

Using superposition with MNA method

Utilities

Instead simplfiy

$$SN(x\#) := \left| \text{str2num}(\text{eval}(\text{num2str}(x\#))) \right|$$

Complex Signum

$$c\text{sign}(z) := \begin{cases} \text{sign}(\text{Re}(z)) & \text{if } \text{Re}(z) \neq 0 \\ \text{sign}(\text{Im}(z)) & \text{otherwise} \end{cases}$$

Circuit and admittance matrix, by hand or using MNA function from the other worksheet.

V1	1	0
R1	1	2
C1	2	0
RT	2	3
CT	2	3
LK	3	4
RK	4	5
CK	5	0
RO	5	0
CO	5	0

$$A := \begin{bmatrix} \frac{1}{R1} & -\frac{1}{R1} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 1 \\ -\frac{1}{R1} & \frac{R1 \cdot (1 + s \cdot CT \cdot RT + s \cdot C1 \cdot RT) + RT}{R1 \cdot RT} & -\frac{1 + s \cdot CT \cdot RT}{RT} & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & -\frac{1 + s \cdot CT \cdot RT}{RT} & \frac{RT \cdot (1 + s^2 \cdot CT \cdot LK) + s \cdot LK}{s \cdot LK \cdot RT} & -\frac{1}{s \cdot LK} & 0 & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{s \cdot LK} & \frac{RK + s \cdot LK}{s \cdot LK \cdot RK} & -\frac{1}{RK} & 0 & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{RK} & \frac{RK \cdot (1 + s \cdot CO \cdot RO + s \cdot CK \cdot RO) + RO}{RK \cdot RO} & 0 & 0 & 0 & 0 & 0 & 0 \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$\chi := "X"$

Solve the Linear System

$$B := [0 \ 0 \ 0 \ 0 \ 0 \ 0 \ V1s]^T \quad V := SN(A^{-1} \cdot B)$$

Complex Freq

$$H(s, C1) := SN \left(\begin{bmatrix} V \\ 2 \\ V \\ 1 \end{bmatrix} \right) \quad \text{or } H(s, C1, R1, XT, RT, \dots)$$

Square Wave

$$v_1(t, f) := Vo \cdot c\text{sign}(-i \cdot e^{i \cdot 2 \cdot \pi \cdot f \cdot t})$$

Values

$$\begin{aligned} R1 &:= 327.1 \text{ k}\Omega & C1 &:= 200 \text{ pF} & Vo &:= 0.8 \text{ V} \\ RT &:= 9 \text{ M}\Omega & CT &:= 12.78 \text{ pF} & LK &:= 250 \text{ nH} \\ RK &:= 1.5 \ \Omega & CK &:= 100 \text{ pF} \\ RO &:= 1 \text{ M}\Omega & CO &:= 15 \text{ pF} \end{aligned}$$

Frequency

$$f := 1000 \text{ Hz}$$

FFT Soltuions

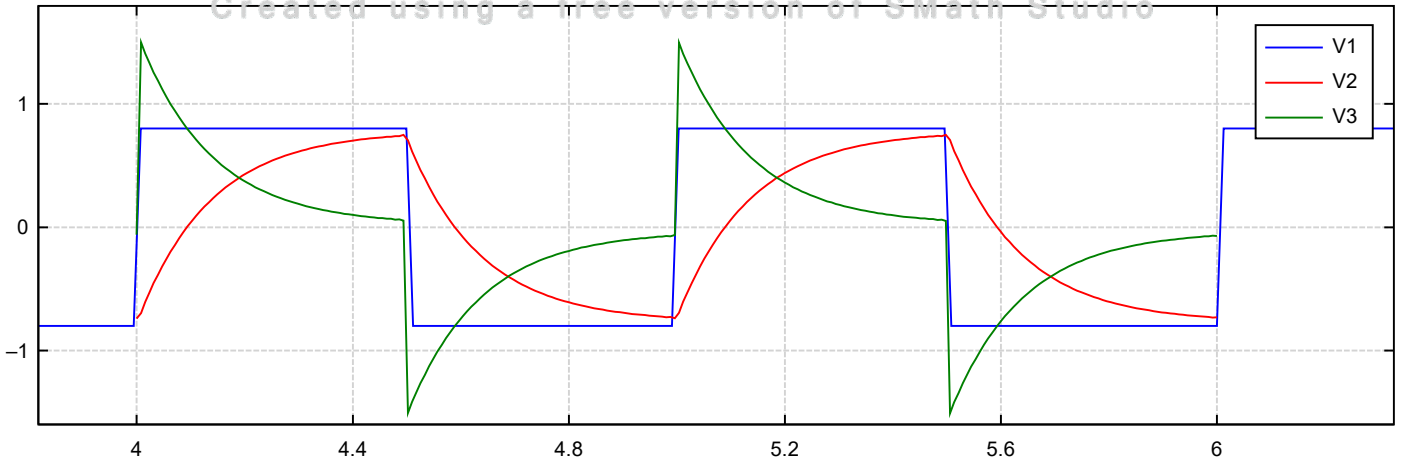
$$N := 2^8 \quad T := \frac{[1..N] - 1}{N - 1} \cdot \frac{2}{f} + \frac{4}{f} \quad k := [1..(0.5 \cdot N + 1)]$$

$$v_{1F} := \overrightarrow{v_1(T, f)} \quad V_{1F} := \text{fft}(v_{1F})$$

$$V_{2F} := \text{try} \left(\text{eval} \left(H(i \cdot (k - 1) \cdot 2 \cdot \pi \cdot f, C1) \cdot \frac{1}{N} \cdot V_{1F} \right)_k \right) \text{ on error } 0$$

$$\Pi := \begin{cases} \text{Re} \left(v_1 \left(\frac{x}{f}, f \right) \right) \\ \text{augment} \left(T \cdot f, \overrightarrow{\text{Re}(v_{2F})} \right) \\ \text{augment} \left(T \cdot f, \overrightarrow{\text{Re}(v_{1F} - v_{2F})} \right) \end{cases}$$

$$v_{2F} := \text{ifft} \left(\text{eval} \left(\text{stack} \left(V_{2F}, \overrightarrow{\text{reverse} \left(V_{2F} [2..(0.5 \cdot N)] \right)} \right) \right) \right) \cdot N \text{ V}$$



Alvaro

appVersion(4) = "1.74.9654.0"