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Discrete Time Signals Formulas

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List of 14 Discrete Time Signals Formulas

Discrete Time Signals

1) Bilinear Transformation Frequency

Open Calculator

fx $$f_b = \frac{2 \cdot \pi \cdot f_c}{\tan\left(\pi \cdot \frac{f_c}{f_e}\right)}$$

ex $$76.81935\text{Hz} = \frac{2 \cdot \pi \cdot 4.52\text{Hz}}{\tan\left(\pi \cdot \frac{4.52\text{Hz}}{40.1\text{Hz}}\right)}$$

2) Cutoff Angular Frequency

Open Calculator

fx $$\omega_{co} = \frac{M \cdot f_{ce}}{W_{ss} \cdot K}$$

ex $$0.96\text{rad/s} = \frac{8 \cdot 2.52\text{Hz}}{7 \cdot 3\text{s}}$$

3) Damping Coefficient of Second Order Transmittance

Open Calculator

fx $$\zeta_o = \left(\frac{1}{2}\right) \cdot R_{in} \cdot C_{in} \cdot \sqrt{\frac{K_f \cdot L_o}{W_{ss} \cdot C_{in}}}$$

ex $$2.896851\text{Ns/m} = \left(\frac{1}{2}\right) \cdot 4.51\Omega \cdot 3.8\text{F} \cdot \sqrt{\frac{0.76 \cdot 4\text{H}}{7 \cdot 3.8\text{F}}}$$

4) Fourier Transform of Rectangular Window

Open Calculator

fx $$W_{rn} = \frac{\sin(2 \cdot \pi \cdot T_o \cdot f_{inp})}{\pi \cdot f_{inp}}$$

ex $$0.037345 = \frac{\sin(2 \cdot \pi \cdot 40 \cdot 5.01\text{Hz})}{\pi \cdot 5.01\text{Hz}}$$

5) Frequency Dirac Comb Angle

Open Calculator

fx $$\theta = 2 \cdot \pi \cdot f_{inp} \cdot \frac{1}{f_o}$$

ex $$0.629575\text{rad} = 2 \cdot \pi \cdot 5.01\text{Hz} \cdot \frac{1}{50\text{Hz}}$$

6) Hamming Window

Open Calculator

fx $$W_{hm} = 0.54 - 0.46 \cdot \cos\left(\frac{2 \cdot \pi \cdot n}{W_{ss} - 1}\right)$$

ex $$0.814263 = 0.54 - 0.46 \cdot \cos\left(\frac{2 \cdot \pi \cdot 2.11}{7 - 1}\right)$$

7) Hanning Window

Open Calculator

fx $$W_{hn} = \frac{1}{2} - \left(\frac{1}{2}\right) \cdot \cos\left(\frac{2 \cdot \pi \cdot n}{W_{ss} - 1}\right)$$

ex $$0.798112 = \frac{1}{2} - \left(\frac{1}{2}\right) \cdot \cos\left(\frac{2 \cdot \pi \cdot 2.11}{7 - 1}\right)$$

8) Initial Frequency of Dirac Comb Angle

Open Calculator

fx $$f_o = \frac{2 \cdot \pi \cdot f_{inp}}{\theta}$$

ex $$50.77219\text{Hz} = \frac{2 \cdot \pi \cdot 5.01\text{Hz}}{0.62\text{rad}}$$

9) Inverse Transmittance Filtering

Open Calculator

fx $$K_n = \left(\sin c\left(\pi \cdot \frac{f_{inp}}{f_e}\right)\right)^{-1}$$

ex $$1.306905 = \left(\sin c\left(\pi \cdot \frac{5.01\text{Hz}}{40.1\text{Hz}}\right)\right)^{-1}$$

10) Maximal Variation of Cutoff Angular Frequency

Open Calculator

fx $$M = \frac{\omega_{co} \cdot W_{ss} \cdot K}{f_{ce}}$$

ex $$8 = \frac{0.96\text{rad/s} \cdot 7 \cdot 3\text{s}}{2.52\text{Hz}}$$

11) Natural Angular Frequency of Second Order Transmittance

Open Calculator

fx $$\omega_n = \sqrt{\frac{K_f \cdot L_o}{W_{ss} \cdot C_{in}}}$$

ex $$0.338062\text{rad/s} = \sqrt{\frac{0.76 \cdot 4\text{H}}{7 \cdot 3.8\text{F}}}$$

12) Sampling Frequency of Bilinear

Open Calculator

fx $$f_e = \frac{\pi \cdot f_c}{\arctan\left(\frac{2 \cdot \pi \cdot f_c}{f_b}\right)}$$

ex $$40.09552\text{Hz} = \frac{\pi \cdot 4.52\text{Hz}}{\arctan\left(\frac{2 \cdot \pi \cdot 4.52\text{Hz}}{76.81\text{Hz}}\right)}$$

13) Transmittance Filtering

Open Calculator

fx $$K_f = \sin c\left(\pi \cdot \left(\frac{f_{inp}}{f_e}\right)\right)$$

ex $$0.765167 = \sin c\left(\pi \cdot \left(\frac{5.01\text{Hz}}{40.1\text{Hz}}\right)\right)$$

14) Triangular Window

Open Calculator

$$W_{tn} = 0.42 - 0.52 \cdot \cos\left(\frac{2 \cdot \pi \cdot n}{W_{ss} - 1}\right) - 0.08 \cdot \cos\left(\frac{4 \cdot \pi \cdot n}{W_{ss} - 1}\right)$$

ex

$$0.753159 = 0.42 - 0.52 \cdot \cos\left(\frac{2 \cdot \pi \cdot 2.11}{7 - 1}\right) - 0.08 \cdot \cos\left(\frac{4 \cdot \pi \cdot 2.11}{7 - 1}\right)$$

Variables Used

- C_{in} Initial Capacitance *(Farad)*
- f_b Bilinear Frequency *(Hertz)*
- f_c Distortion Frequency *(Hertz)*
- f_{ce} Central Frequency *(Hertz)*
- f_e Sampling Frequency *(Hertz)*
- f_{inp} Input Periodic Frequency *(Hertz)*
- f_o Initial Frequency *(Hertz)*
- K Clock Count *(Second)*
- K_f Transmittance Filtering
- K_n Inverse Transmittance Filtering
- L_o Input Inductance *(Henry)*
- M Maximal Variation
- n Number of Samples
- R_{in} Input Resistance *(Ohm)*
- T_o Unlimited Time Signal
- W_{hm} Hamming Window
- W_{hn} Hanning Window
- W_{rn} Rectangular Window
- W_{ss} Sample Signal Window
- W_{tn} Triangular Window
- ζ_o Damping Coefficient *(Newton Second per Meter)*

- **θ** Signal Angle *(Radian)*
- ω_{co} Cutoff Angular Frequency *(Radian per Second)*
- ω_{n} Natural Angular Frequency *(Radian per Second)*

Constants, Functions, Measurements used

- Constant: **pi**, 3.14159265358979323846264338327950288
  Archimedes' constant
- Function: **arctan**, arctan(Number)
  Inverse trigonometric tangent function
- Function: **cos**, cos(Angle)
  Trigonometric cosine function
- Function: **ctan**, ctan(Angle)
  Trigonometric cotangent function
- Function: **sin**, sin(Angle)
  Trigonometric sine function
- Function: **sinc**, sinc(Number)
  Sinc function (normalized)
- Function: **sqrt**, sqrt(Number)
  Square root function
- Function: **tan**, tan(Angle)
  Trigonometric tangent function
- Measurement: **Time** in Second (s)
  Time Unit Conversion
- Measurement: **Angle** in Radian (rad)
  Angle Unit Conversion
- Measurement: **Frequency** in Hertz (Hz)
  Frequency Unit Conversion
- Measurement: **Capacitance** in Farad (F)
  Capacitance Unit Conversion
- Measurement: **Electric Resistance** in Ohm (Ω)
  Electric Resistance Unit Conversion

- Measurement: **Inductance** in Henry (H)
  Inductance Unit Conversion
- Measurement: **Damping Coefficient** in Newton Second per Meter (Ns/m)
  Damping Coefficient Unit Conversion
- Measurement: **Angular Frequency** in Radian per Second (rad/s)
  Angular Frequency Unit Conversion

Check other formula lists

- **Continuous Time Signals Formulas**
- **Discrete Time Signals Formulas**

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