Formula Sheet

Laplace Transforms

Laplace Transform $F(s)$	Time Function $f(t)$
1	Unit-impulse function $\delta(t)$
$\frac{1}{s}$	Unit-step function $u_s(t)$
$\frac{1}{s^2}$	Unit-ramp function t
$\frac{n!}{S^{n+1}}$	t^n (n = positive integer)
$\frac{1}{s+\alpha}$	$e^{-\alpha t}$
$\frac{1}{(s+\alpha)^2}$	$te^{-\alpha t}$

Mason's Gain Formula

Given an SFG with N forward paths and K loops, the gain between the input node y_{in} and output node y_{out} is [3]

$$M = \frac{y_{\text{out}}}{y_{\text{in}}} = \sum_{k=1}^{N} \frac{M_k \Delta_k}{\Delta} \tag{3-54}$$

where

y_{in} = input-node variable

y_{out} = output-node variable

M = gain between y_{in} and y_{out}

N = total number of forward paths between y_{in} and y_{out}

M_k = gain of the kth forward paths between y_{in} and y_{out}

$$\Delta = 1 - \sum_i L_{i1} + \sum_j L_{j2} - \sum_k L_{k3} + \ldots \tag{3-55}$$

L_{mr} = gain product of the mth ($m = i, j, k, \ldots$) possible combination of r nontouching loops ($1 \leq r \leq K$).

or

$\Delta = 1-$ (sum of the gains of **all individual** loops) $+$ (sum of products of gains of all possible combinations of **two** nontouching loops) $-$ (sum of products of gains of all possible combinations of **three** nontouching loops) $+ \cdots$

Δ_k = the Δ for that part of the SFG that is nontouching with the kth forward path.