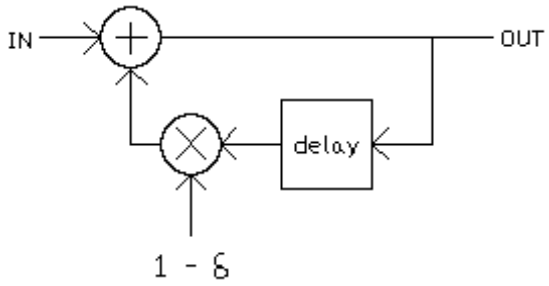
Exponential decay implemented digitally N1AL 6/8/2009



Let's compare the exponential decay of the above circuit to that of an analog R-C network to see if we have the correct equation for the time constant.

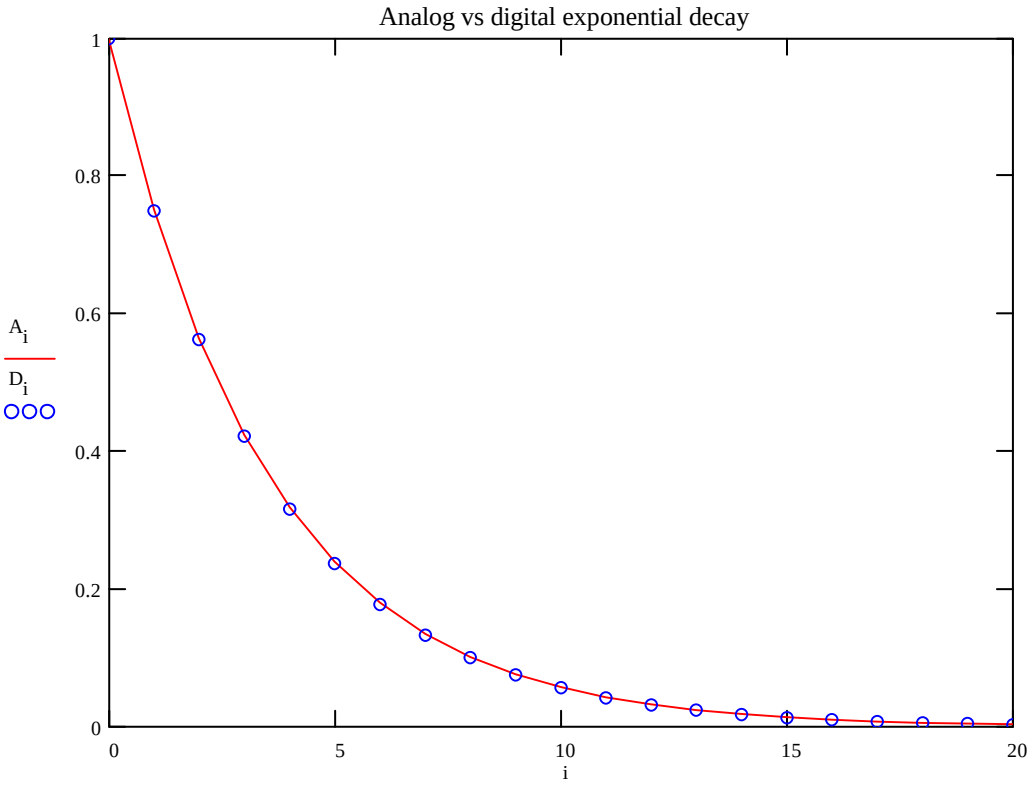
$n := 100$ $\quad i := 0 .. n$ The analog circuit starts at time zero (with value 1.0).

$\quad j := 1 .. n$ For the digital circuit, we assume there was a pulse at the input with value 1.0 at time zero.

$\delta := \frac{1}{4}$ $\quad \tau := \left(\frac{1}{\delta} - \frac{1}{2}\right)$ This is the equation for time constant that we want to check. The time constant τ is in units of sample period.

$D_0 := 1$ $\quad D_j := (1 - \delta) \cdot D_{j-1}$ Digital circuit response.

$A_i := e^{\frac{-i}{\tau}}$ Analog circuit response



It works pretty well even for large δ. (The approximation is best for small δ / large time constant, τ.)