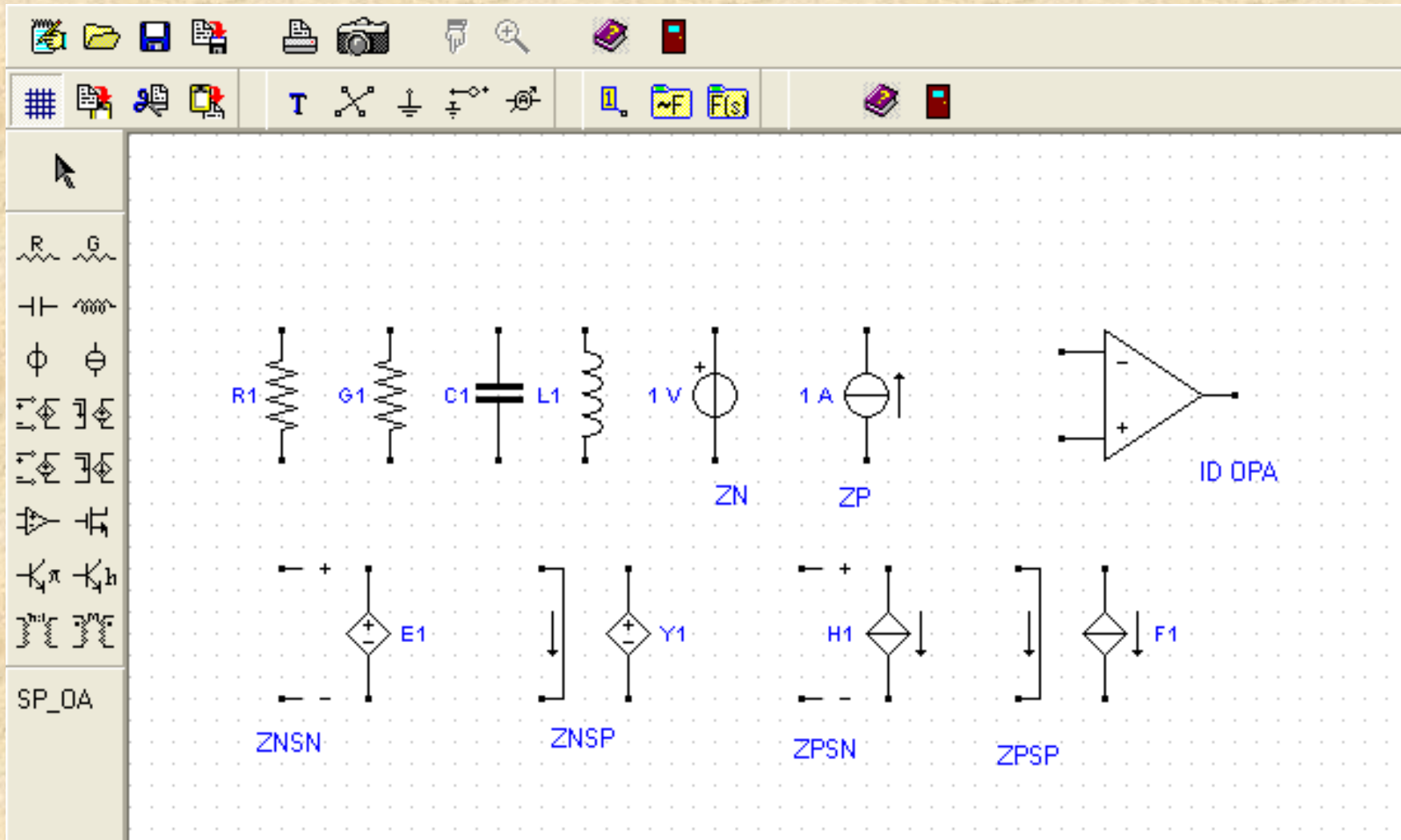


Zajęcia 4

Program SapWin

**Rozwiązywanie
liniowych obwodów elektrycznych**



Name:

Value:

☒ Symbolic

Name:

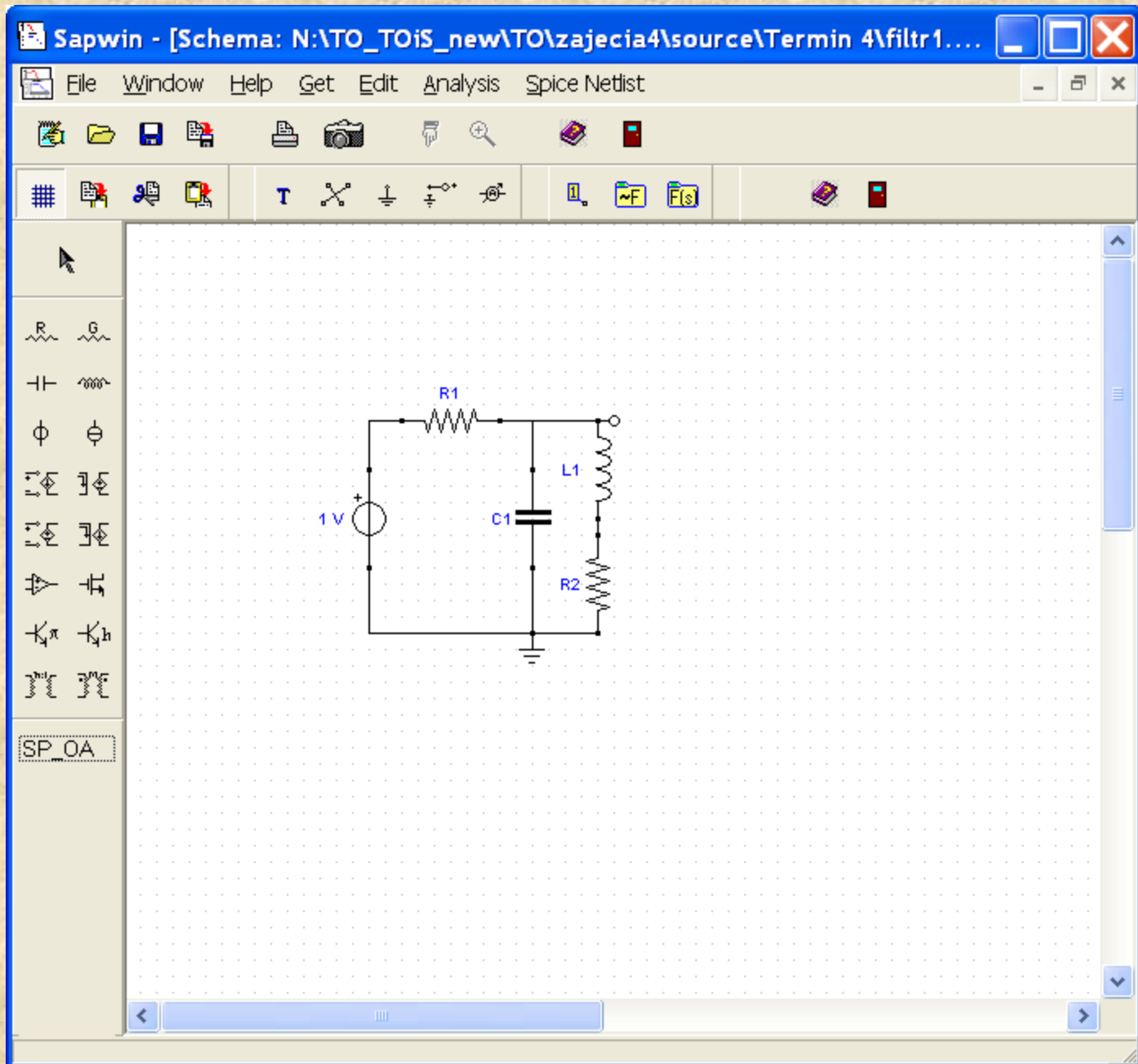
Value:

☒ Symbolic

Uwaga!

Linie, które nie mają się łączyć
nie mogą krzyżować się pod
kątem prostym!

Na schemacie musi być zaznaczone
jedno (i tylko jedno)
napięcie lub prąd wyjściowe



Sapwin - [filtr1.fdt - Numeric]

File Window Help Symbolic Numeric Phasor Gain Loss Phase Delay Pole/Zero

Step Resp. Impulse Resp. List of Values Approximation



$$1000 \frac{s + 10}{s^2 + 1010s + 1.01e+06}$$

End Time: 1 s

Frequency Interval

Start 2

End 10000

☐ Hz ☒ rad/s

☐ Y Linear ☐ X Linear



Refresh

Components

Parameter

C1	1E-5
L1	0.1
R1	100
R2	1



frequency = 159.15 Hz = 1000 rad/s

$0.9901 - j 9.802e-05 = 0.9901 \text{ arg}(-0.0056723^\circ)$

Frequency

1000

☐ Hz ☒ rad/s

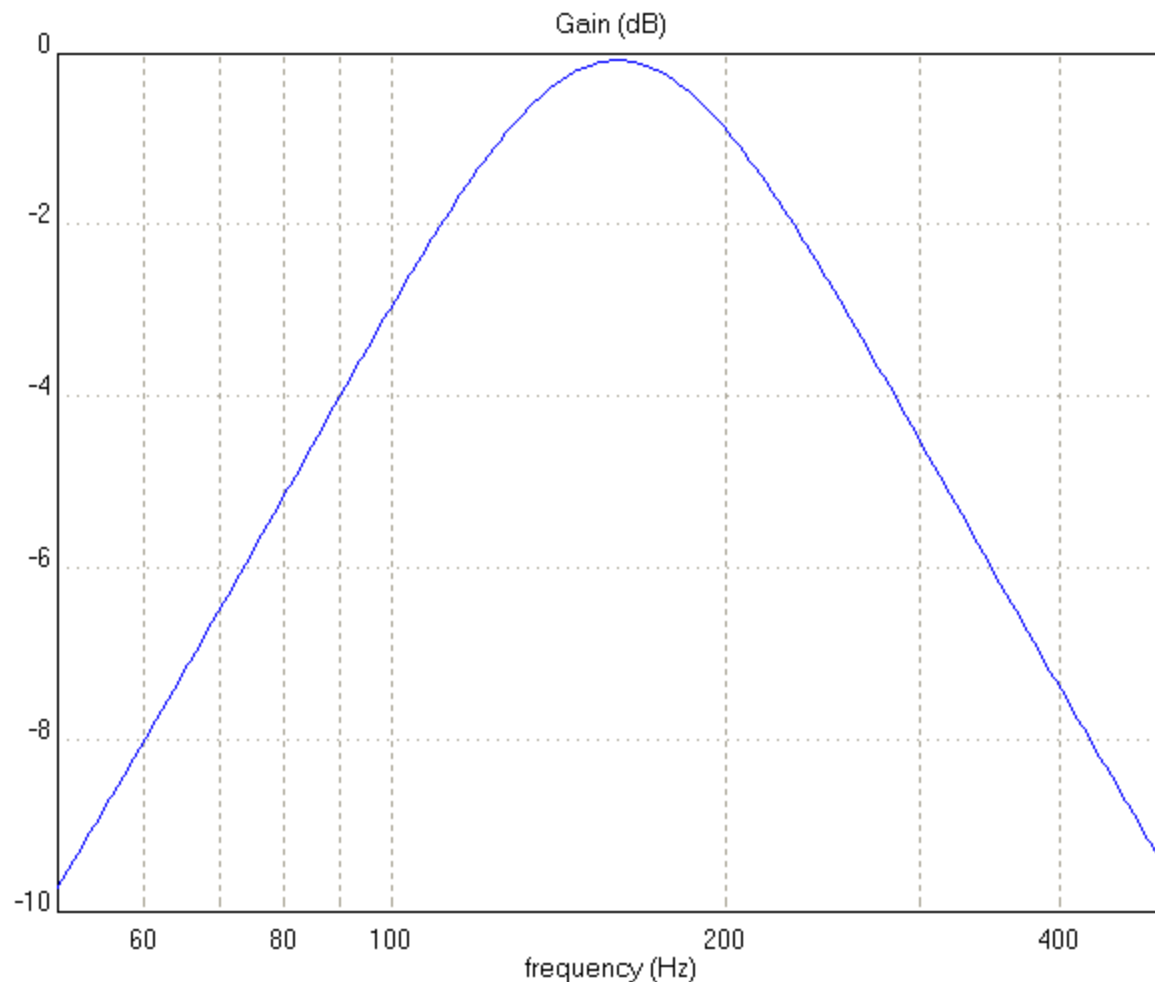
Refresh

Components

C1	1E-5
L1	0.1
R1	100
R2	1

Sapwin - [filtr1.fdt - Gain]

File Window Help Symbolic Numeric Phasor Gain Loss Phase Delay Pole/Zero Step Resp.
Impulse Resp. List of Values Approximation



End Time: 1 s

Frequency Interval

Start 50

End 500

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear



Refresh

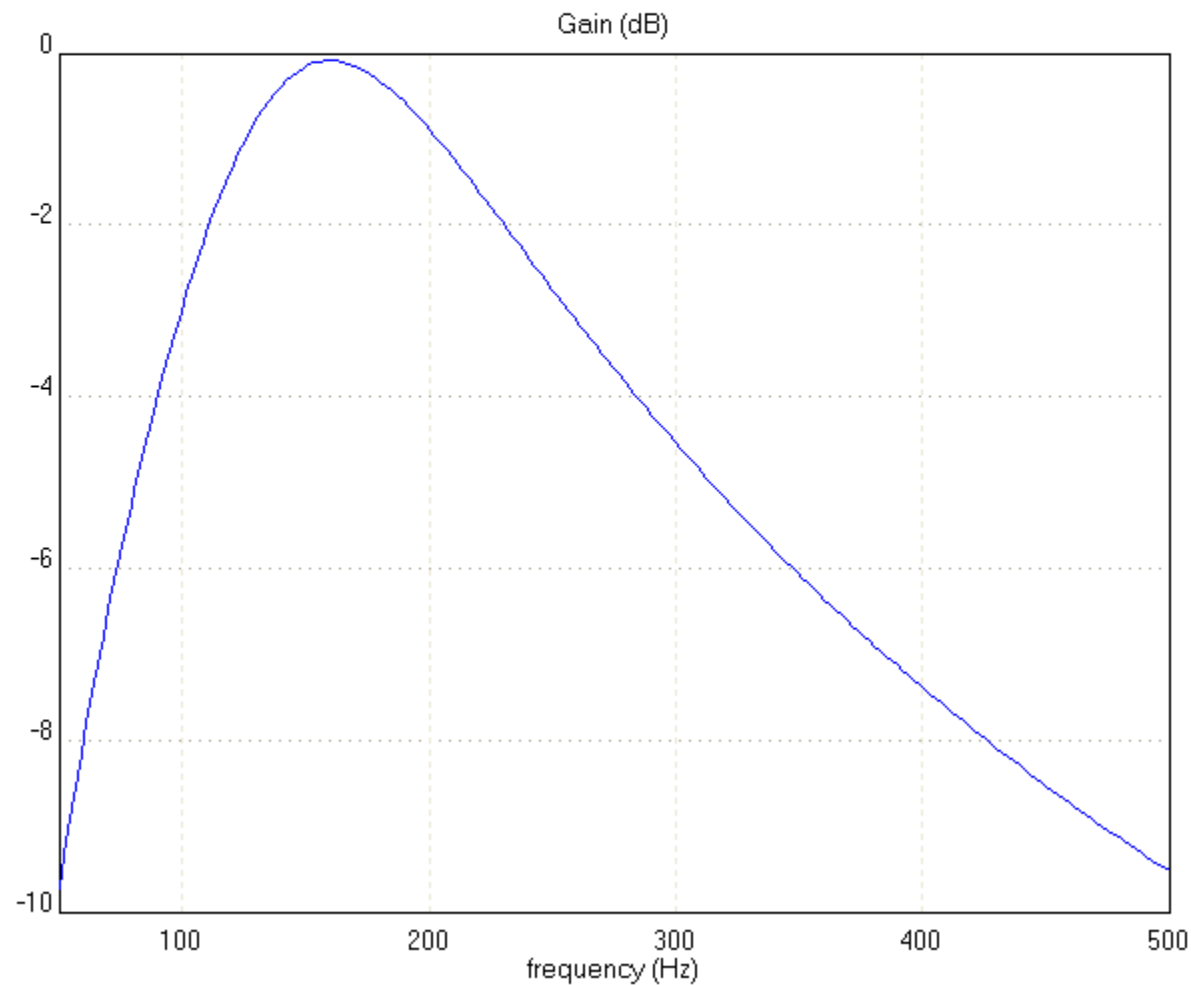
Components

Parameter

C1	1E-5
L1	0.1
R1	100
R2	1

Sapwin - [filtr1.fdt - Gain]

File Window Help Symbolic Numeric Phasor **Gain** Loss Phase Delay Pole/Zero Step Resp.
Impulse Resp. List of Values Approximation



End Time: 1 s

Frequency Interval

Start 50

End 500

☒ Hz ☐ rad/s

☐ Y Linear ☒ X Linear



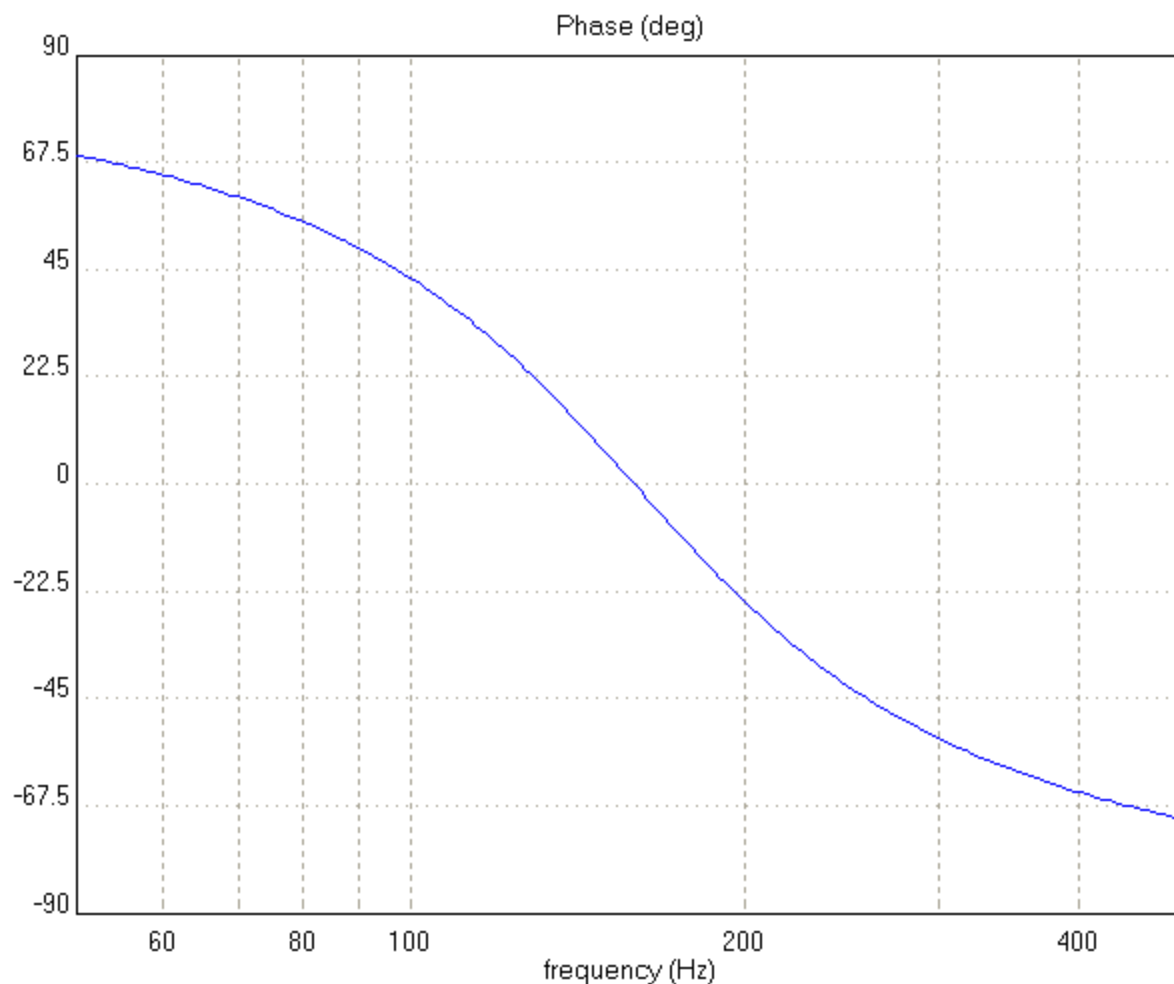
Refresh

Components Parameter

C1	1E-5
L1	0.1
R1	100
R2	1

Sapwin - [filtr1.fdt - Phase]

File Window Help Symbolic Numeric Phasor Gain Loss **Phase** Delay Pole/Zero Step Resp.
Impulse Resp. List of Values Approximation



End Time: 1 s

Frequency Interval

Start 50

End 500

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear



Refresh

Components

Parameter

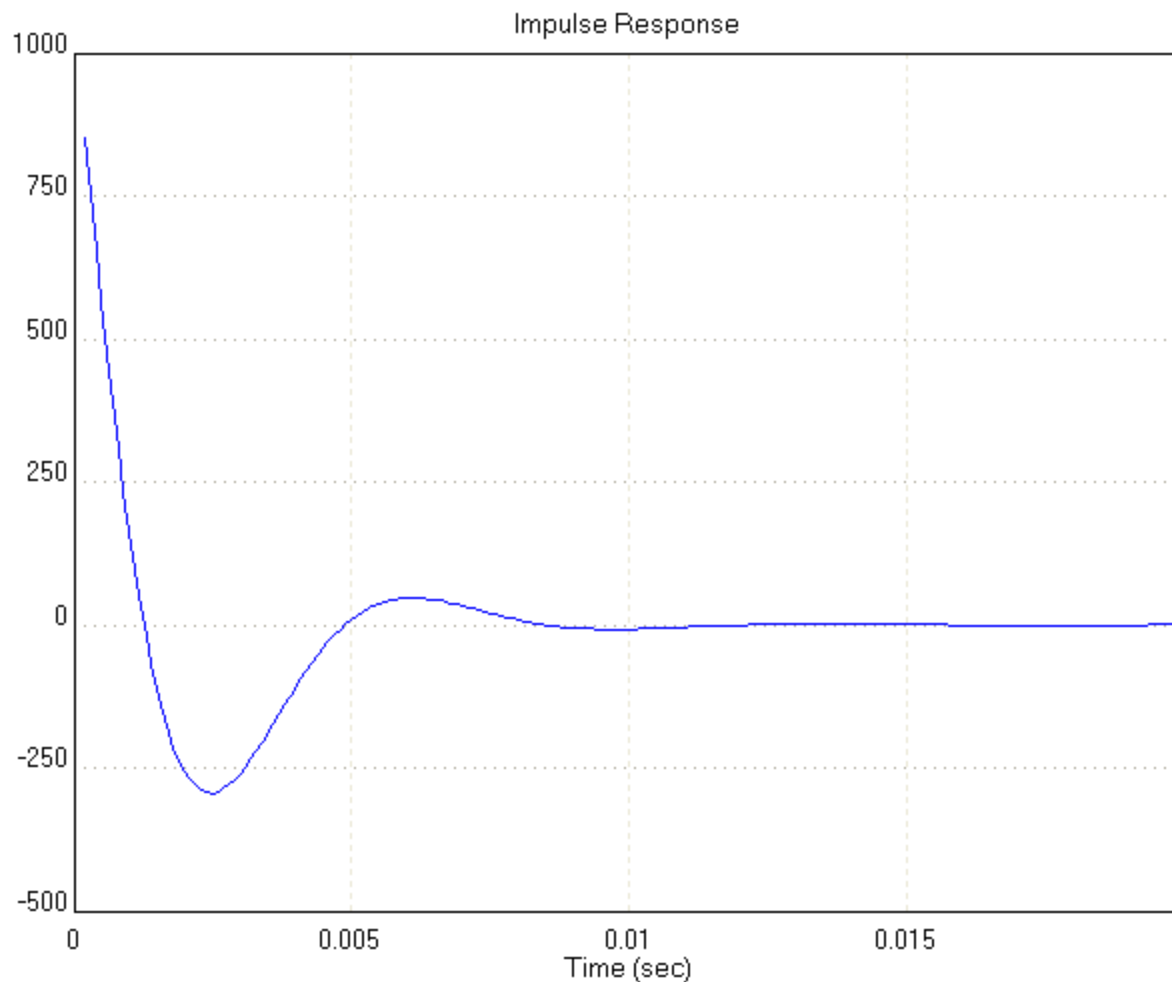
C1	1E-5
L1	0.1
R1	100
R2	1

Sapwin - [filtr1.fdt - Impulse Response]

File Window Help Symbolic Numeric Phasor Gain Loss Phase Delay Pole/Zero Step Resp.
Impulse Resp. List of Values Approximation



Minimalizuj



End Time: .02 s

Frequency Interval

Start 50

End 500

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear

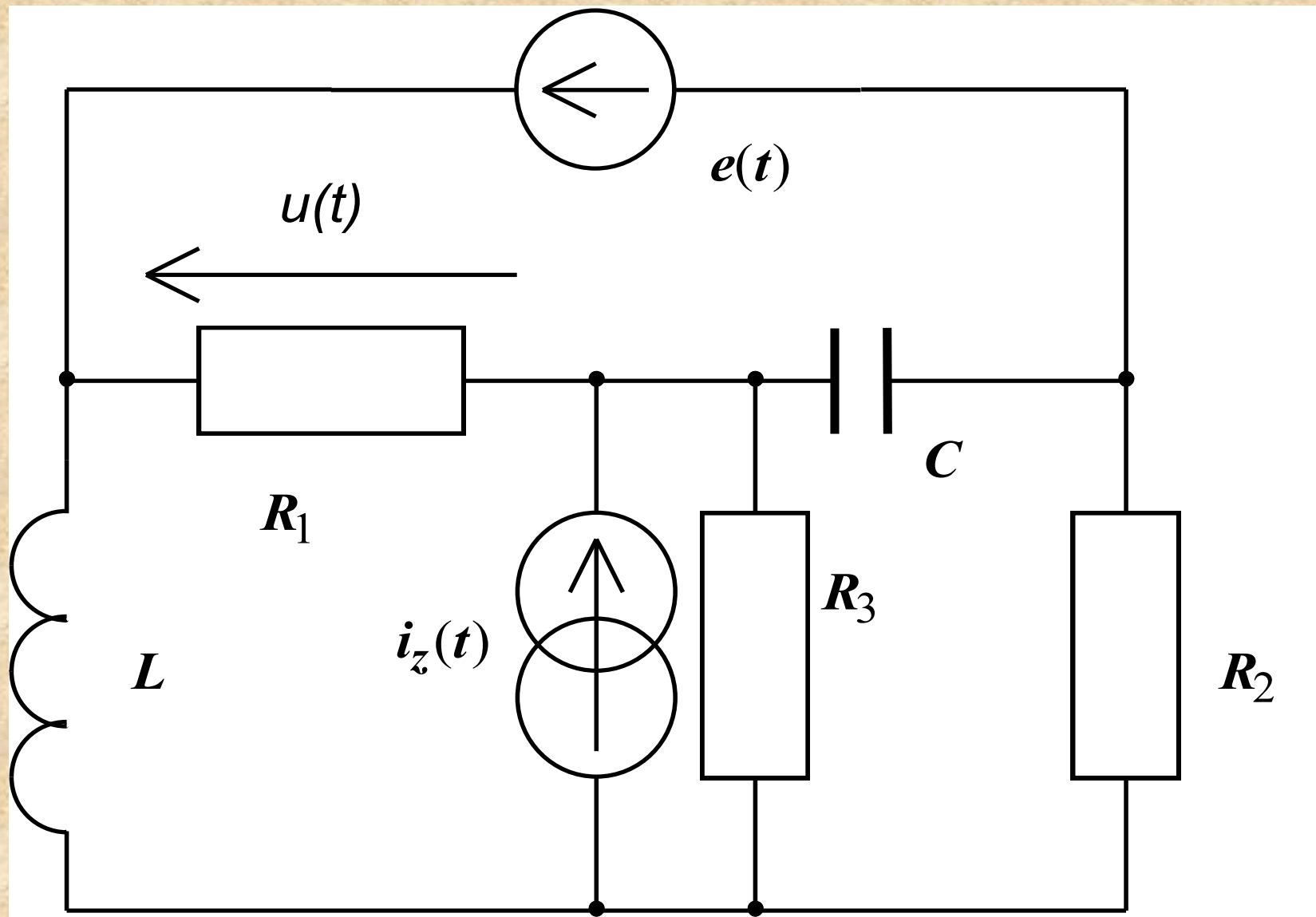


Refresh

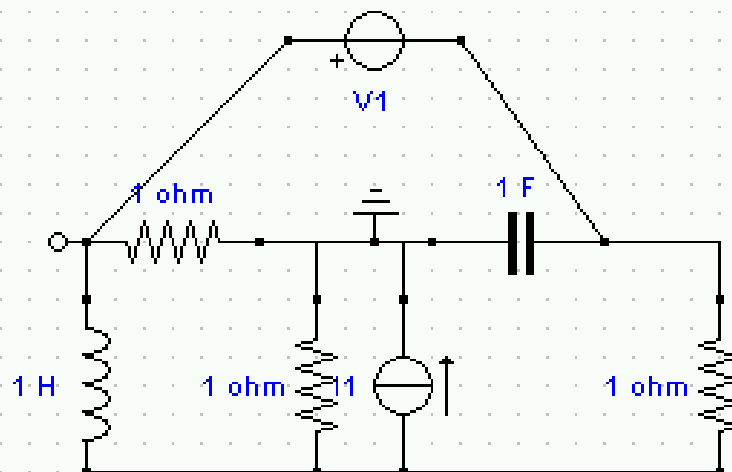
Components

Parameter

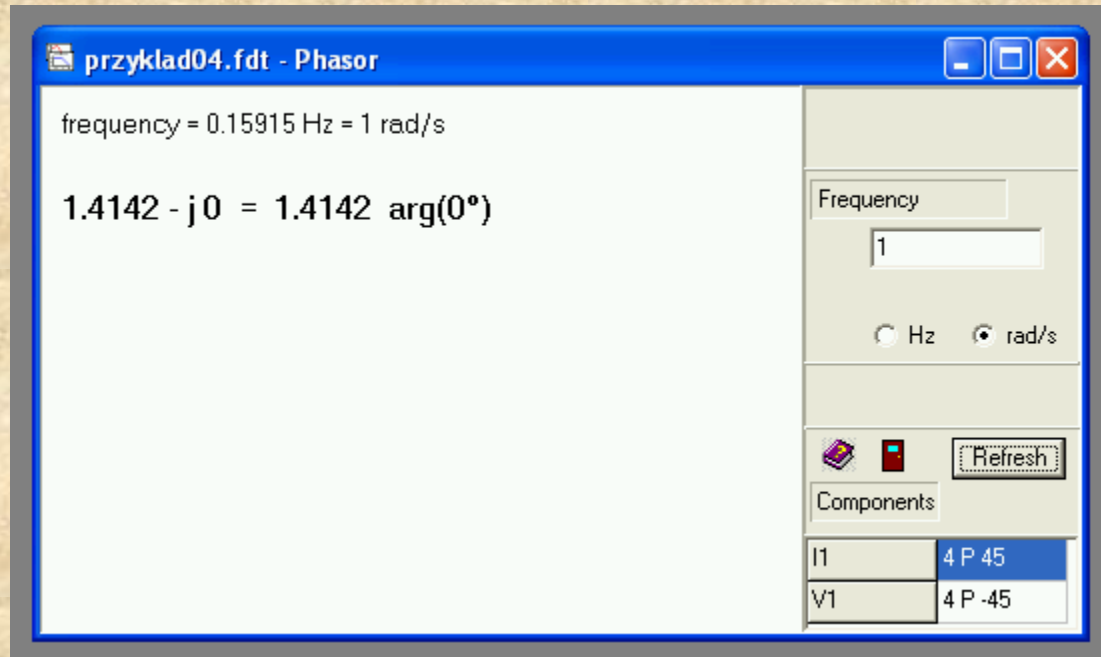
C1	1E-5
L1	0.1
R1	100
R2	1



$$e(t) = 4 \sin\left(t - \frac{\pi}{4}\right), i_z(t) = 4 \sin\left(t + \frac{\pi}{4}\right), R_1 = 1, R_2 = 1, R_3 = 1, C = 1, L = 1.$$



$$e(t) = 4 \sin(t - \frac{\pi}{4}), i_z(t) = 4 \sin(t + \frac{\pi}{4}), R_1 = 1, R_2 = 1, R_3 = 1, C = 1, L = 1.$$

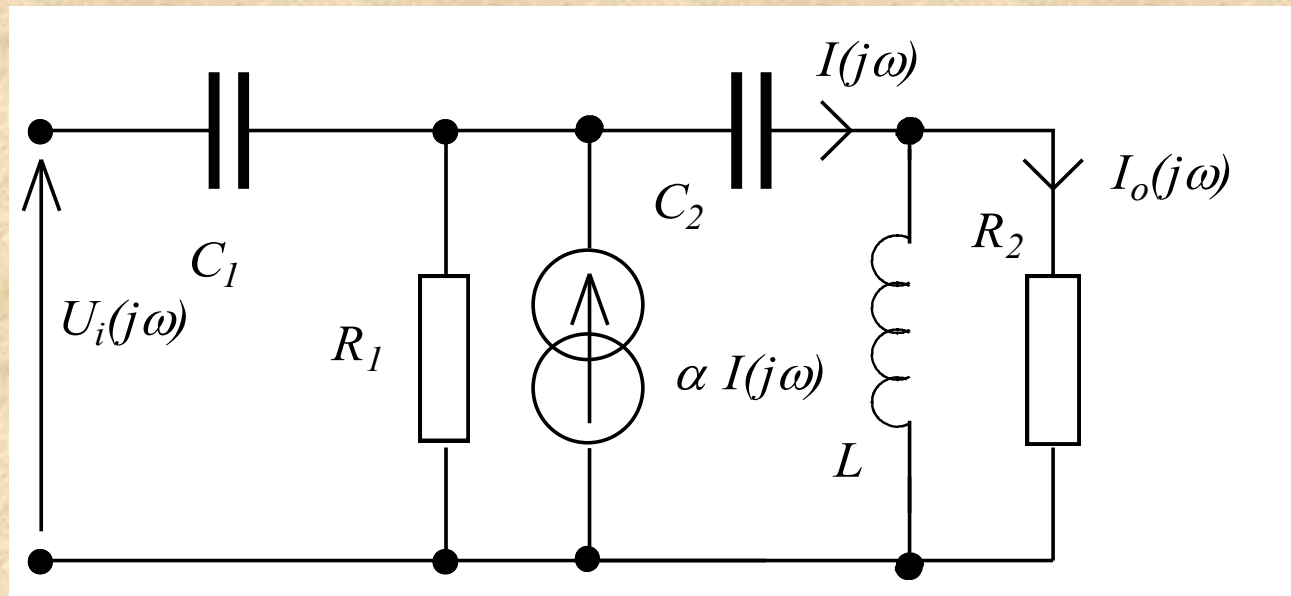


$$u(t) = 1.4142 \sin(t) = \sqrt{2} \sin(t).$$

Wyznaczyć charakterystykę widmową

$$H(j\omega) = I_o(j\omega) / U_i(j\omega)$$

$$R_1 = 1, R_2 = 1, C_1 = C_2 = 1, L = 1, \alpha = 1.$$



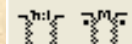
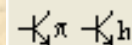
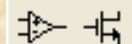
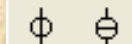
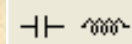
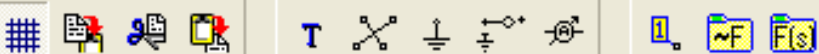
SAPWIN

A teraz rozwiążemy ten przykład za pomocą programu komputerowego SapWin

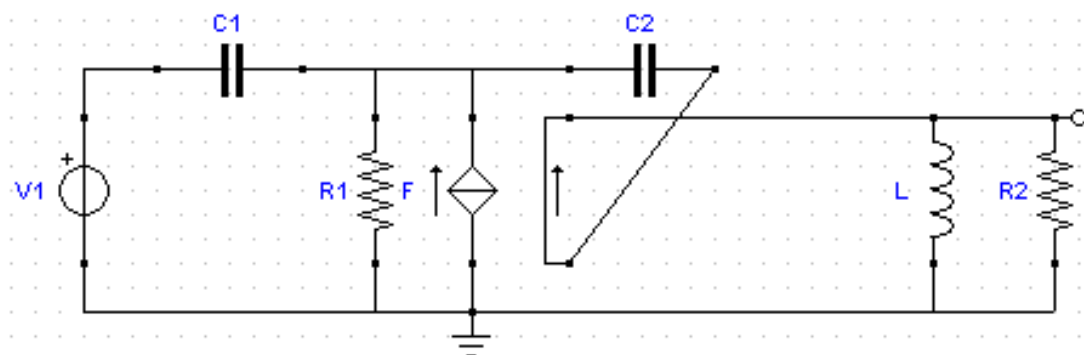


Sapwin - [Schema: C:\Program Files\SapWin\SapWin3\przyklad03.sch]

File Window Help Get Edit Analysis Spice Netlist



SP OA



End Time: 1.0 s

Frequency Interval

Start .1

End 10

☐ Hz ☒ rad/s

☐ Y Linear ☐ X Linear

 Refresh

Components	Parameter
------------	-----------

C1	1
C2	1
F	1
L	1
R1	1
R2	1
V1	1



przyklad03.fdt - Numeric



$$\frac{s^3}{s^3 + 2s^2 + 2s + 1}$$

End Time: 1.0 s

Frequency Interval

Start .1

End 10

☐ Hz ☒ rad/s☐ Y Linear ☐ X Linear

Refresh

Components

Parameter

C1	1
C2	1
F	1
L	1
R1	1
R2	1
V1	1

Sapwin

FileWindowHelpSymbolicNumericPhasorGainLossPhaseDelayPole/ZeroStep Resp.Impulse Resp.List of ValuesApproximation

przyklad03.fdt - Phasor

frequency = 0.015915 Hz = 0.1 rad/s

$$-0.000199 - j 0.00098 = 0.001 \text{ arg}(-101.48^\circ)$$

Frequency

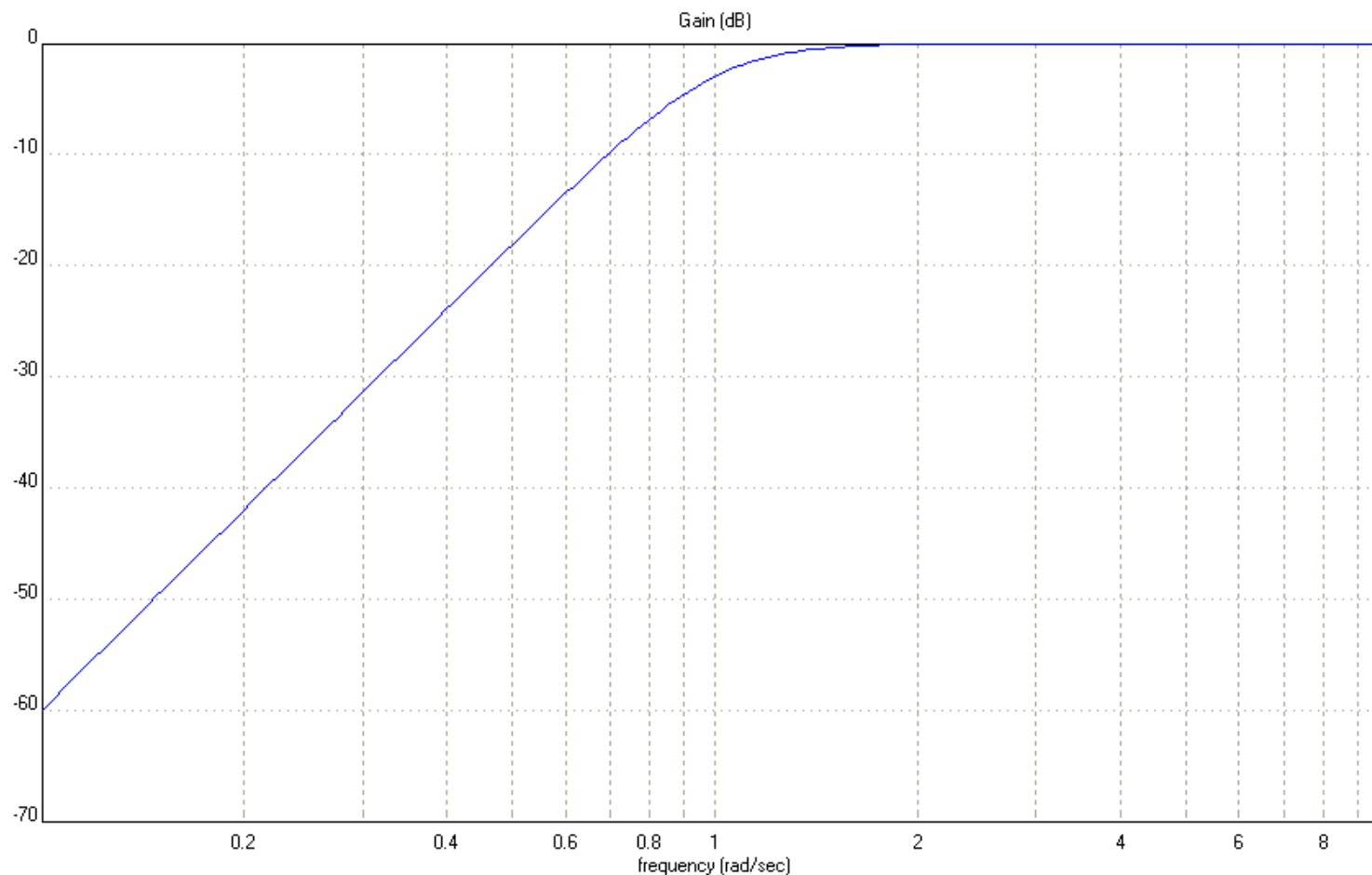
.1

☐ Hz☒ rad/s

Refresh

Components

C1	1
C2	1
F	1
L	1
R1	1
R2	1
V1	1 P 0



End Time: 1.0 s

Frequency Interval

Start .1

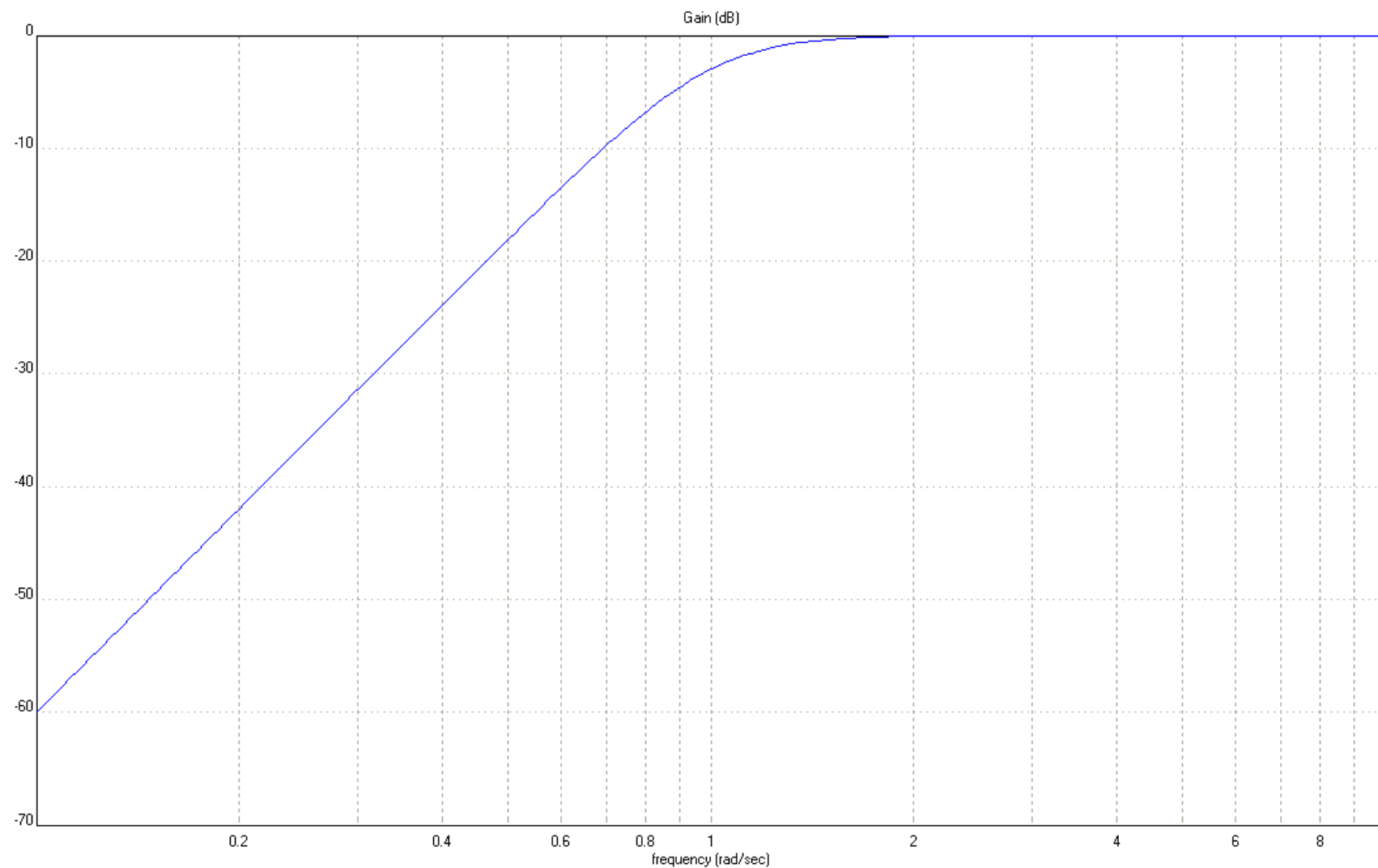
End 10

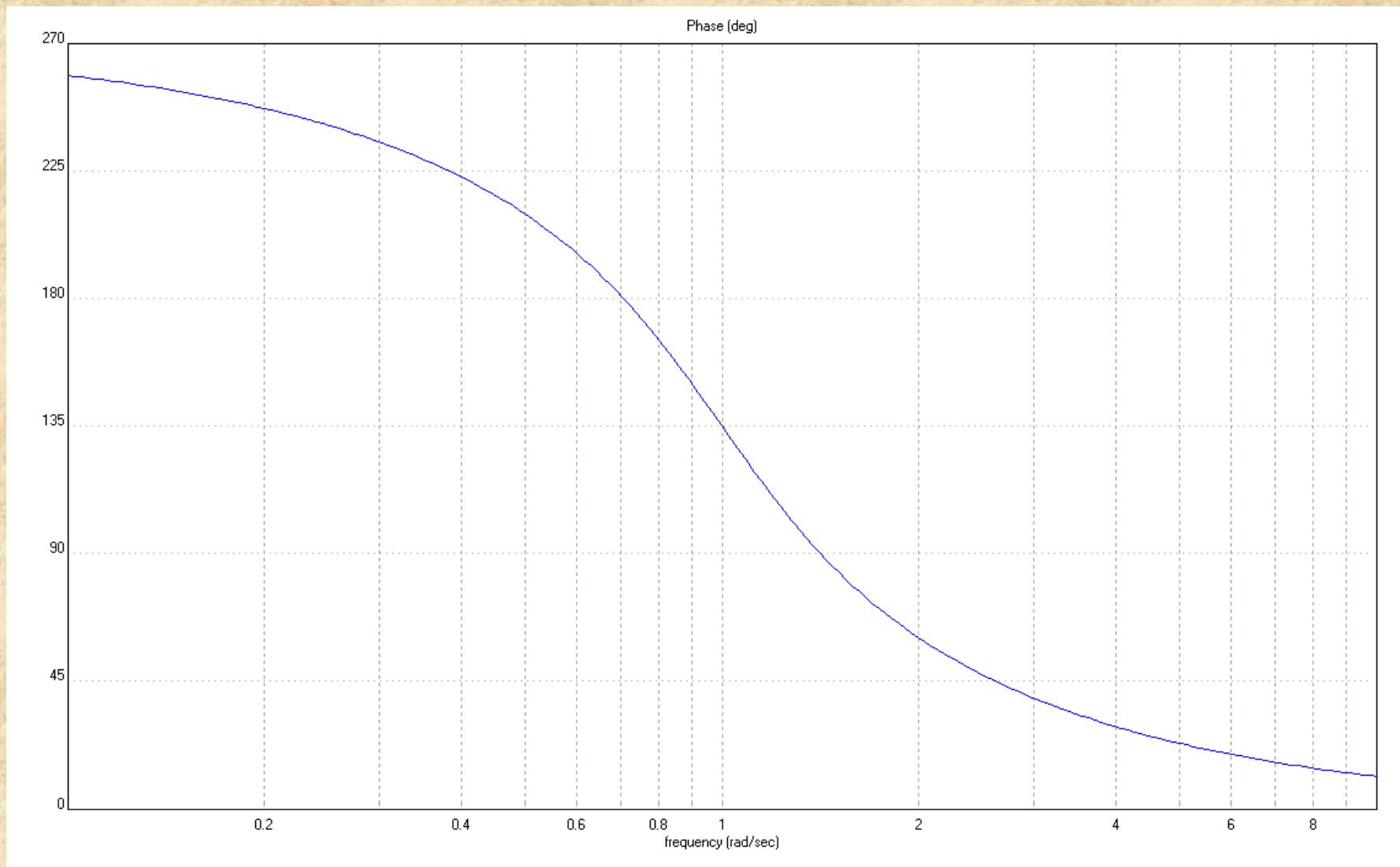
☐ Hz ☒ rad/s☐ Y Linear ☐ X Linear

Refresh

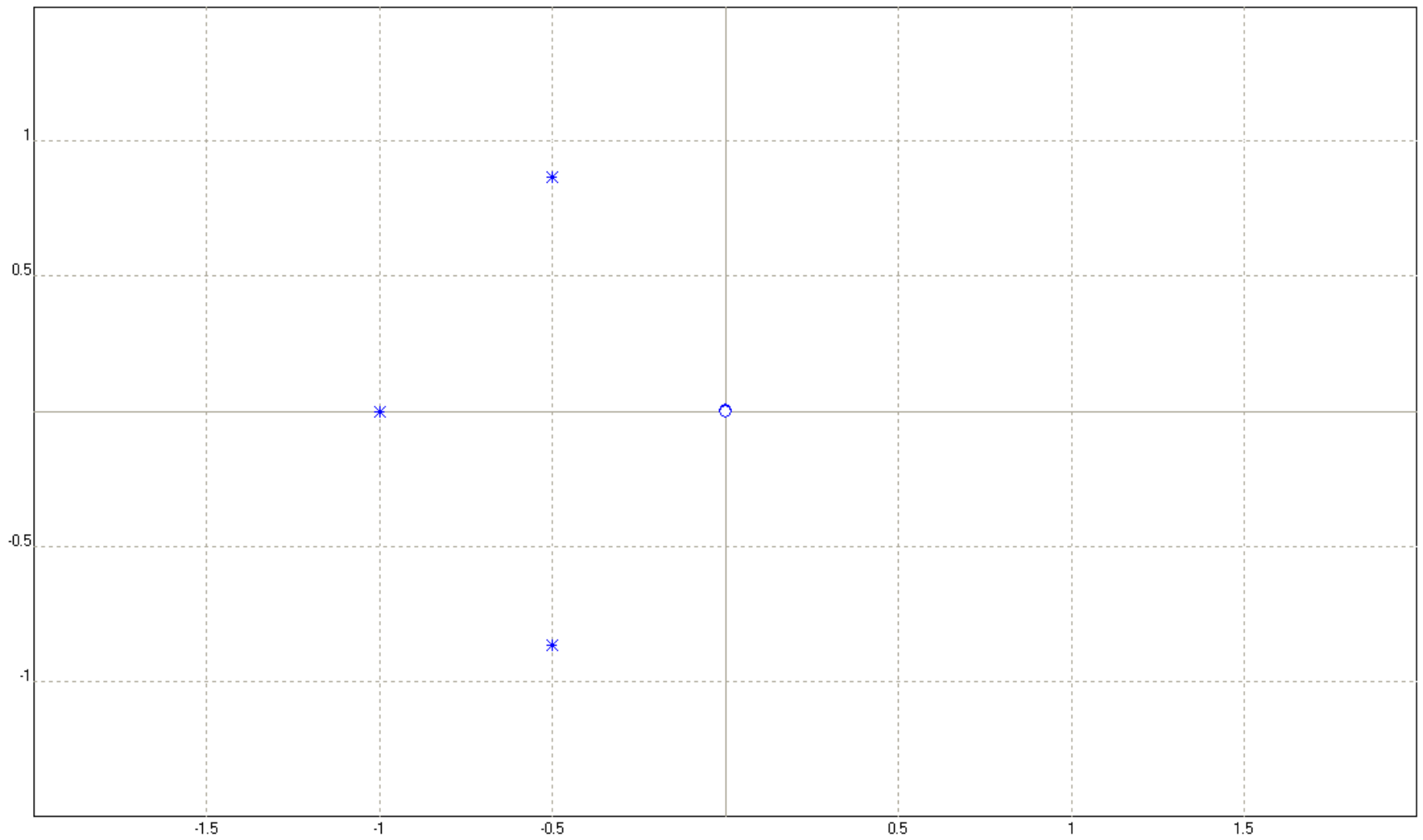
Components Parameter

C1	1
C2	1
F	1
L	1
R1	1
R2	1
V1	1

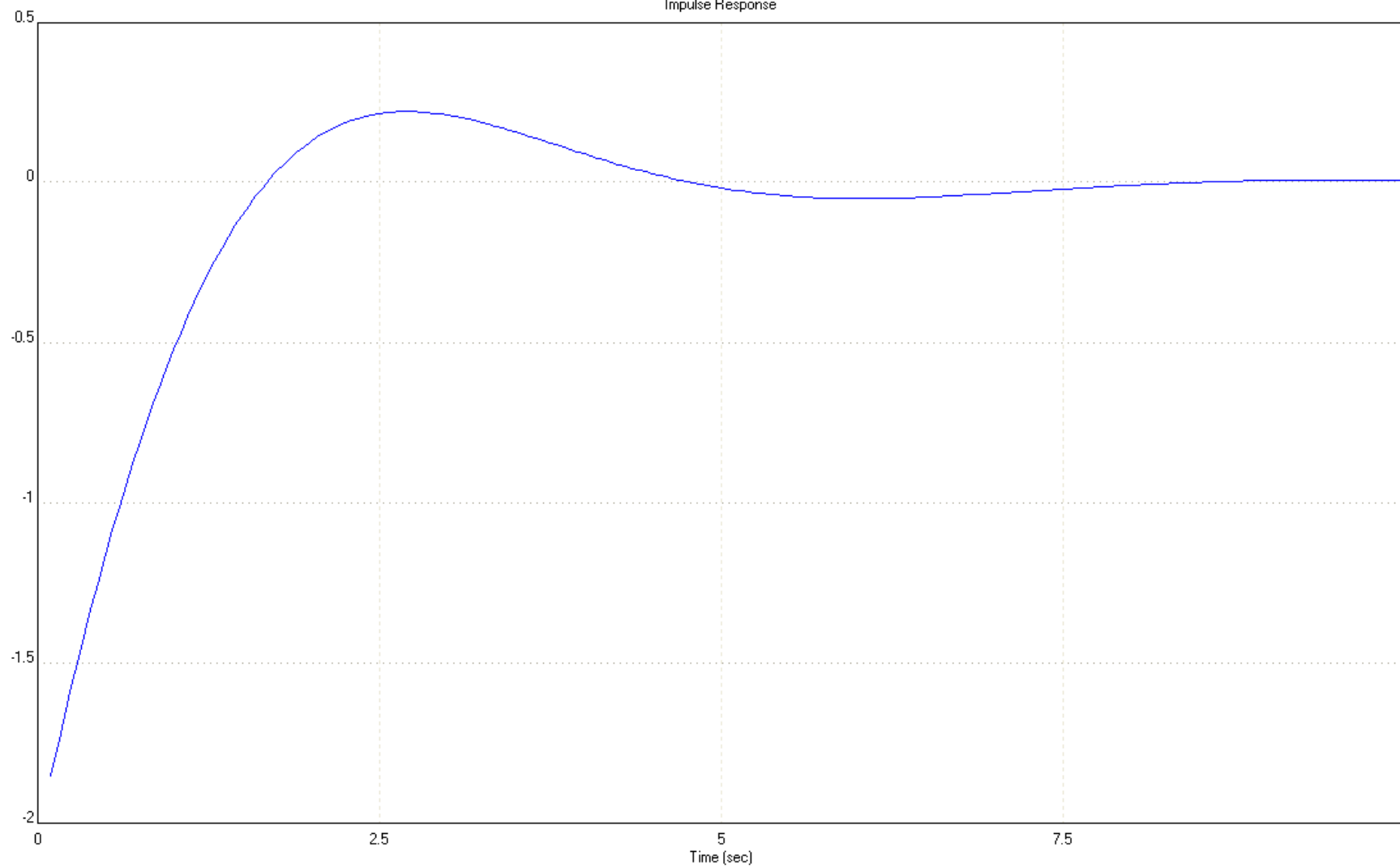


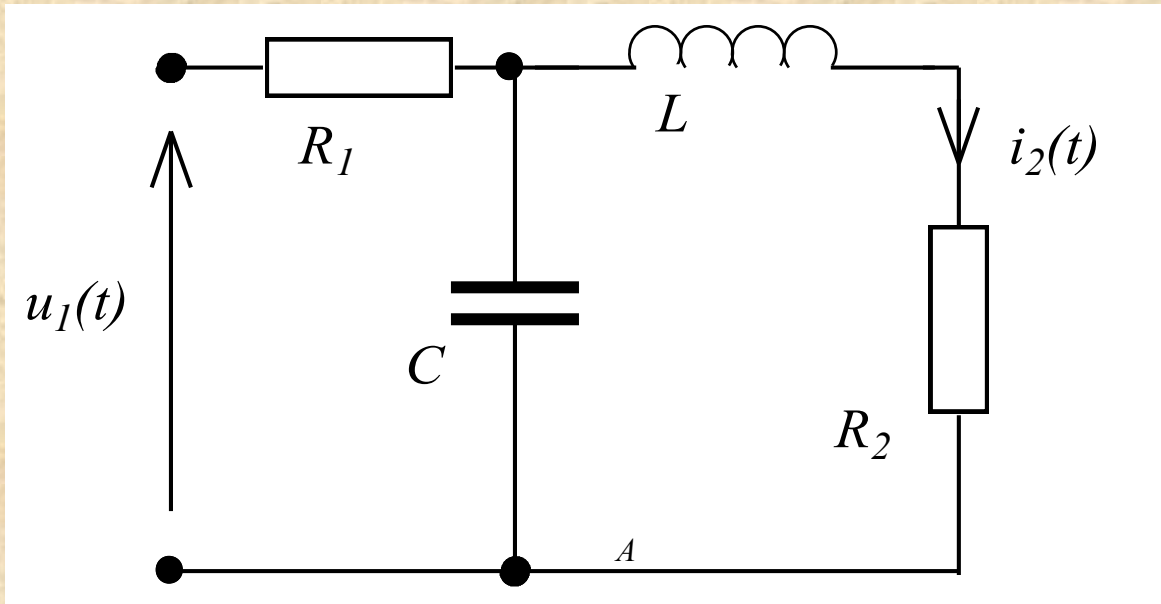


Poles and Zeros



Impulse Response



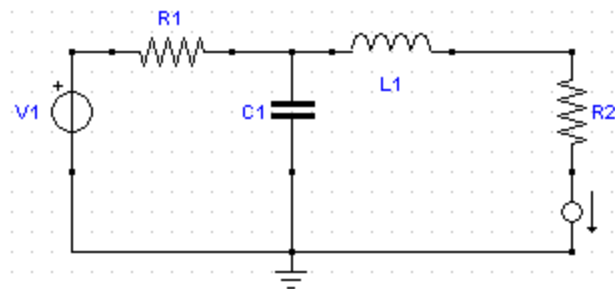
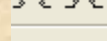
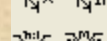
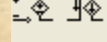
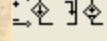
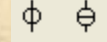
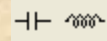
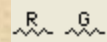
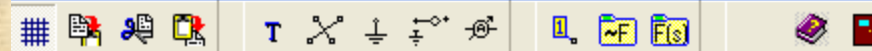


$$R_1 = 1k\Omega, R_2 = 1k\Omega, C = 318nF, L = 159mH.$$

Wyznaczyć i wykreślić widmowe charakterystyki:
amplitudową $A(2\pi f)$ i fazową układu $\varphi(2\pi f)$, jeżeli:


$$p(t) = u_1(t), \quad r(t) = i_2(t)$$

Schema: C:\Program Files\SapWin\SapWin3\przyklad04.sch



Sapwin

FileWindowHelpSymbolicNumericPhasorGainLossPhaseDelayPole/ZeroStep Resp.Impulse Resp.List of ValuesApproximation



przyklad04.fdt

(+ V1)

(+ R2 + R1)

(+ C1 R1 R2 + L1) s

(+ C1 L1 R1) s^2

End Time: 005 s



Frequency Interval

Start 5

End 10

☐ Hz☒ rad/s

☐ Y Linear☐ X Linear


 Refresh

ComponentsParameter

C1	3.18E-7
L1	0.159
R1	1000
R2	1000
V1	1

Sapwin

FileWindowHelpSymbolicNumericPhasorGainLossPhaseDelayPole/ZeroStep Resp.Impulse Resp.List of ValuesApproximation



przyklad04.fdt - Numeric

19778

+1

2

s

+9434 s

+3.9555e+07

End Time: 0.005 s



Frequency Interval

Start 5

End 10

☐ Hz ☒ rad/s

☐ Y Linear ☐ X Linear

 Refresh

ComponentsParameter

C1	3.18E-7
L1	0.159
R1	1000
R2	1000
V1	1

Sapwin

File Window Help Symbolic Numeric Phasor Gain Loss Phase Delay Pole/Zero Step Resp. Impulse Resp. List of Values Approximation



przyklad04.fdt - Phasor

frequency = 1000 Hz = 6283.2 rad/s

$4.3331\text{e-}07 - j0.00033366 = 0.00033366 \text{ arg}(-89.926^\circ)$

Frequency

1000

☒ Hz

☐ rad/s



Refresh

Components

C1 3.18E-7

L1 0.159

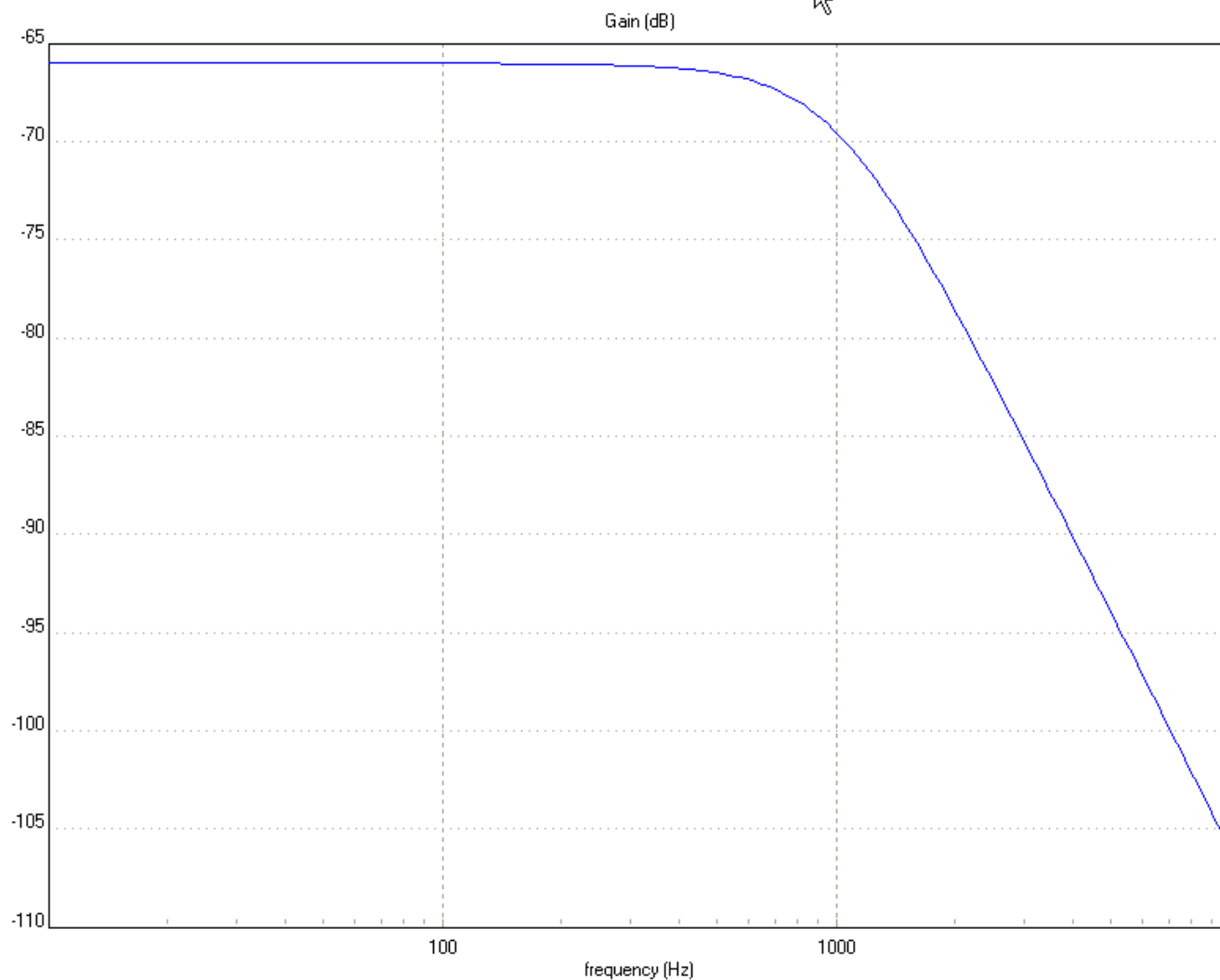
R1 1000

R2 1000

V1 1 P 0



przyklad04.fdt - Gain



End Time: .005 s

Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s☐ Y Linear ☐ X Linear

Refresh

Components

Parameter

C1 3.18E-7

L1 0.159

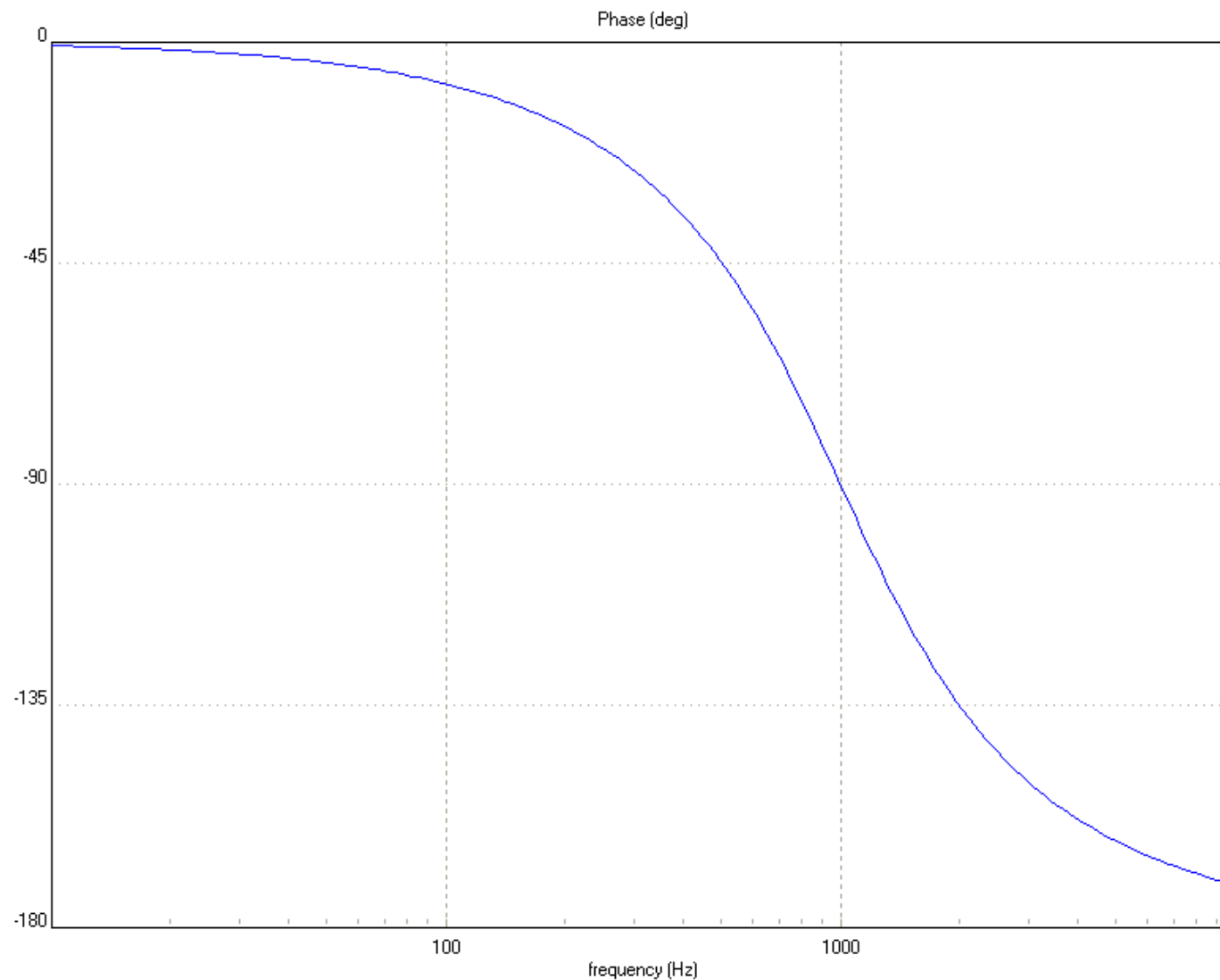
R1 1000

R2 1000

V1 1



przyklad04.fdt - Phase





End Time: .005 s

Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s☐ Y Linear ☐ X Linear  Refresh

Components Parameter

C1 3.18E-7

L1 0.159

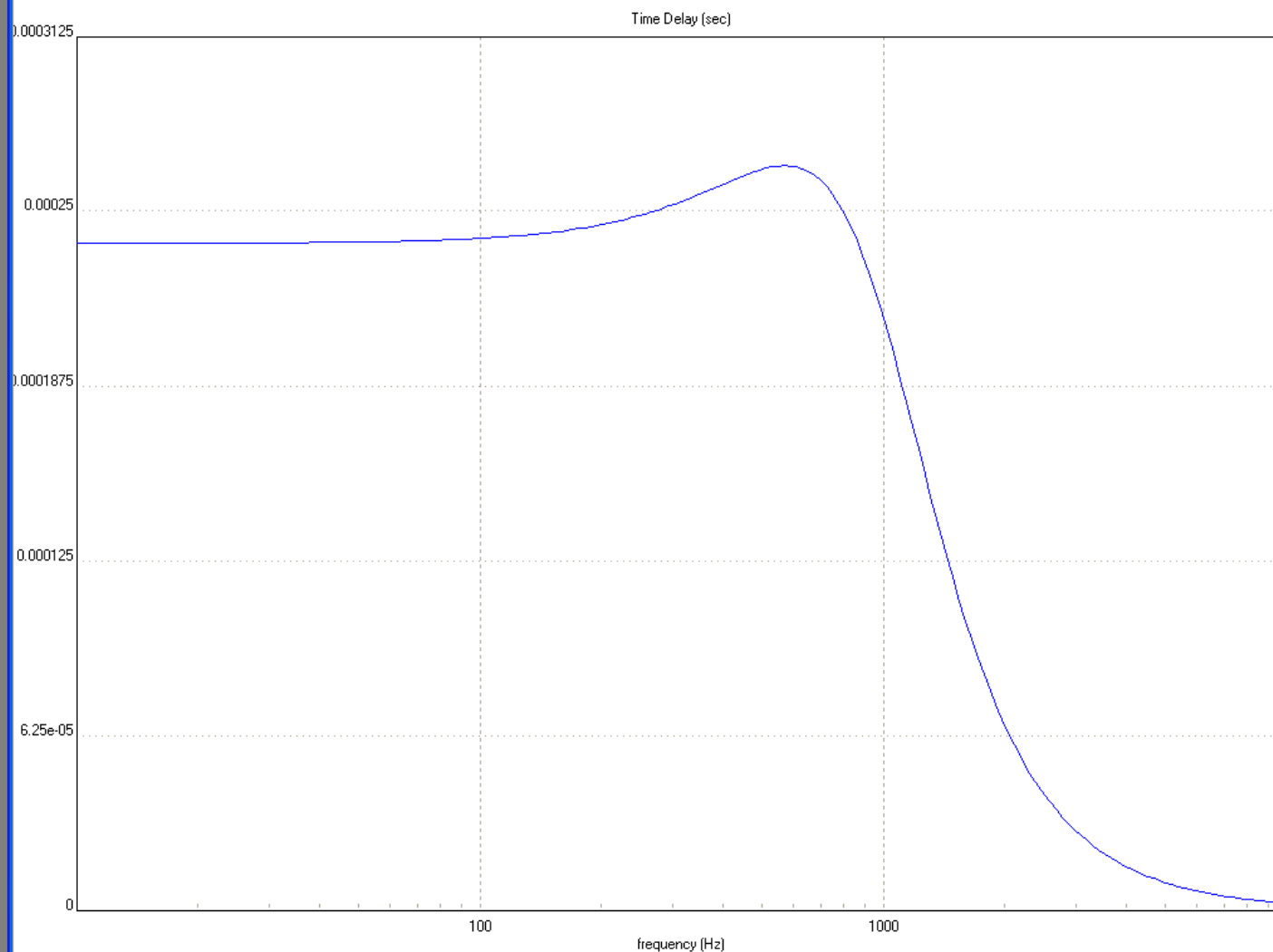
R1 1000

R2 1000

V1 1



przyklad04.fdt - Delay



End Time: 3e-3 s

Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear

Components Parameter

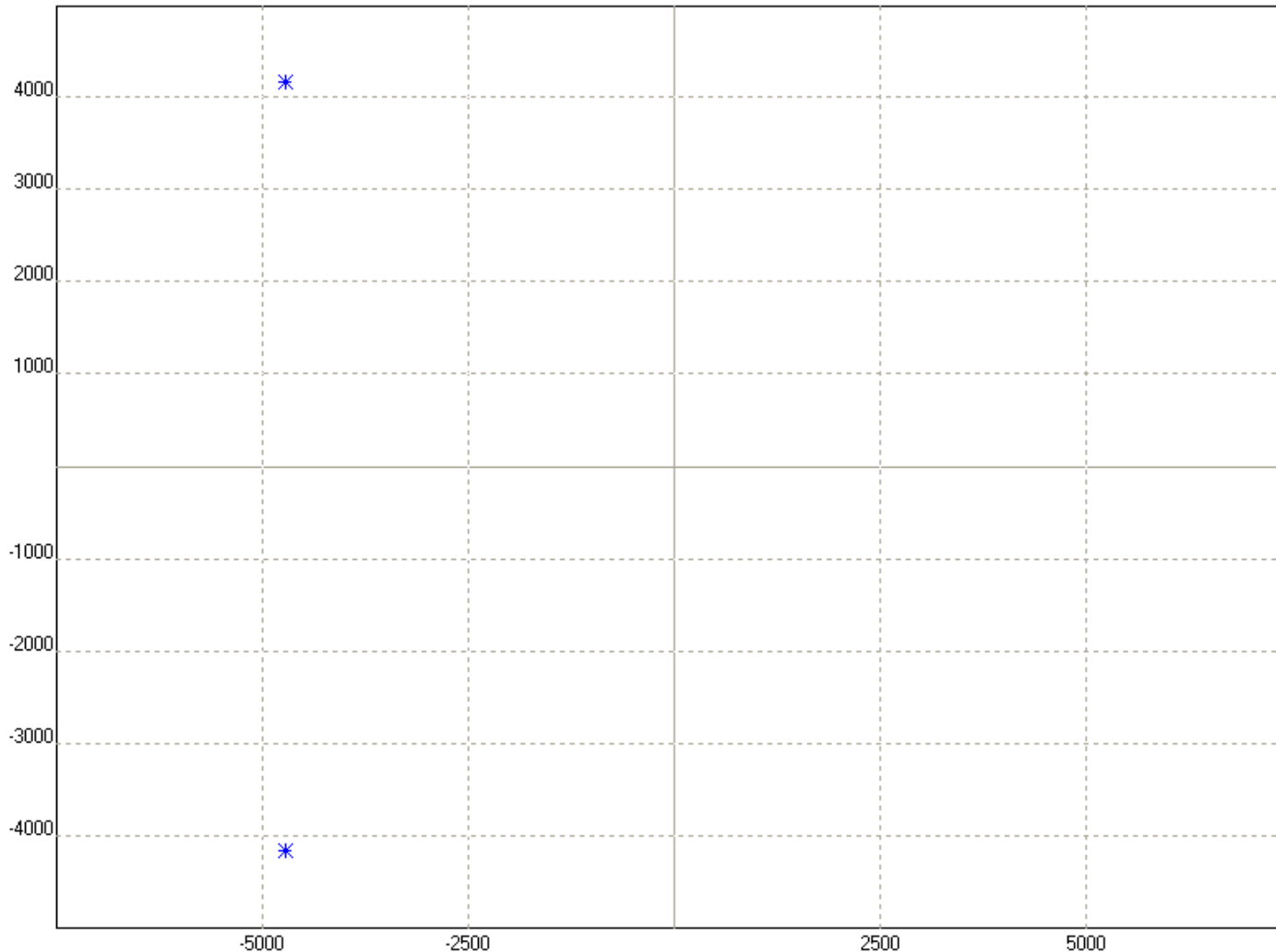
C1	3.18E-7
L1	0.159
R1	1000
R2	1000
V1	1

Schem...



przyklad04.fdt - Poles/Zeros

Poles and Zeros





End Time: .005 s

Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s☐ Y Linear ☐ X Linear  Refresh

Components Parameter

C1	3.18E-7
L1	0.159
R1	1000
R2	1000
V1	1



przyklad04.fdt - Impulse Response



Impulse Response

End Time: 3e-3 s



Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear

  Refresh

Components Parameter

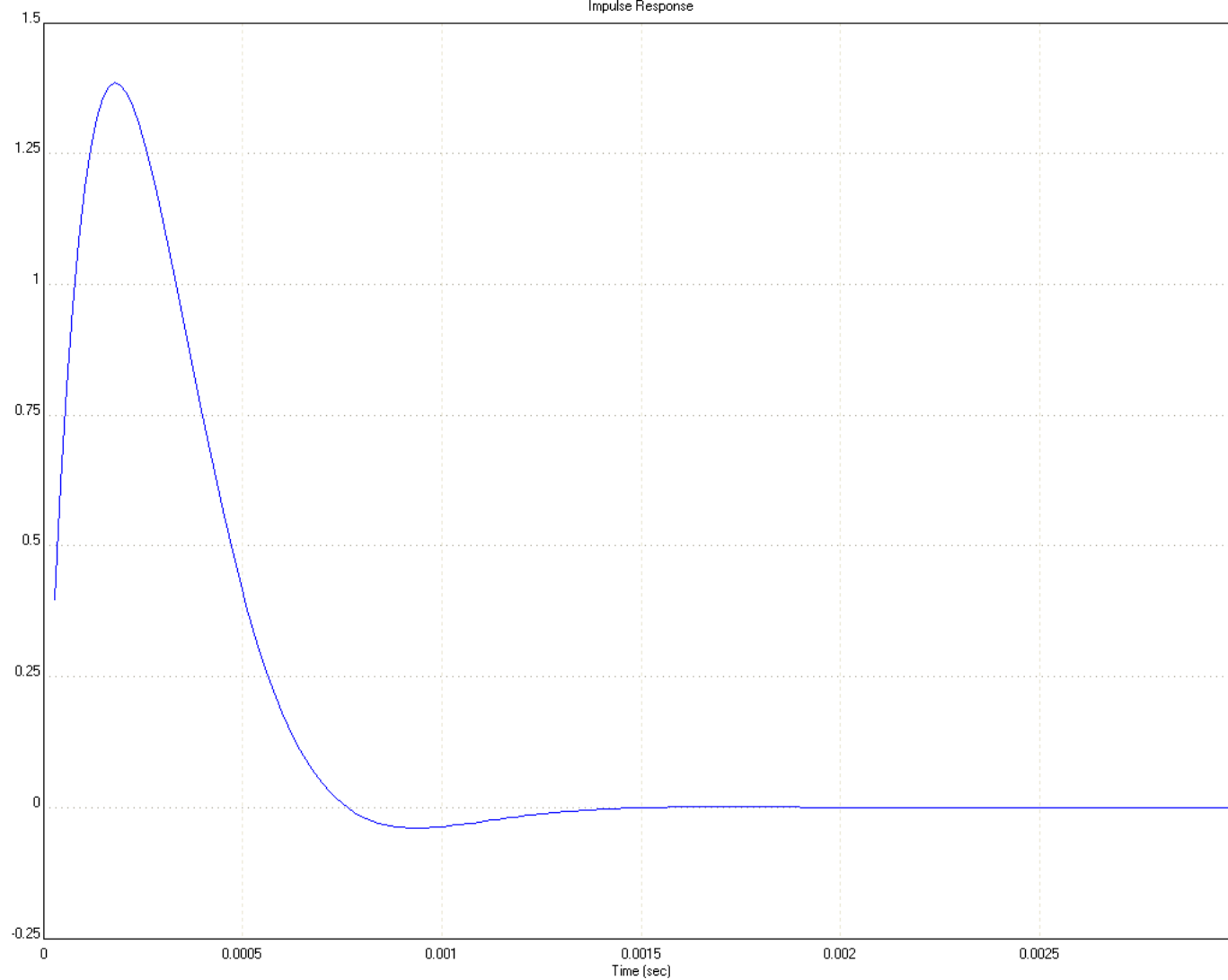
C1	3.18E-7
----	---------

L1	0.159
----	-------

R1	1000
----	------

R2	1000
----	------

V1	1
----	---



Schem...

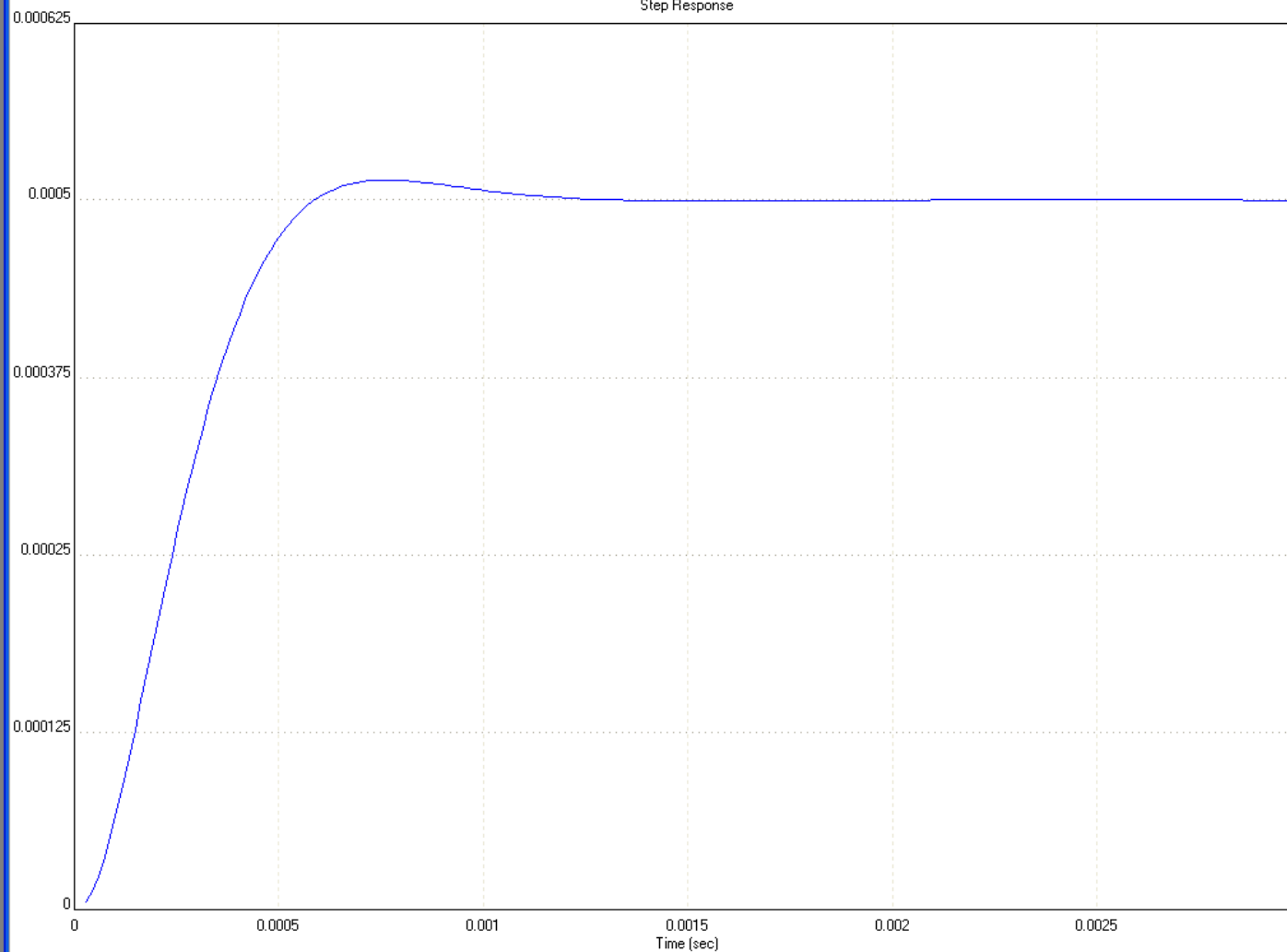




przyklad04.fdt - Step Response



Step Response



End Time: 3e-3 s

Frequency Interval

Start 10

End 10000

☒ Hz ☐ rad/s

☐ Y Linear ☐ X Linear



Refresh

Components

Parameter

C1 3.18E-7

L1 0.159

R1 1000

R2 1000

V1 1

Schem...

