SOME USEFUL FORMULAS

\[ \sin \alpha \pm \sin \beta = 2 \sin \frac{1}{2}(\alpha \pm \beta) \cos \frac{1}{2}(\alpha \mp \beta) \]
\[ \cos \alpha + \cos \beta = 2 \cos \frac{1}{2}(\alpha + \beta) \cos \frac{1}{2}(\alpha - \beta) \]
\[ X(j\omega) = \int_{-\infty}^{\infty} x(t)e^{-j\omega t} \, dt \quad \quad x(t) = \frac{1}{2\pi} \int_{-\infty}^{\infty} X(j\omega)e^{j\omega t} \, d\omega \]

\[ x(t) = A_0 + \sum_{k=1}^{N} A_k \cos(2\pi f_k t + \phi_k) \]
\[ f(x) = a_0 + \sum_{n=1}^{\infty} \left( a_n \cos \frac{n\pi x}{L} + b_n \sin \frac{n\pi x}{L} \right) \]

\[ H(z) = \sum_{n=0}^{\infty} a^n z^{-n} = \frac{1}{1 - az^{-1}} \quad |a| < 1 \]

\[ y[n] = \sum_{k=0}^{M} b_k x[n-k] = \sum_{k=0}^{M} b_k A e^{j\phi} e^{j\omega(n-k)} \]

\[ e^x = 1 + \frac{x}{1} + \frac{x^2}{2.1} + \frac{x^3}{3.2.1} + \frac{x^4}{4.3.2.1} + \ldots \]
\[ 1 + x + x^2 + x^3 + x^4 + \ldots x^n = \frac{1-x^{n+1}}{1-x}, \quad x < 1 \]

<table>
<thead>
<tr>
<th>Time-Domain: ( x(t) )</th>
<th>Frequency-Domain: ( X(j\omega) )</th>
</tr>
</thead>
<tbody>
<tr>
<td>( e^{-\alpha t} u(t) \ (\alpha &gt; 0) )</td>
<td>( \frac{1}{a+j\omega} )</td>
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<tr>
<td>( e^{b t} u(-t) \ (b &gt; 0) )</td>
<td>( \frac{1}{b-j\omega} )</td>
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<tr>
<td>( u(t + \frac{1}{2}T) - u(t - \frac{1}{2}T) )</td>
<td>( \frac{\sin(\omega T/2)}{\omega/2} )</td>
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<tr>
<td>( \frac{\sin(\omega_b t)}{\pi t} )</td>
<td>( [u(\omega + \omega_b) - u(\omega - \omega_b)] )</td>
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<td>( \delta(t) )</td>
<td>( 1 )</td>
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<tr>
<td>( \delta(t - \tau) )</td>
<td>( e^{-j\omega \tau} )</td>
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<tr>
<td>( u(t) )</td>
<td>( \pi \delta(\omega) + \frac{1}{j\omega} )</td>
</tr>
<tr>
<td>( 1 )</td>
<td>( 2\pi \delta(\omega) )</td>
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<tr>
<td>( e^{j\omega t} )</td>
<td>( 2\pi \delta(\omega - \omega_0) )</td>
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<tr>
<td>( A \cos(\omega_0 t + \phi) )</td>
<td>( \pi A e^{j\phi} \delta(\omega - \omega_0) + \pi A e^{-j\phi} \delta(\omega + \omega_0) )</td>
</tr>
<tr>
<td>( \cos(\omega_0 t) )</td>
<td>( \pi \delta(\omega - \omega_0) + \pi \delta(\omega + \omega_0) )</td>
</tr>
<tr>
<td>( \sin(\omega_0 t) )</td>
<td>( -j\pi \delta(\omega - \omega_0) + j\pi \delta(\omega + \omega_0) )</td>
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