

θ_{CC} common symbol for FET channel-to-case thermal resistance in °C/watt.

θ_{JC} common symbol for bipolar junction-to-case thermal resistance in °C/watt.

A^* common symbol for Richardson's constant. $A^* = 8.7$ amperes · cm/°K

BV_{GD} *See* gate-to-drain breakdown voltage.

BV_{GS} *See* gate-to-source breakdown voltage.

dv/dt rate of change of voltage withstand capability without spurious turn-on of the device.

H_{ci} *See* intrinsic coercive force.

n_e common symbol for excess noise in watts.

n_sh common symbol for shot noise in watts.

n_t common symbol for thermal noise in watts.

10base2 a type of coaxial cable used to connect nodes on an Ethernet network. The 10 refers to the transfer rate used on standard Ethernet, 10 megabits per second. The base means that the network uses baseband communication rather than broadband communications, and the 2 stands for the maximum length of cable segment, 185 meters (almost 200). This type of cable is also called "thin" Ethernet, because it is a smaller diameter cable than the 10base5 cables.

10base5 a type of coaxial cable used to connect nodes on an Ethernet network. The 10 refers to the transfer rate used on standard Ethernet, 10 megabits per second. The base means that the network uses baseband communication rather than broadband communications, and the 5 stands for the maximum length of cable segment of approximately 500 meters. This type of cable is also called "thick" Ethernet, because it is a larger diameter cable than the 10base2 cables.

10baseT a type of coaxial cable used to connect nodes on an Ethernet network. The 10 refers to the transfer rate used on standard Ethernet, 10 megabits per second. The base means that the network uses baseband communication rather than broadband communications, and the T stands for twisted (wire) cable.

2-D Attasi model a 2-D model described by the equations

$$x_{i+1,j+1} = -A_1A_2x_{i,j} + A_1x_{i+1,j} + A_2x_{i,j+1} + Bu_{ij}$$
$$y_{ij} = Cx_{ij} + Du_{ij}$$

$i, j \in Z_+$ (the set of nonnegative integers). Here $x_{ij} \in R^n$ is the local state vector, $u_{ij} \in R^m$ is the input vector, $y_{ij} \in R^p$ is the output vector, and A_1, A_2, B, C, D are real matrices. The model was introduced by Attasi in "Systemes lineaires homogenes a deux indices," *IRIA Rapport Laboria*, No. 31, Sept. 1973.

2-D Fornasini–Marchesini model a 2-D model described by the equations

$$x_{i+1,j+1} = A_0x_{i,j} + A_1x_{i+1,j} + A_2x_{i,j+1} + Bu_{ij} \quad (1a)$$
$$y_{ij} = Cx_{ij} + Du_{ij} \quad (1b)$$

$i, j \in Z_+$ (the set of nonnegative integers) here $x_{ij} \in R^n$ is the local state vector, $u_{ij} \in R^m$ is the input vector, $y_{ij} \in R^p$ is the output vector A_k $(k = 0, 1, 2)$, B, C, D are real matrices. A 2-D model described by the equations

$$x_{i+1,j+1} = A_1x_{i+1,j} + A_2x_{i,j+1} + B_1u_{i+1,j} + B_2u_{i,j+1} \quad (2)$$

$i, j \in Z_+$ and (1b) is called the second 2-D Fornasini–Marchesini model, where x_{ij}, u_{ij}, and y_{ij} are defined in the same way as for (1), A_k, B_k $(k = 0, 1, 2)$ are real matrices. The model (1) is a particular case of (2).

2-D general model a 2-D model described by the equations

$$x_{i+1,j+1} = A_0x_{i,j} + A_1x_{i+1,j} + A_2x_{i,j+1} + B_0u_{ij} + B_1u_{i+1,j} + B_2u_{i,j+1}$$
$$y_{ij} = Cx_{ij} + Du_{ij}$$

$i, j \in Z_+$ (the set of nonnegative integers) here $x_{ij} \in R^n$ is the local state vector, $u_{ij} \in R^m$ is the input vector, $y_{ij} \in R^p$ is the output vector and A_k, B_k $(k = 0, 1, 2)$, C, D are real matrices. In particular case for $B_1 = B_2 = 0$ we obtain the first 2-D Fornasini–Marchesini model and for $A_0 = 0$ and $B_0 = 0$ we obtain the second 2-D Fornasini–Marchesini model.

2-D polynomial matrix equation a 2-D equation of the form

$$AX + BY = C \quad (1)$$

where $A \in R^{k\times p}[s]$, $B \in R^{k\times q}[s]$, $C \in R^{k\times m}[s]$ are given, by a solution to (1) we mean any pair $X \in R^{p\times m}[s]$, $Y \in R^{q\times m}[s]$ satisfying the equation. The equation (1) has a solution if and only if the matrices $[A, B, C]$ and $[A, B, 0]$ are column equivalent or the greatest common left divisor of A and B is a left divisor of C. The 2-D equation

$$AX + YB = C \qquad (2)$$

$A \in R^{k\times p}[s]$, $B \in R^{q\times m}[s]$, $C \in R^{k\times m}[s]$ are given, is called the bilateral 2-D polynomial matrix equation. By a solution to (2) we mean any pair $X \in R^{p\times m}[s]$, $Y \in R^{k\times q}[s]$ satisfying the equation. The equation has a solution if and only if the matrices

$$\begin{bmatrix} A & 0 \\ 0 & B \end{bmatrix} \text{ and } \begin{bmatrix} A & C \\ 0 & B \end{bmatrix}$$

are equivalent.

2-D Roesser model a 2-D model described by the equations

$$\begin{bmatrix} x^h_{i+1,j} \\ x^v_{i,j+1} \end{bmatrix} = \begin{bmatrix} A_1 & A_2 \\ A_3 & A_4 \end{bmatrix} \begin{bmatrix} x^h_{ij} \\ x^v_{ij} \end{bmatrix} + \begin{bmatrix} B_1 \\ B_2 \end{bmatrix} u_{ij}$$

$i, j \in Z_+$ (the set of nonnegative integers),

$$y_{ij} = C \begin{bmatrix} x^h_{ij} \\ x^v_{ij} \end{bmatrix} + Du_{ij}$$

Here $x^h_{ij} \in R^{n_1}$ and $x^v_{ij} \in R^{n_2}$ are the horizontal and vertical local state vectors, respectively, $u_{ij} \in R^m$ is the input vector, $y_{ij} \in R^p$ is the output vector and A_1, A_2, A_3, A_4, B_1, B_2, C, D are real matrices. The model was introduced by R.P. Roesser in "A discrete state-space model for linear image processing," *IEEE Trans. Autom. Contr.*, AC-20, No. 1, 1975, pp. 1-10.

2-D shuffle algorithm an extension of the Luenberger shuffle algorithm for 1-D case. The 2-D shuffle algorithm can be used for checking the regularity condition

$$\det\left[Ez_1z_2 - A_0 - A_1z_1 - A_2z_2\right] \neq 0$$

for some $(z_1, z_2) \in C \times C$ of the singular general model (*See* singular 2-D general model). The algorithm is based on the row compression of suitable matrices.

2-D Z-transform $F(z_1, z_2)$ of a discrete 2-D function f_{ij} satisfying the condition $f_{ij} = 0$ for $i < 0$ or/and $j < 0$ is defined by

$$F(z_1, z_2) = \sum_{i=0}^{\infty}\sum_{j=0}^{\infty} f_{ij} z_1^{-i} z_2^{-j}$$

An 2-D discrete f_{ij} has the 2-D Z-transform if the sum

$$\sum_{i=0}^{\infty}\sum_{j=0}^{\infty} f_{ij} z_1^{-i} z_2^{-j}$$

exists.

2DEGFET *See* high electron mobility transistor(HEMT).

2LG *See* double phase ground fault.

3-dB bandwidth for a causal low-pass or bandpass filter with a frequency function $H(j\omega)$ the frequency at which $|H(j\omega)|_{dB}$ is less than 3 dB down from the peak value $|H(\omega_P)|$.

3-level laser a laser in which the most important transitions involve only three energy states; usually refers to a laser in which the lower level of the laser transition is separated from the ground state by much less than the thermal energy kT. *Contrast with* 4-level laser.

3-level system a quantum mechanical system whose interaction with one or more electromagnetic fields can be described by considering primarily three energy levels. For example, the cascade, vee, and lambda systems are 3-level systems.

4-level laser a laser in which the most important transitions involve only four energy states; usually refers to a laser in which the lower level of the laser transition is separated from the ground state by much more than the thermal energy kT. *Contrast with 3-level laser*.

45 Mbs DPCM for NTSC color video a codec wherein a subjectively pleasing picture is required at the receiver. This does not require transparent coding quality typical of TV signals. The output bit-rate for video matches the DS3 44.736 Megabits per second rate. The coding is done by PCM coding the NTSC composite video signal at three times the color subcarrier frequency using 8 bit per pixel. Prediction of current pixel is obtained by averaging the pixel three after current and 681 pixels before next to maintain the subcarrier phase. A leak factor is chosen before computing prediction error to main the quality of the image. For example a leak factor of $\frac{31}{32}$ the prediction decay is maintained at the center of the dynamic range.

$$X_L^- = 128 + \frac{31}{32}\left(X^- - 128\right) .$$

Finally, a clipper at the coder and decoder is employed to prevent quantization errors.

90% withstand voltage a measure of the practical lightning or switching-surge impulse withstand capability of a piece of power equipment. This voltage withstand level is two standard deviations above the BIL of the equipment.

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