1 Equations

1.1 Fourier Stuff

$$x(t) = \int_{-\infty}^{\infty} X(f)e^{j2\pi ft}\mathrm{d}f, X(f) = \int_{-\infty}^{\infty} x(t)e^{-j2\pi ft}\mathrm{d}t$$
$$\mathcal{F}\{\mathrm{rect}(t/T)\} = T\mathrm{sinc}(fT) = T\,\mathrm{sin}(\pi fT)/\pi fT$$
$$\mathcal{F}\{\mathrm{sinc}(t/T)\} = T\mathrm{rect}(fT)$$
$$\mathcal{F}\{1 - |\tau|/T\} = T\mathrm{sinc}^2(fT)$$
$$x(t) = \sum_{n=-\infty}^{\infty} c_n e^{j2\pi nf_o t}, c_n = \int_{-\infty}^{\infty} x(t)\exp(-j2\pi nf_o t)\mathrm{d}t$$

1.2 Basic Signals and Systems Stuff

$$\textstyle\int_{-\infty}^{\infty} x^2(t)\mathrm{d}t = \int_{-\infty}^{\infty} |X(f)|^2\mathrm{d}f$$
$$\psi_x(f) = |X(f)|^2, G_x(f) = \textstyle\sum |c_n|^2\delta(f - nf_o), G_x(f) = \lim_{T\to\infty} \frac{1}{T}|X_T(f)|^2$$
$$R_x(\tau) = \textstyle\int_{-\infty}^{\infty} x(t)x(t+\tau)\mathrm{d}t, R_x(\tau) = \lim_{T\to\infty} \frac{1}{T}\int_{-\infty}^{\infty} x(t)x(t+\tau)\mathrm{d}t$$
$$\mathrm{sinc}(1.4/\pi) \approx 0.707, \textstyle\int_{-\infty}^{\infty} \mathrm{sinc}(x)\mathrm{d}x = 1$$
$$y(t) = x(t) * h(t) = \textstyle\int_{-\infty}^{\infty} x(t-\tau)h(\tau)\mathrm{d}\tau$$

1.3 Trig.

$$\sin(a+b) = \sin a\cos b + \cos a\sin b, \cos(a+b) = \cos a\cos b - \sin a\sin b$$
$$\sin(a\pm b) = \sin a\cos b \pm \cos a\sin b, \cos(a\pm b) = \cos a\cos b \mp \sin a\sin b$$
$$\sin 2a = 2\sin a\cos a, \cos 2a = \cos^2 a - \sin^2 a = 2\cos^2 a - 1, \cos^2 a = 0.5 + 0.5\cos(2a)$$
$$\cos a = (e^{ja} + e^{-ja})/2, \sin a = (e^{ja} - e^{-ja})/j2, \tan a = \sin a/\cos a$$

1.4 Analog-to-Digital

$$\mathrm{SNR\ [dB]} = 10\log(\mathrm{SNR})$$
$$SNR_q = \sigma_x^2/(q^2/12), SNR_{q,dB} = 6.02b + 10.8 + 10\log(\sigma_x^2/V_{pp}^2), SNR_j = 3/(\sigma_t^2 + f_H^2)$$

1.5 Probability

$$p_X(x) = \mathrm{d}F_X(x)/\mathrm{d}x$$
$$p_n(x) = \frac{\exp\{[-(x-\mu)^2]/2\sigma^2\}}{\sqrt{2\pi\sigma^2}}, F_n(X > a) = Q((a-\mu)/\sigma)$$
$$E[X^n] = \textstyle\int_{-\infty}^{\infty} x^n p(x)\mathrm{d}x, \sigma_x^2 = E[(X - m_x)^2] = E[X^2] - m_x^2$$
$$G_x(f) = \textstyle\int_{-\infty}^{\infty} R_x(\tau)\exp[-j2\pi f\tau]\mathrm{d}\tau, \sigma_x^2 = R_x(0) - m_x^2$$
$$-(z-a_1)^2/2\sigma_o^2 + \ln P(s_1) \underset{H_2}{\overset{H_1}{\gtrless}} (z-a_2)^2/2\sigma_o^2 + \ln P(s_2)$$
$$P_B = P(H_2|s_1)P(s_1) + P(H_1|s_2)P(s_2)$$

Q-Function Table

z	$Q(z)$	z	$Q(z)$
0.0	0.50000	2.0	0.02275
0.1	0.46017	2.1	0.01786
0.2	0.42074	2.2	0.01390
0.3	0.38209	2.3	0.01072
0.4	0.34458	2.4	0.00820
0.5	0.30854	2.5	0.00621
0.6	0.27425	2.6	0.00466
0.7	0.24196	2.7	0.00347
0.8	0.21186	2.8	0.00256
0.9	0.18406	2.9	0.00187
1.0	0.15866	3.0	0.00135
1.1	0.13567	3.1	0.00097
1.2	0.11507	3.2	0.00069
1.3	0.09680	3.3	0.00048
1.4	0.08076	3.4	0.00034
1.5	0.06681	3.5	0.00023
1.6	0.05480	3.6	0.00016
1.7	0.04457	3.7	0.00011
1.8	0.03593	3.8	0.00007
1.9	0.02872	3.9	0.00005