ECE 3041 Spring 2009

Homework No. 1

Due Week of January 19

Section L01, T12-3

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Homework. Determine X_{AVG}, X_{rms}, & cf for

$$x(t) = A \sin \omega t \qquad \omega = 2\pi f \qquad f = \frac{1}{T}$$

$$X_{AVG} = \frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x(t)\,dt = \boxed{0 = X_{AVG}}$$

$$X_{rms} = \sqrt{\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} x^2(t)\,dt} =$$

$$\sqrt{\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} A^2 \sin^2 \omega t\,dt}$$

$$\sin^2\theta = \frac{1}{2}\left[1 - \cos 2\theta\right]$$

$$X_{rms} = \sqrt{\frac{1}{T}\int_{-\frac{T}{2}}^{\frac{T}{2}} \frac{A^2}{2}\left[1 - \cos 2\omega t\right] dt} = \frac{A}{\sqrt{2}}$$

$$\boxed{X_{rms} = \frac{A}{\sqrt{2}}}$$

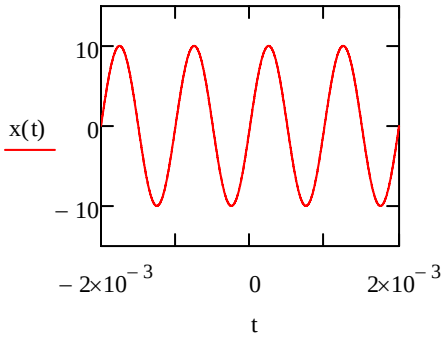
$$cf = \frac{A}{X_{rms}} = \boxed{\sqrt{2} = cf}$$

ECE 3041 Homework 1 Example

Determine the average, rms, and crest factor of x(t)

$A := 10 \cdot V \qquad T := 1ms \qquad f := \frac{1}{T} \qquad \omega := 2 \cdot \pi \cdot f$

$x(t) := A \cdot \sin(\omega \cdot t)$



$$X_{avg} := \frac{1}{T} \cdot \int_{\frac{-T}{2}}^{\frac{T}{2}} x(t)\, dt = 0\ V$$

$$X_{rms} := \sqrt{\frac{1}{T} \cdot \int_{\frac{-T}{2}}^{\frac{T}{2}} x(t)^2\, dt} = 7.071\ V$$

$$cf := \frac{A}{X_{rms}} = 1.414$$

$X_{avg} = 0\ V$ $X_{rms} = 7.071\ V$ $cf = 1.414$