[HOME]

Winding Currents

The current in a transformer winding has an AC component and a DC component.

$$I_{DC} = \frac{1}{T} \cdot \int_0^T i(t)\, dt \qquad I_{RMS} = \sqrt{\frac{1}{T} \cdot \int_0^T i(t)^2\, dt}$$

$$I_{AC}^2 = I_{RMS}^2 - I_{DC}^2 \qquad I_{RMS}^2 = I_{DC}^2 + I_{AC}^2$$

Derived current equations for some common wave shapes:

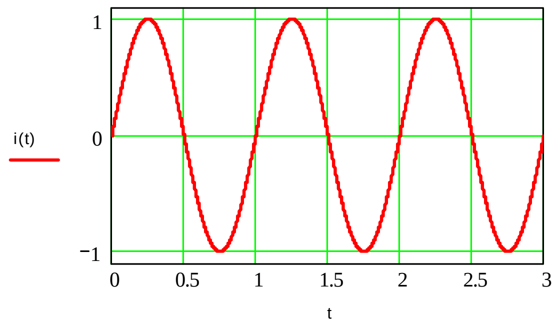
Sinusoid:

$i(t) := \sin(2 \cdot \pi \cdot t)$

$$I_{RMS} = \frac{I_{pk}}{\sqrt{2}} = 0.7071 \cdot I_{pk}$$

$$I_{DC} = 0$$

$$I_{AC} = \frac{I_{pk}}{\sqrt{2}}$$



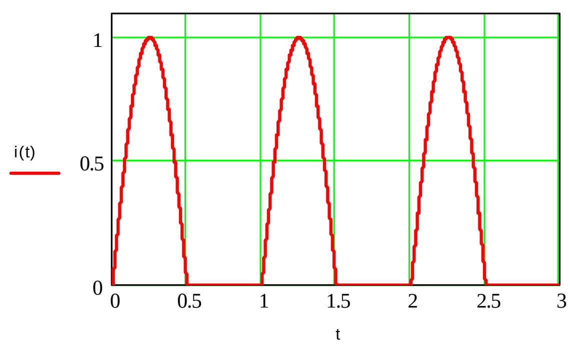
Half Sinusoid:

$i(t) := \mathrm{if}(x(t) < 0.5, \sin(2 \cdot \pi \cdot x(t)), 0)$

$$I_{RMS} = \frac{1}{2} \cdot I_{pk}$$

$$I_{DC} = \frac{I_{pk}}{\pi}$$

$$I_{AC} = I_{pk} \cdot \sqrt{\frac{\pi^2 - 4}{4 \cdot \pi^2}} = 0.3856 \cdot I_{pk}$$



1408 Airport Road | Endicott, NY 13760 |
Tel: 607-785-0938 | Fax 607-785-1109 |

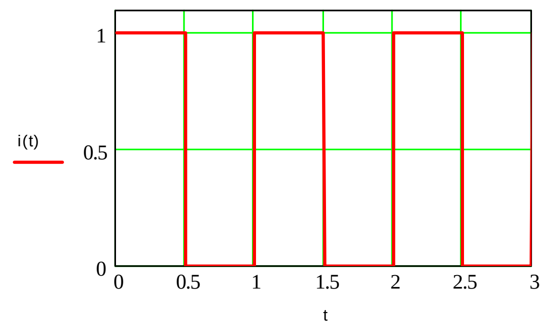
Rectangular Wave:

$$i(t) := \text{if}(x(t) < 0.5, 1, 0)$$

$$I_{RMS} = I_{pk} \cdot \sqrt{D}$$

$$I_{DC} = I_{pk} \cdot D$$

$$I_{AC} = I_{pk} \cdot \sqrt{D \cdot (1 - D)}$$



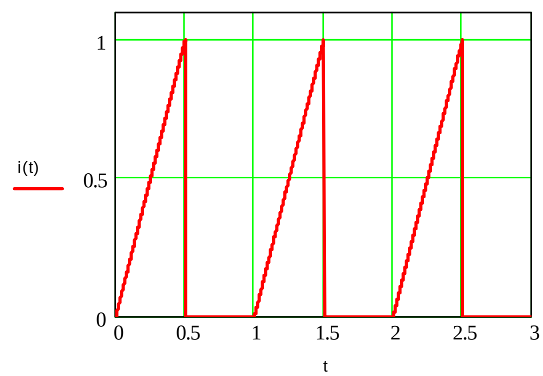
Triangle Wave:

$$i(t) := \text{if}(x(t) < 0.5, 2 \cdot x(t), 0)$$

$$I_{RMS} = I_{pk} \cdot \sqrt{\frac{D}{3}}$$

$$I_{DC} = I_{pk} \cdot \frac{D}{2}$$

$$I_{AC} = I_{pk} \cdot \sqrt{D \cdot \left(\frac{1}{3} - \frac{D}{4}\right)}$$



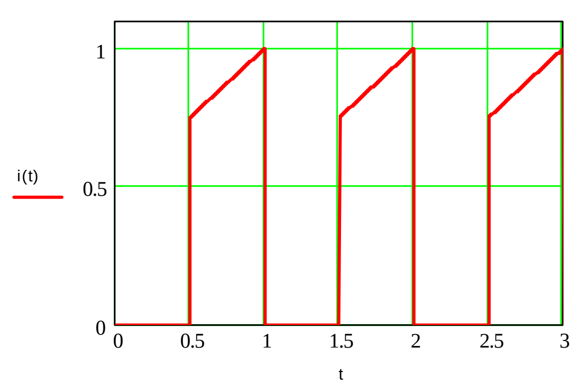
Trapezoid :

$$i(t) := \text{if}\left(x(t) < 0.5, 0, 0.5 + \frac{x(t)}{2}\right)$$

$$I_{RMS} = \sqrt{\frac{\left(I_m^{\,2} + I_m \cdot I_{pk} + I_{pk}^{\,2}\right) \cdot D}{3}}$$

$$I_{DC} = \frac{I_{pk} + I_m}{2} \cdot D$$

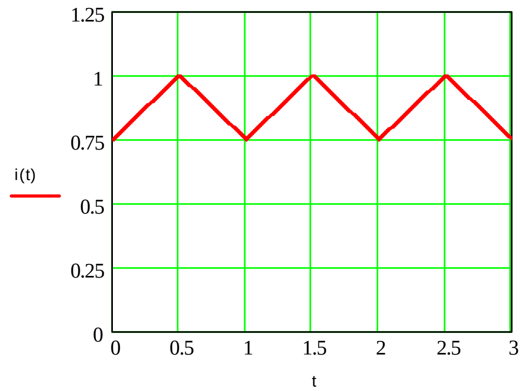
$$I_{AC} = \sqrt{\frac{\left(I_m^{\,2} + I_m \cdot I_{pk} + I_{pk}^{\,2}\right) \cdot D}{3} - \left(\frac{I_{pk} + I_m}{2} \cdot D\right)^2}$$



Continuous Output Inductor Current:

$$i(t) := \text{if}\left[x(t) < 0.5,\ 0.75 + \frac{x(t)}{2},\ 1 - \left(\frac{x(t)}{2} - .25\right)\right]$$

$$I_{RMS} = \sqrt{I_{pk}^{2} - I_{pk} \cdot \Delta I + \frac{1}{3} \cdot \Delta I^{2}}$$



$$I_{DC} = \frac{1}{2} \cdot \left(2 \cdot I_{pk} - \Delta I\right)$$

$$I_{AC} = \frac{\Delta I}{\sqrt{12}}$$

[HOME]

1408 Airport Road | Endicott, NY 13760 |
Tel: 607-785-0938 | Fax 607-785-1109 |