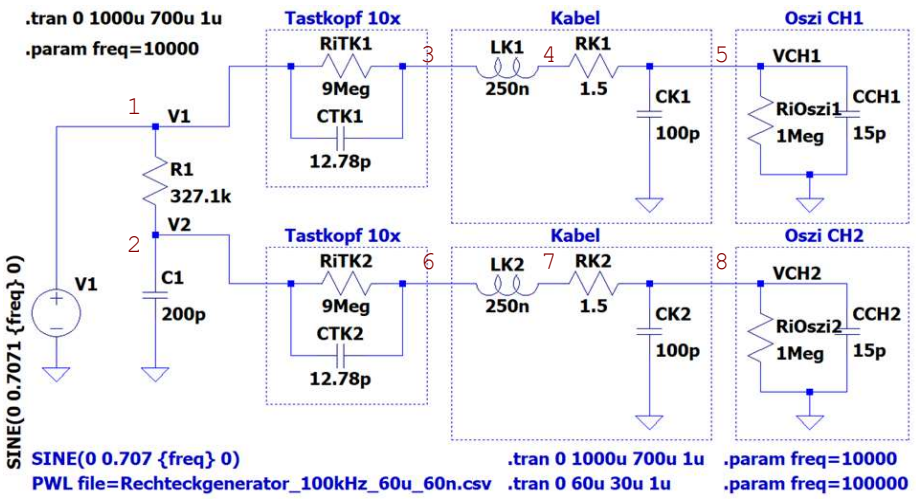
MNA & Spice#




```
V1 1 0
R1 1 2
C1 2 0
Ri1 1 3
CT1 1 3
LK1 3 4
RK1 4 5
CK1 5 0
Rio1 5 0
CH1 5 0
Ri2 2 6
CT2 2 6
LK2 6 7
RK2 7 8
CK2 8 0
RiO2 8 0
CH2 8 0
```

```
V1 1 0 V1s
R1 1 2 327.1k
C1 2 0 200p
Ri1 1 3 9M
CT1 1 3 12.78p
LK1 3 4 250n
RK1 4 5 1.5
CK1 5 0 100p
Rio1 5 0 1M
CH1 5 0 15p
Ri2 2 6 9M
CT2 2 6 12.78p
LK2 6 7 250n
RK2 7 8 1.5
CK2 8 0 100p
RiO2 8 0 1M
CH2 8 0 15p
```

$\chi s := \text{"}\chi s\text{"}$ $\chi\# := \text{""}$

Numeric solution

$circ := \text{strrep}(\text{description}(\chi\#), \text{"V1s"}, \text{"SINE(0 0.7071 10000 0)"})$

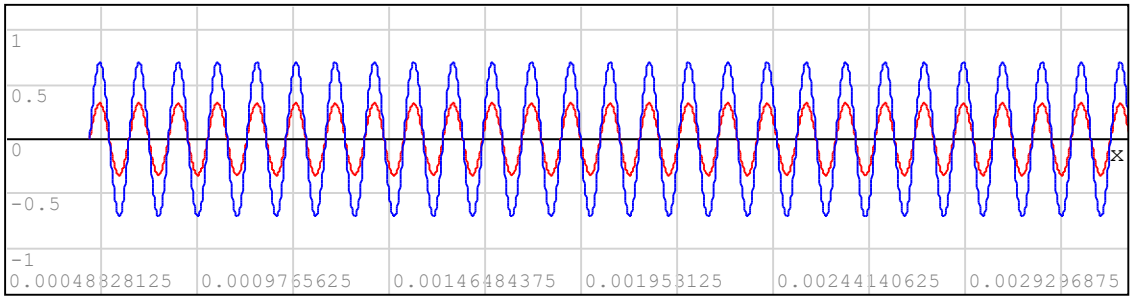
$mode := \text{".TRAN 0 10000u 700u 1u"}$

$save := \text{".SAVE V(1) V(2) I(R1)"}$

$CR := \text{num2str}(\text{str2num}(\text{concat}(\text{"\"}, \text{"000D"}, \text{"\"})))$

$M := \text{"\{CR\}\{circ\}\{CR\}\{mode\}\{CR\}\{save\}\{CR\}.END"}, \_$

$T := \text{col}(M, 1)$



$$\begin{cases} \text{augment}(T, \text{col}(M, 2)) \\ \text{augment}(T, 100000 \cdot \text{col}(M, 3)) \end{cases}$$

Simbolic solution

$[A\ B\ X\ V\ I] := MNA(\chi s)$

$$A = \begin{bmatrix} \frac{R1 \cdot (1 + s \cdot CT1 \cdot Ri1)}{R1 \cdot Ri1} + Ri1 & -\frac{1}{R1} & -\frac{1 + s \cdot CT1 \cdot Ri1}{Ri1} & 0 & 0 & 0 & 0 & 0 & 0 \\ -\frac{1}{R1} & \frac{R1 \cdot (1 + s \cdot CT2 \cdot Ri2 + s \cdot C1 \cdot Ri2)}{R1 \cdot Ri2} + Ri2 & 0 & 0 & 0 & 0 & -\frac{1 + s \cdot CT2 \cdot Ri2}{Ri2} & 0 & 0 \\ -\frac{1 + s \cdot CT1 \cdot Ri1}{Ri1} & 0 & \frac{Ri1 \cdot (1 + s^2 \cdot CT1 \cdot LK1) + s \cdot LK1}{s \cdot LK1 \cdot Ri1} & -\frac{1}{s \cdot LK1} & 0 & 0 & 0 & 0 & 0 \\ 0 & 0 & -\frac{1}{s \cdot LK1} & \frac{RK1 + s \cdot LK1}{s \cdot LK1 \cdot RK1} & -\frac{1}{RK1} & 0 & 0 & 0 & 0 \\ 0 & 0 & 0 & -\frac{1}{RK1} & \frac{RK1 \cdot (1 + s \cdot CH1 \cdot Rio1 + s \cdot CK1 \cdot Rio1) + Rio1}{RK1 \cdot Rio1} & 0 & 0 & 0 & 0 \\ 0 & -\frac{1 + s \cdot CT2 \cdot Ri2}{Ri2} & 0 & 0 & 0 & 0 & \frac{Ri2 \cdot (1 + s^2 \cdot CT2 \cdot LK2) + s \cdot LK2}{s \cdot LK2 \cdot Ri2} & -\frac{1}{s \cdot LK2} & 0 \\ 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{s \cdot LK2} & \frac{RK2 + s \cdot LK2}{s \cdot LK2 \cdot RK2} & -\frac{1}{RK2} \\ 0 & 0 & 0 & 0 & 0 & 0 & 0 & -\frac{1}{RK2} & \frac{RK2 \cdot (1 + s \cdot CH2 \cdot RiO2) + s \cdot}{RK2 \cdot RiO2} \\ 1 & 0 & 0 & 0 & 0 & 0 & 0 & 0 & 0 \end{bmatrix}$$

$$I = \Big[-\frac{\Big(-\Big(\Big(\Big(-\big(RiO2+RK2\cdot\big(1+s\cdot RiO2\cdot\big(CH2+CK2\big)\big)\big)\Big)\cdot\Big(\big(RK2+s\cdot LK2\big)\cdot\big(Ri2\cdot\big(1+s^{2}\cdot CT2\cdot LK2\big)+s\cdot LK2\big)\cdot\Big(\big(Ri1\cdot\big(1+s^{2}\cdot CT1\cdot LK1\big)+s\cdot LK1\big)\cdot Rio1\cdot s\cdot LK1-\big(Rio1+RK1\cdot\big(1+s\cdot Rio1\cdot\big(CH1+CK1\big)\big)\big)\Big)\cdot\Big(\big(RK1+s\cdot LK1\big)\cdot\big(Ri1\cdot\big(1+s \cdots}{\cdots}$$

$$B = \begin{bmatrix} 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ 0 \\ V1 \end{bmatrix} \qquad X = \begin{bmatrix} V(1) \\ V(2) \\ V(3) \\ V(4) \\ V(5) \\ V(6) \\ V(7) \\ V(8) \\ I(V1) \end{bmatrix}$$

$$V = \Big[-\frac{s\cdot LK2\cdot\big(1+s\cdot CT2\cdot Ri2\big)\cdot\Big(\Big(\Big(\Big(\big(-\big(Ri1\cdot\big(1+s^{2}\cdot CT1\cdot LK1\big)+s\cdot LK1\big)\cdot Rio1\cdot s\cdot LK1+\big(Rio1+RK1\cdot\big(1+s\cdot Rio1\cdot\big(CH1+CK1\big)\big)\big)\big)\cdot\big(\big(RK1+s\cdot LK1\big)\cdot\big(Ri1\cdot\big(1+s^{2}\cdot CT1\cdot LK1\big)+s\cdot LK1\big)-Ri1\cdot RK1\big)\big)\cdot\Big(\Big(\cdots}{\cdots}$$

Alvaro

appVersion(4) = "1.73.9126.0"