Square Wave Fourier Series Representation
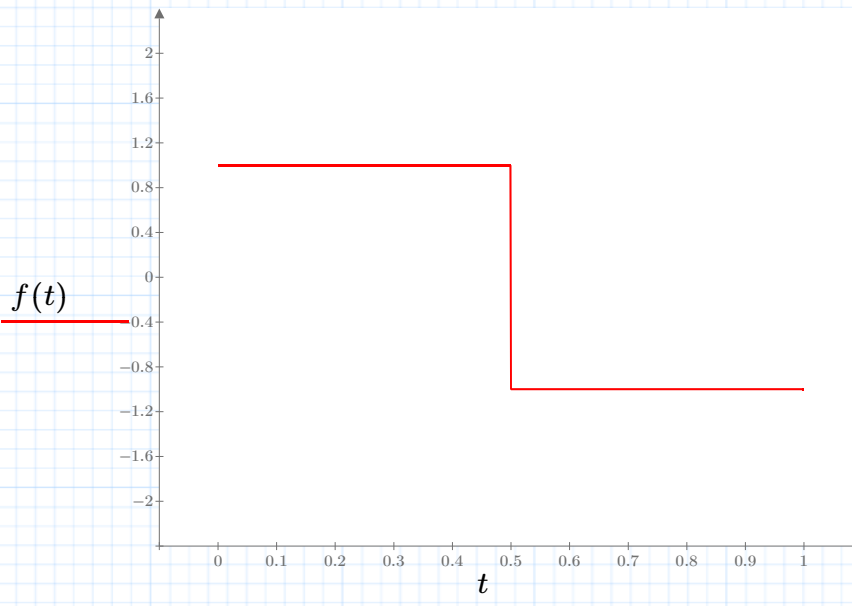
<u>function definition</u>:

$$T := 1 \qquad period \qquad\qquad t := 0, \frac{T}{1000} .. T$$

$$f(t) := \begin{Vmatrix} \text{if } 0 \le t \le \dfrac{T}{2} \\ \quad \begin{Vmatrix} 1 \end{Vmatrix} \\ \text{if } \dfrac{T}{2} \le t \le T \\ \quad \begin{Vmatrix} -1 \end{Vmatrix} \end{Vmatrix}$$

$f(t)$

t

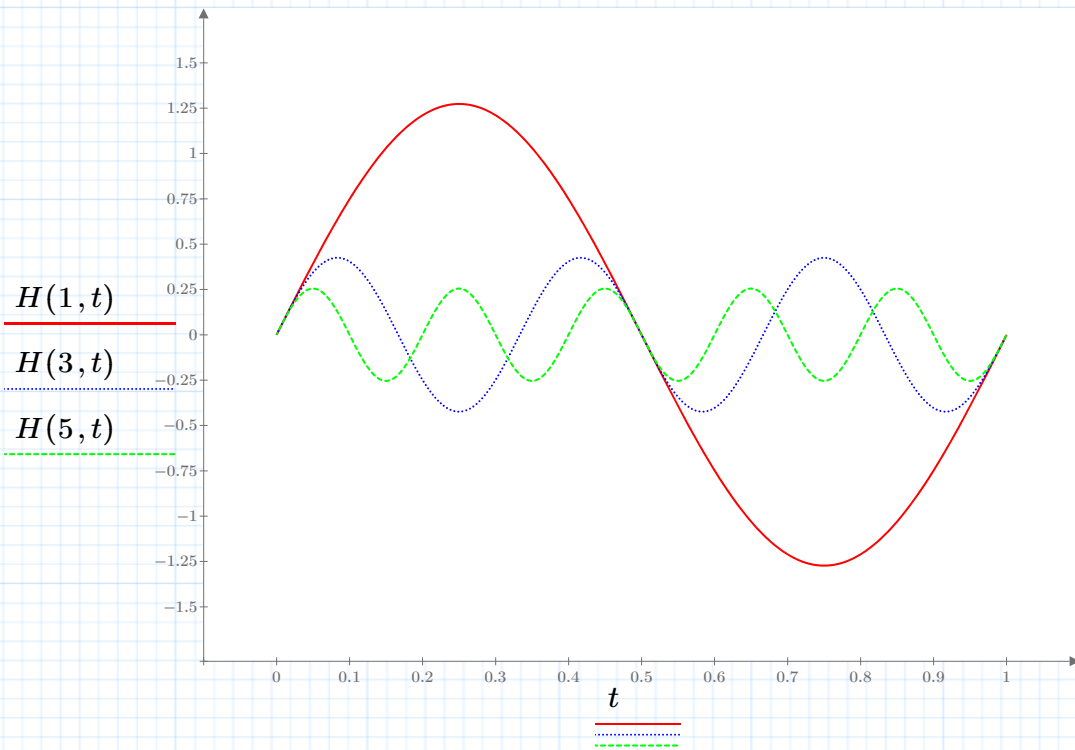<u>Fourier series representation</u>:

$$\omega_0 := \frac{2 \cdot \pi}{T} \qquad\qquad\qquad\qquad \text{fundamental frequency}$$

$$B(i) := \frac{2}{i \cdot \pi} \cdot (1 - \cos(i \cdot \pi)) \qquad\qquad \text{harmonic amplitude}$$
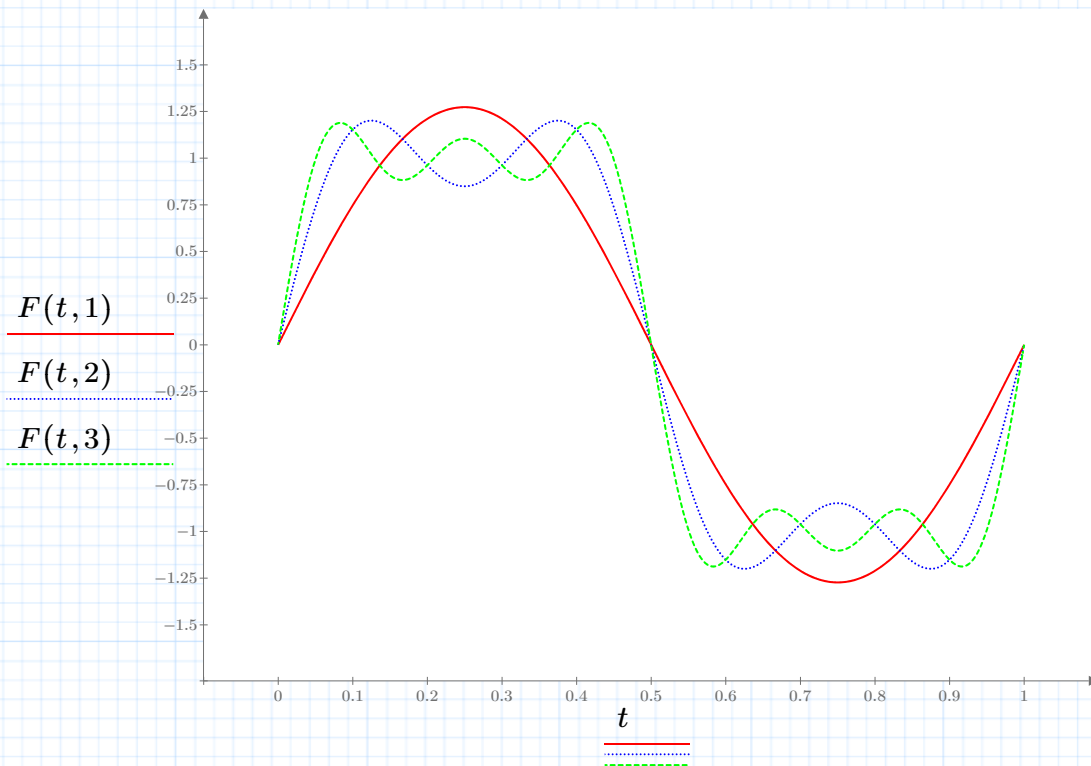
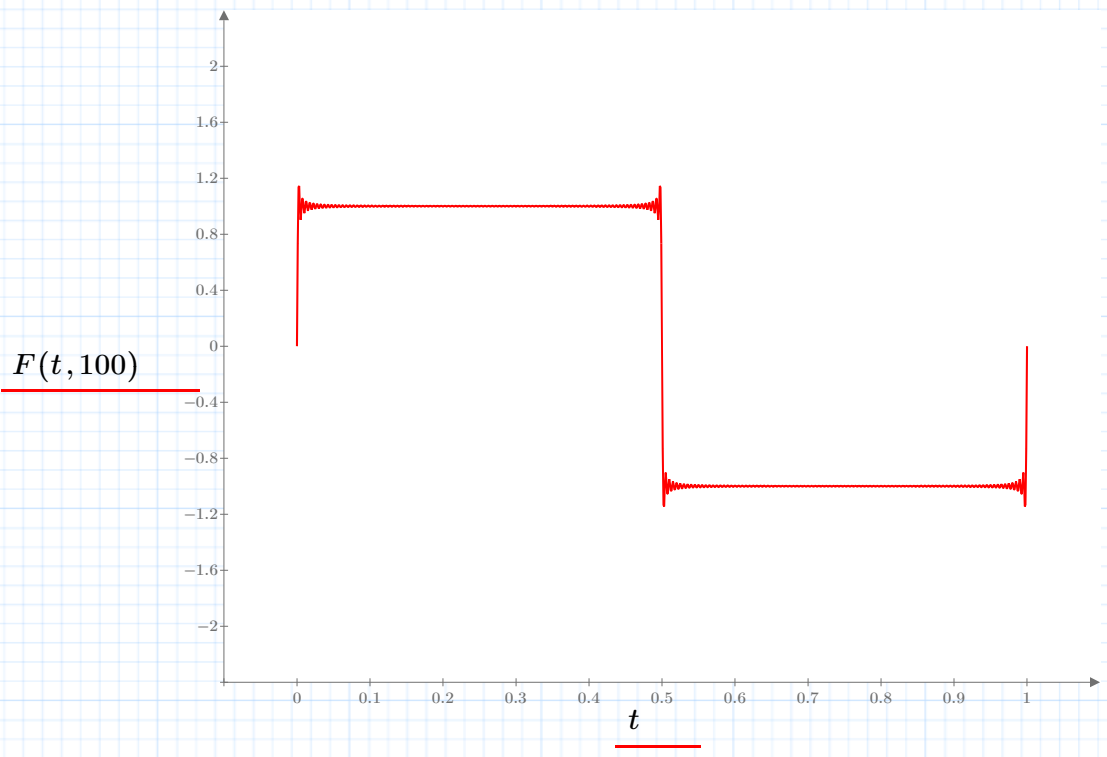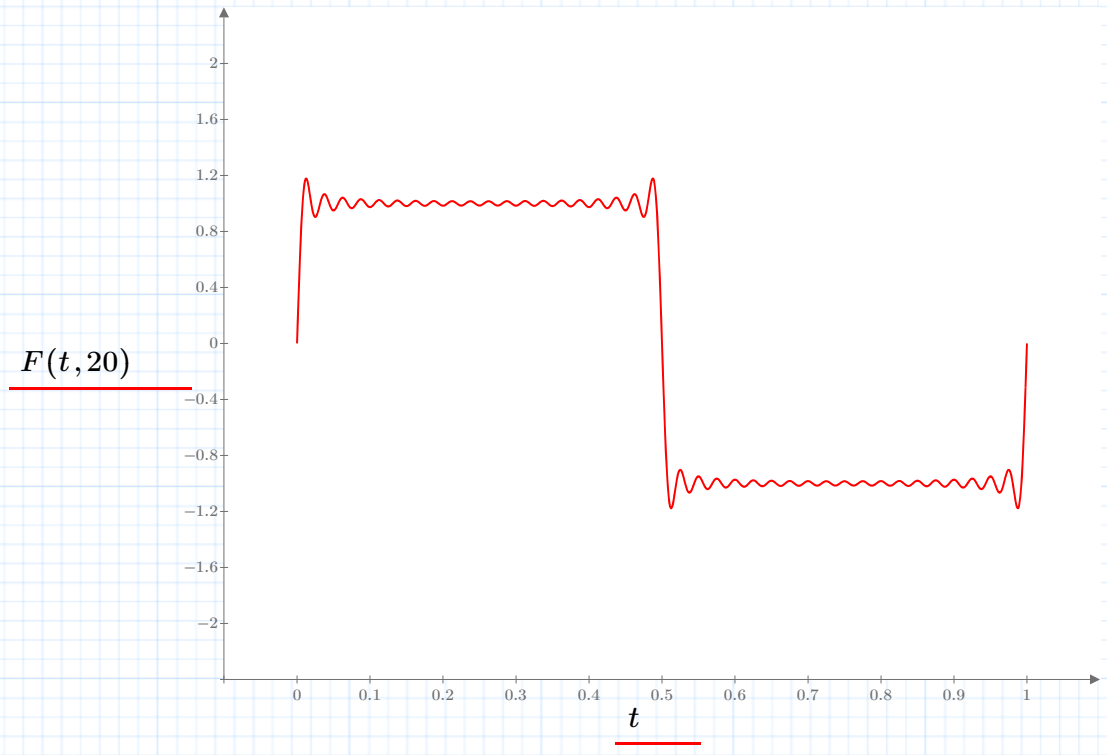$$H(i, t) := B(i) \cdot \sin(i \cdot \omega_0 \cdot t) \qquad\qquad \text{harmonic}$$

$$F(t, n) := \sum_{i=1}^{n} \left(\frac{4}{(2 \cdot i - 1) \cdot \pi} \cdot \sin\big((2 \cdot i - 1) \cdot \omega_0 \cdot t\big) \right) \qquad \text{Fourier series}$$

individual harmonics:

combination of harmonics:

$F(t,20)$

t

$F(t,100)$

t

spectrum:

$$i := 1 .. 13$$

$B(i)$

i