EGR 272
Circuit Theory II
File: Fourier1.MCD

Fourier Series Example: Ramp Waveform

Problem: Consider the periodic waveform shown above.

The Fourier Series representing v(t) has been determined to be

$$v(t) = 5 - \frac{10}{\pi}\sin(2000\pi t) - \frac{10}{2\pi}\sin(4000\pi t) - \frac{10}{3\pi}\sin(6000\pi t) - \text{.....}$$

Use MathCAD to graph v(t) as each term is added to see how this series of sinusoids will actually produce the ramp waveform shown above.

$t := 0, 0.000001 .. 0.003$ (let t vary from 0 to 3ms in order to graph 3 periods)

$V0(t) := 5$ (DC term only)

$V1(t) := V0(t) - \frac{10}{\pi}\cdot\sin(1\cdot 2000\cdot\pi\cdot t)$ (DC term + 1st harmonic)

$V2(t) := V1(t) - \frac{10}{2\cdot\pi}\cdot\sin(2\cdot 2000\cdot\pi\cdot t)$ (DC term + 1st and 2nd harmonics)

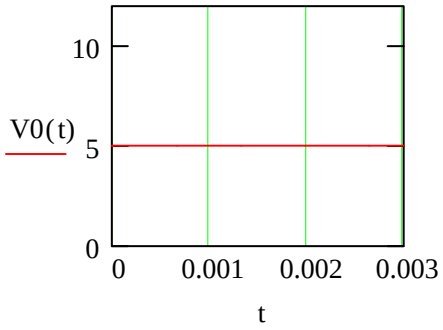
$V3(t) := V2(t) - \frac{10}{3\cdot\pi}\cdot\sin(3\cdot 2000\cdot\pi\cdot t)$ (DC term + 1st, 2nd, and 3rd harmonics)

$V4(t) := V3(t) - \frac{10}{4\cdot\pi}\cdot\sin(4\cdot 2000\cdot\pi\cdot t)$ (DC term + 1st - 4th harmonics)

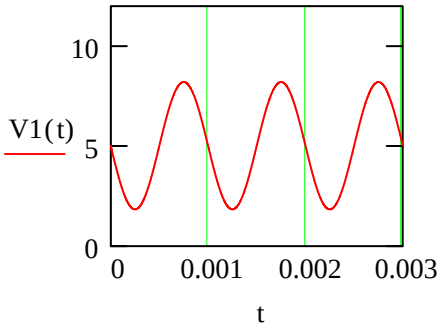
$V5(t) := V4(t) - \frac{10}{5\cdot\pi}\cdot\sin(5\cdot 2000\cdot\pi\cdot t)$ (DC term + 1st - 5th harmonics)

$$V100(t) := 5 - \sum_{N=1}^{100}\left(\frac{10}{N\cdot\pi}\cdot\sin(N\cdot 2000\cdot\pi\cdot t)\right)$$ (DC term + 1st - 100th harmonics)

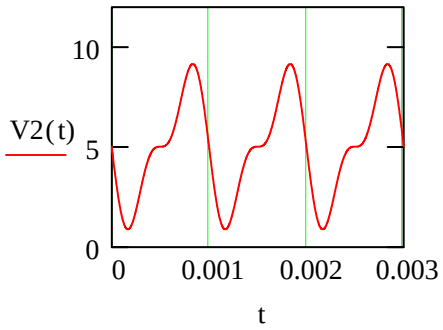
DC term only



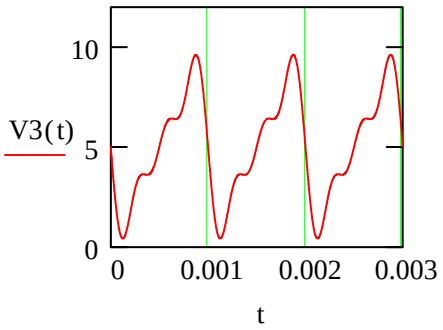
DC term + 1st harmonic



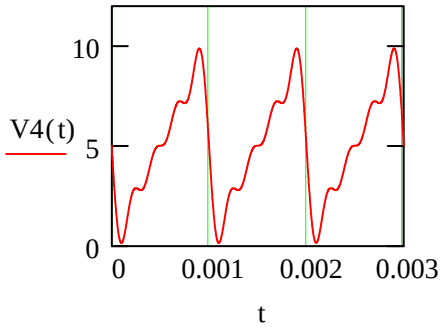
DC term + 1st and 2nd harmonics



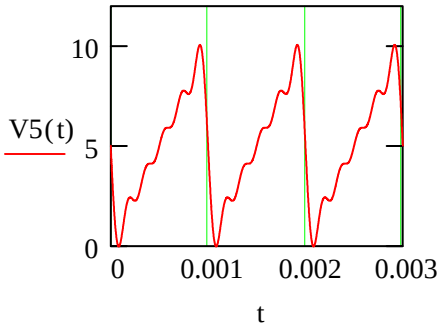
DC term + 1st, 2nd, and 3rd harmonics



DC term + 1st - 4th harmonics



DC term + 1st - 5th harmonics



DC term + 1st - 100th harmonics