

EE_Analysis! Ver.6

Quick Guide

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The Guide uses the screenshots provided by the Connectivity Kit, which is the best way to accomplish this task in a timely manner. As time permits the content list will be expanded to incorporate new topics or categories. I will try to give the user an explanation for each of the categories with problems and solutions as depicted in the screen shots and instructions below them.

Before you start the program, I suggest you select the following.

Angle Measure: Degrees

Number Format: Engineering 2

Complex: On

If you desire more accuracy, when the result is displayed in a box on the screen you can then use [Edit] in the soft menu to display the full value in Standard form. If the result is displayed by a print command, the [Edit] soft key is not available.

Category Definition.

1 Quit! EE Analysis.

- 2 Set Format, Digits & Angle:** In this version I have not imbedded any control directives from this panel into any of the Categories, in order to give the user total control. However selecting greater than 2 Digits as suggested above may cause an erratic display when the program uses the PRINT command. In some **updated** categories the screen contains **Input** and **Output** boxes on the same screen and the Options are selected by the means of checking the box as in the screen below.
If the result is displayed within Boxes and does not fit, highlight the box and press [Edit] and the number will be displayed in standard form with maximum accuracy.

Navigate to the various boxes and check them by either pressing [Enter] or tapping the box twice or tap the check mark in the soft menu [✓] followed by [OK]. In the above screen, **Engineering, 3 Digits and Degrees** are selected prior to going back to the Main Menu.
 This topic is provided to allow you to make these selections without leaving the program.

3 In App calculator. + - * /A||B. Updated and expanded.

This selection allows you to perform some basic functions without exiting the program.

X & Y boxes can contain either Real or Complex Numbers. Enter 45436 in the **X** and 78+56 *i* in the **Y** registers. Double tap the **X||Y** box and tap the **[OK]** soft key. The result appears in Panel 2 as **X = 24.821+17.965i**. Next tap on the **R->P** box and **[OK]** will convert the content of the **X** register to its **Polar form**. Some operations like Add & A||B involves two numbers whereas **R->P** will use the number in the **X** only. Activating the **Exit** [✓] box will return you to the Main Menu. **Swap** [✓] will swap **X & Y** registers and **CLR** [✓] will clear all Input and output registers

Note: You will find throughout this program that the answers are given in **both Rectangular & Polar Forms**.

4 Conversion between Polar and Rectangular. Updated

The screenshot shows the 'Rectangular <--> Polar' calculator interface. Under the '--- INPUTS ---' section, the 'Rectangular=' field contains '24.8E0+18.0E0*i'. The 'Polar=' field shows '32.0E0 ∠ 58.0E0'. Under the '--- OUTPUTS ---' section, the 'Polar' field shows '30.6E0 ∠ 36.0E0' and the 'Rectangular.' field shows '17.0E0' and '27.1E0 *i'. At the bottom, there are 'Exit' and 'Clr' checkboxes, and a row of buttons: 'Edit', three empty buttons, 'Cancel', and 'OK'.

Rectangular AND Polar Inputs

The screenshot shows the 'Rectangular <--> Polar' calculator interface. Under the '--- INPUTS ---' section, the 'Rectangular=' field contains '0'. The 'Polar=' field shows '32.0E0 ∠ 58.0E0'. Under the '--- OUTPUTS ---' section, the 'Polar' field shows '0.00E0 ∠ 0.00E0' and the 'Rectangular.' field shows '17.0E0' and '27.1E0 *i'. At the bottom, there are 'Exit' and 'Clr' checkboxes, and a row of buttons: 'Edit', three empty buttons, 'Cancel', and 'OK'.

Polar to Rectangular

You can start by Clearing the input registers and then enter a Rectangular or Polar value **or both**. The Rectangular number will be converted to Polar, and the Polar number to Rectangular Simultaneously. **Exit** [✓] return you to the Main Menu and **Clr** [✓] clears the registers.

5 Ohms Law, Power. Updated

A circuit has a voltage $V=24_V$ and an impedance of $3+4i$. Find the current and the Power.

Problem

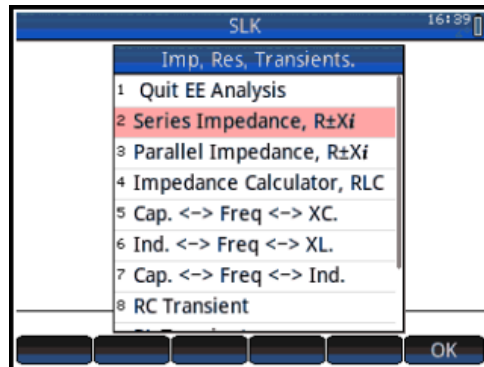
Parameter	Rectangular Form	Polar Form
V	24 0	24 0
I	2.88 -3.84	4.8 -53.13
Z	3 4	5 53.13
P	69.12 -92.16	115.2 -53.13

Result in Rectangular & Polar Forms

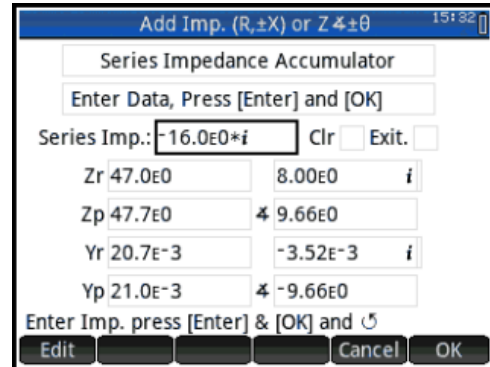
In the above screen there are 4 **Input** registers in the top section. In the bottom section the result is displayed in their Rectangular and Polar forms. I entered a voltage of 24 volts in **V**, and an impedance of $3+4i$ in **Z**, using the **[Enter]** key. Then press **[OK]**

6. Imp. Res, Transients. This category has a sub-menu containing a variety of topics dealing with Impedance calculator, a section on Resonance and Transient analysis.

2 Series Impedances. (sub-menu) Updated



Select 2



Enter components

A 47Ω resistor is in series with a 24Ω Inductor and a 16Ω capacitor. Total impedance = $47.68\angle 9.66^\circ$.

Sequence: 47 [Enter], [OK]. $24i$ [Enter], [OK]. $-16i$ [Enter], [OK]. Total $Z = 47+8i$.

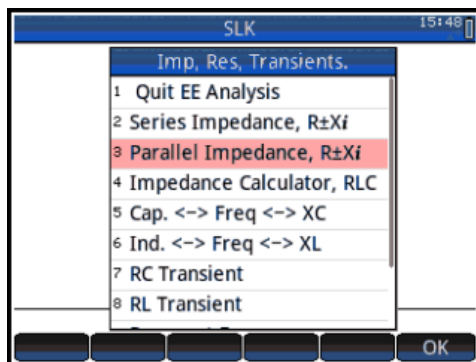
Try three 72Ω resistors are in series. Total resistance $R_t = 216\Omega$.

Sequence: 72 [Enter], [OK], [OK], [OK]. Result $R_t = 216\Omega$.

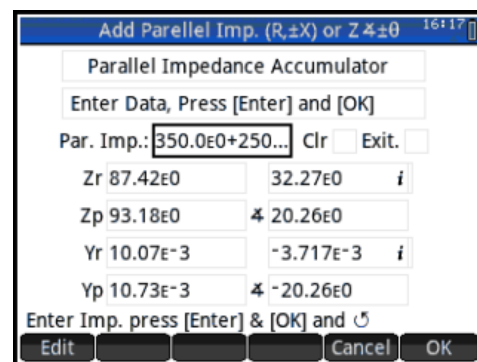
Try three Impedances in series. $12+16i$, $+ 47-68i$ $+ 72+8i = 131-44i$.

Sequence: $12+16i$ [Enter], [OK] $47-68i$ [Enter], [OK] $72+8i$ [Enter], [OK]. Total $Z = 138.19\angle -18.57^\circ$.

3 Parallel Impedances. (sub-menu) Updated



Select 3



Enter components

A $120+118i$ is in parallel with $210-96i$ and $350+250i$. Total parallel impedance $Z_p = 93.183\angle 20.264^\circ$.

Sequence: $120+118i$ [Enter], [OK] $210-96i$ [Enter], [OK] $350+250i$. [Enter], [OK] $Z_t = 87.4156+32.2736i$

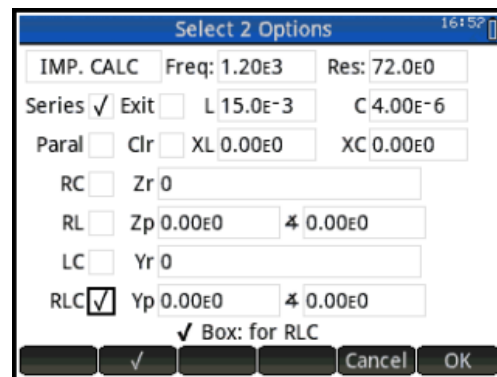
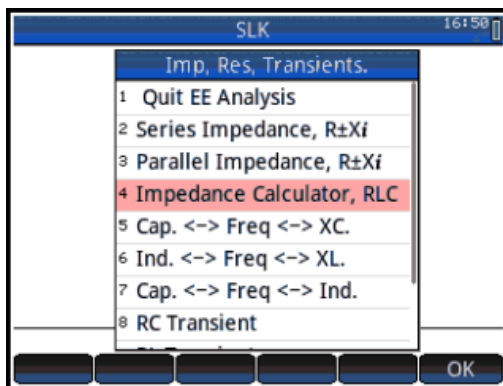
$$Y_r = 10.07E-3 - 3.717E-3 i \quad Y_p = 10.73E-3 \angle -20.26^\circ$$

4 Impedance Calculator (sub-menu)

Updated

Note: In this section the calculator will choose (L & C) or (XL & XC) by checking the content of the Freq. register. If Freq = 0, (XL & XC) values will be used. If Freq \neq 0, then (L & C) will be used.

There are 5 Input registers on the screen, **Freq**, **Res**, **L**, **C**, **XL** and **XC**. Select or check either Series or Paral. box, + one of (RC, RL, LC, or RLC), followed by [OK] to produce the result. Even if all registers have values in them, the choice is made by what you select on the left. Eg. If RC [] then L or XL will be ignored. Also notice the Exit and Clr boxes that can be checked to either Clear all data or return to the Main Menu.



Select 4 & Enter a Freq of 1200_Hz. A Res. of 72 Ω , L = 15mH and C = 4 μ F.
Next Check boxes for Series [] and RLC [] Press [OK]

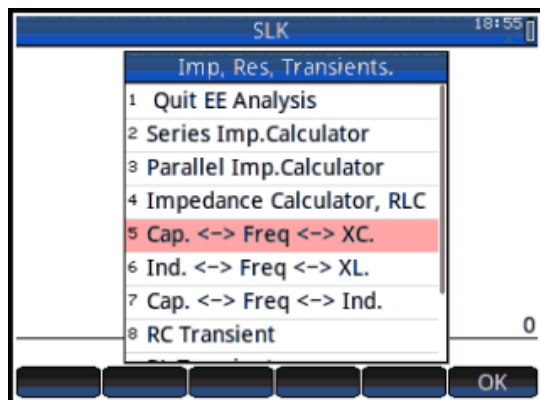


Result for RLC.

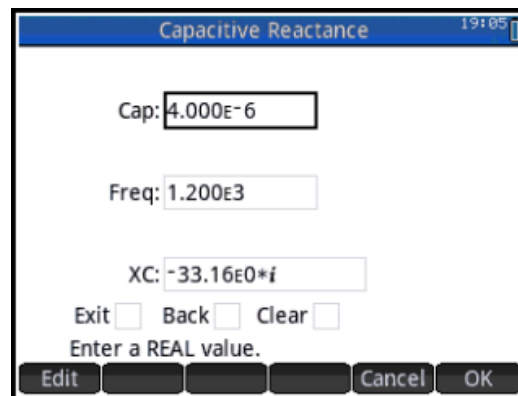
Note: You can clear all registers by activating the **Clr** [✓] and [OK]
or return to the Main Menu by activating **Exit** [✓] and [OK] .

5 Cap \leftrightarrow Freq \leftrightarrow XC. (sub-menu) Updated

The updated part here is the on-screen Exit [], Back [], and Clear [].



Select 5

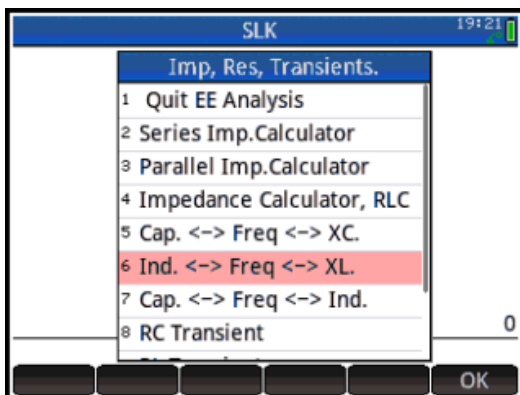


Input Cap=4E-6, Freq=1200Hz.

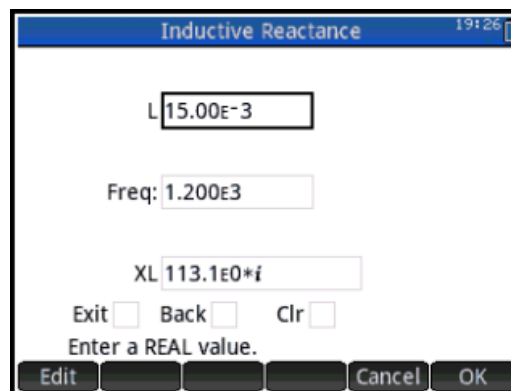
Here you can select any two values and solve for the third.

6 L \leftrightarrow Freq \leftrightarrow XL. (sub-menu) Updated

The updated part here is also the on-screen Exit [], Back [], and Clear [].



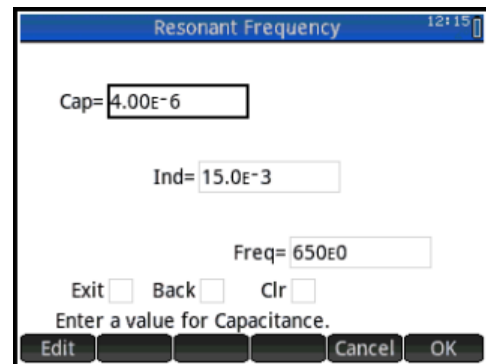
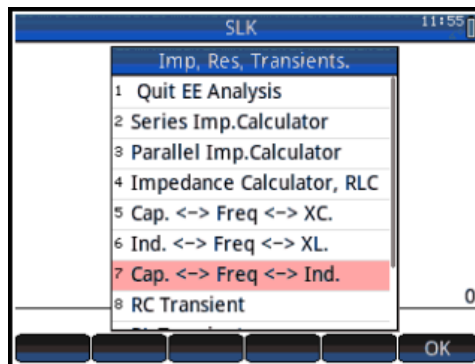
Select 6



Input L = 15E-3, Freq=1200Hz

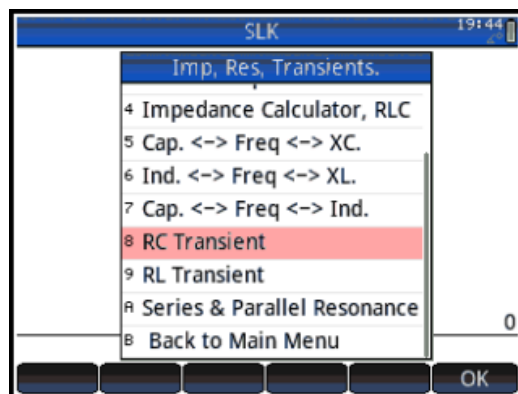
Here you can select any two values and solve for the third.

7 Cap \leftrightarrow Freq \leftrightarrow Ind. (sub-menu)

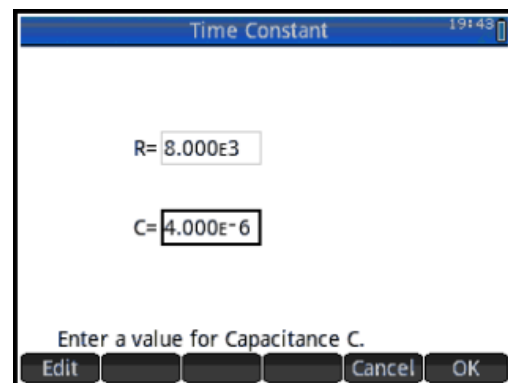


Here you can enter Cap and Ind and solve for the resonant Freq. Or enter any two value and solve for the third unknown.

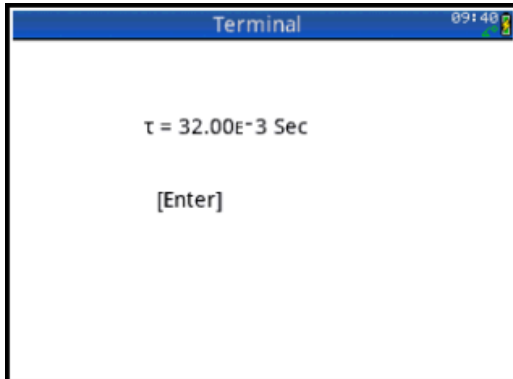
8 RC Transient (sub-menu) no change



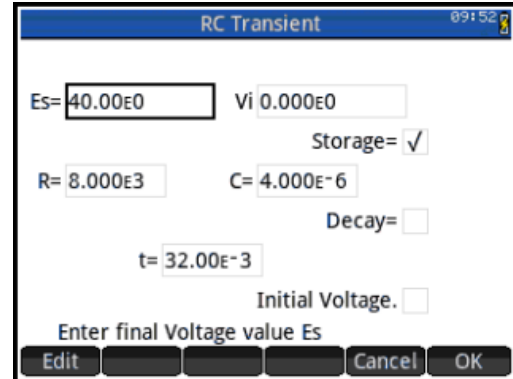
Select. 7. RC Transient



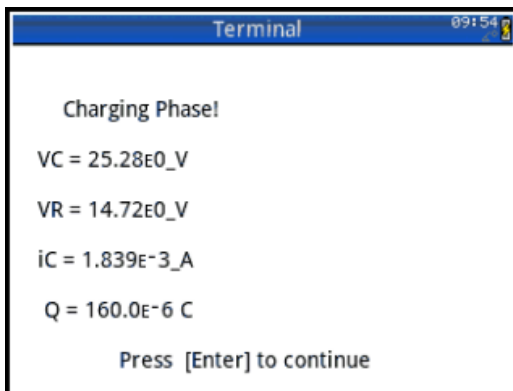
Enter 8E3 for R & 4E-6 for C.



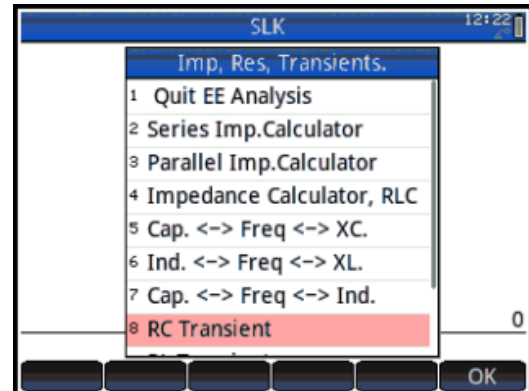
Time Constant = 32mSec



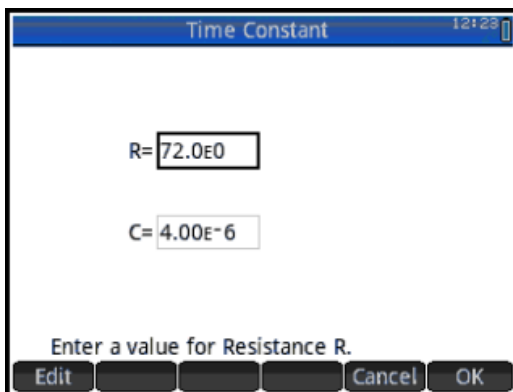
Inputs. Also check Storage Box [OK]



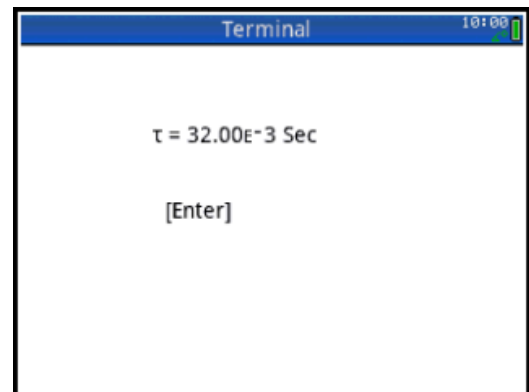
Result at 32mS



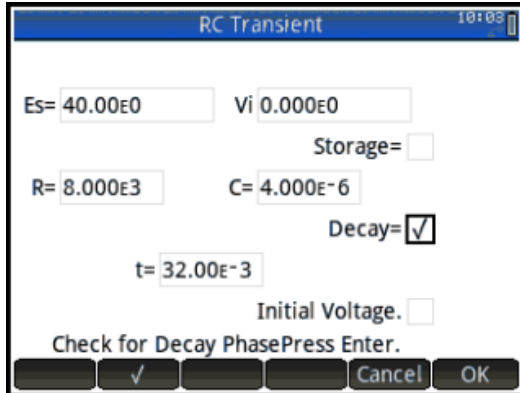
Select 7



Input. Note: R may = R1+R2 for Discharge



Time Constant 32ms.



RC Transient

Es= 40.00E0 Vi 0.000E0

Storage= ☐

R= 8.000E3 C= 4.000E-6

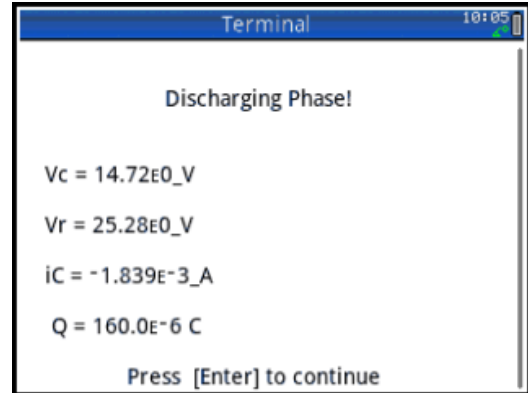
Decay= ☒

t= 32.00E-3

Initial Voltage. ☐

Check for Decay Phase Press Enter.

Check Decay Box [OK]



Terminal

Discharging Phase!

Vc = 14.72E0_V

Vr = 25.28E0_V

iC = -1.839E-3_A

Q = 160.0E-6 C

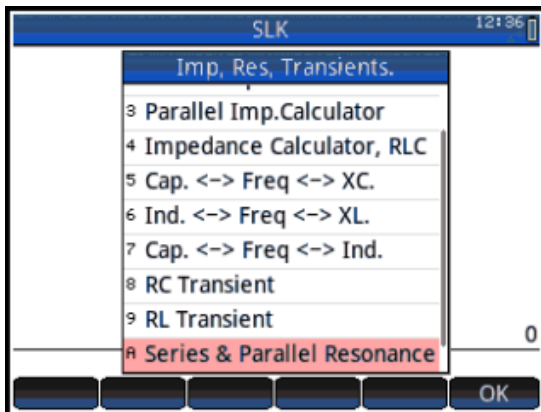
Press [Enter] to continue

Result

9 RL Transient (sub-menu) Same process as RC Transients

A- Series & Parallel Resonance.

And (sub-menu)

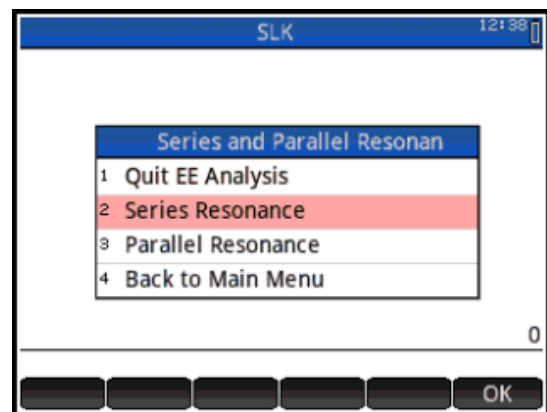


SLK

Imp, Res, Transients.

- 3 Parallel Imp. Calculator
- 4 Impedance Calculator, RLC
- 5 Cap. <-> Freq <-> XC.
- 6 Ind. <-> Freq <-> XL.
- 7 Cap. <-> Freq <-> Ind.
- 8 RC Transient
- 9 RL Transient
- 10 Series & Parallel Resonance**

Select A

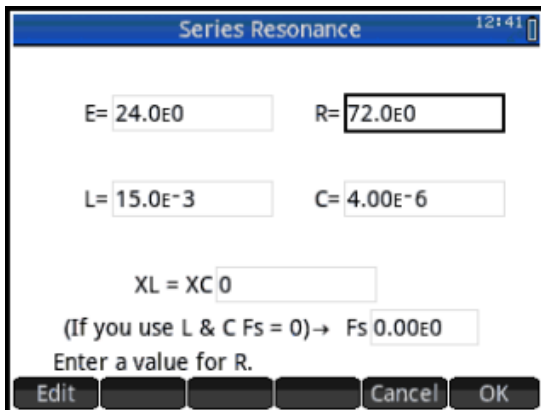


SLK

Series and Parallel Resonance

- 1 Quit EE Analysis
- 2 Series Resonance**
- 3 Parallel Resonance
- 4 Back to Main Menu

Select 2



Series Resonance

E= 24.0E0 R= 72.0E0

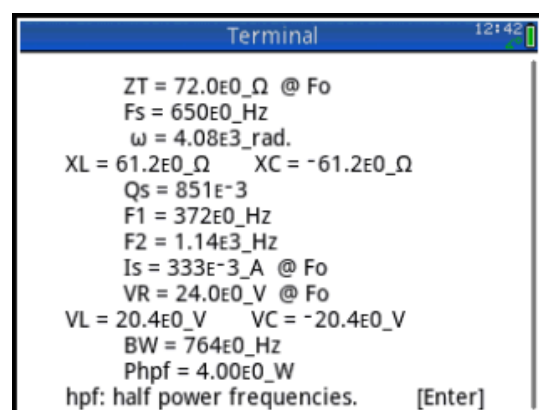
L= 15.0E-3 C= 4.00E-6

XL = XC 0

(If you use L & C Fs = 0) → Fs 0.00E0

Enter a value for R.

We are using L & C so Fs = 0. Fs, XL, & XC will be calculated. Result



Terminal

ZT = 72.0E0_Ω @ Fo

Fs = 650E0_Hz

ω = 4.08E3_rad.

XL = 61.2E0_Ω XC = -61.2E0_Ω

Qs = 851E-3

F1 = 372E0_Hz

F2 = 1.14E3_Hz

Is = 333E-3_A @ Fo

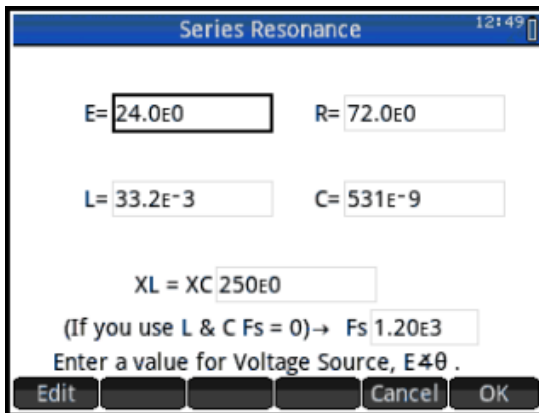
VR = 24.0E0_V @ Fo

VL = 20.4E0_V VC = -20.4E0_V

BW = 764E0_Hz

Phpf = 4.00E0_W

hpf: half power frequencies. [Enter]



Series Resonance

E= 24.0E0 R= 72.0E0

L= 33.2E-3 C= 531E-9

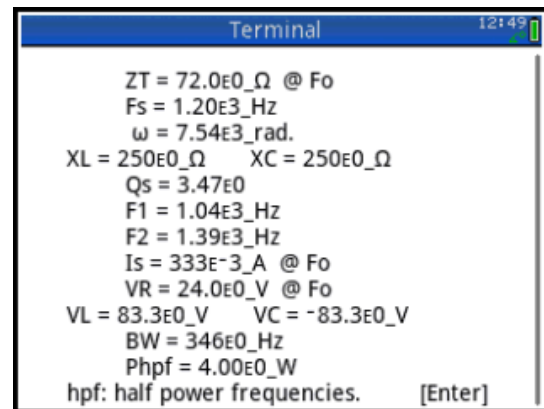
XL = XC 250E0

(If you use L & C Fs = 0) → Fs 1.20E3

Enter a value for Voltage Source, E 40 .

Edit Cancel OK

Here we use XL & XC so we assign 1200 Hz to FS.



Terminal

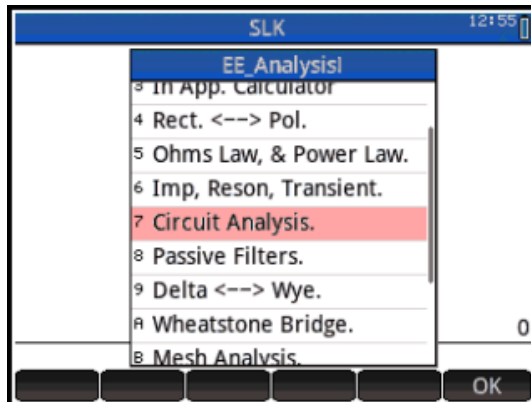
ZT = 72.0E0_Ω @ Fo
 Fs = 1.20E3_Hz
 ω = 7.54E3_rad.
 XL = 250E0_Ω XC = 250E0_Ω
 Qs = 3.47E0
 F1 = 1.04E3_Hz
 F2 = 1.39E3_Hz
 Is = 333E-3_A @ Fo
 VR = 24.0E0_V @ Fo
 VL = 83.3E0_V VC = -83.3E0_V
 BW = 346E0_Hz
 Phpf = 4.00E0_W
 hpf: half power frequencies. [Enter]

Result

Use the same process for Parallel Resonance.

7 Circuit Analysis:

Solve AC or DC circuit with either ESource or Isource and ZTs.



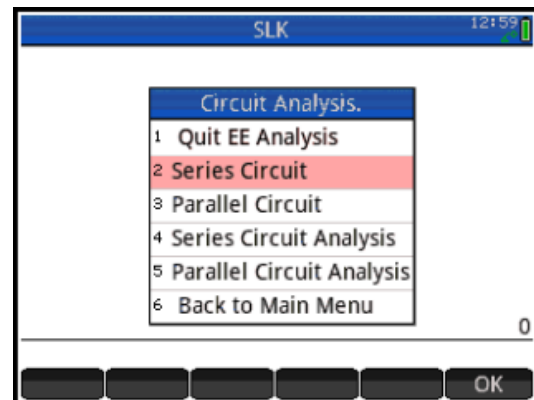
SLK

EE_Analysis

- 3 In App. Calculator
- 4 Rect. <--> Pol.
- 5 Ohms Law, & Power Law.
- 6 Imp, Reson, Transient.
- 7 Circuit Analysis.
- 8 Passive Filters.
- 9 Delta <--> Wye.
- A Wheatstone Bridge.
- B Mesh Analysis.

OK

Select 7 Circuit Analysis.



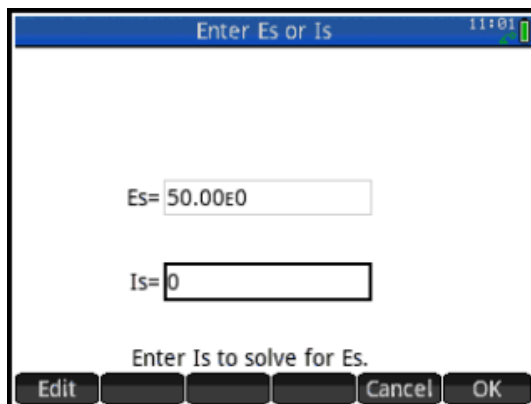
SLK

Circuit Analysis.

- 1 Quit EE Analysis
- 2 Series Circuit
- 3 Parallel Circuit
- 4 Series Circuit Analysis
- 5 Parallel Circuit Analysis
- 6 Back to Main Menu

OK

Select 2. Series Circuit



Enter Es or Is

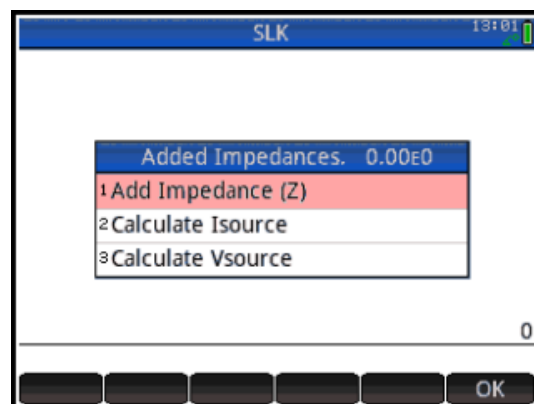
Es= 50.00E0

Is= 0

Enter Is to solve for Es.

Edit Cancel OK

Enter 50 V as ES & Press [OK]



SLK

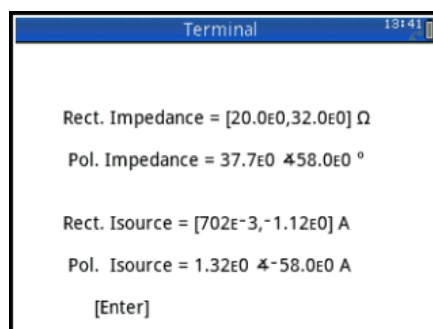
Added Impedances. 0.00E0

- 1 Add Impedance (Z)
- 2 Calculate Isource
- 3 Calculate Vsource

OK

Select 1 to accumulate all Impedances.

The next step is to enter all Series impedances, which will be accumulated. Select 1, enter the first impedance, press enter. The screen will return to prompt you for another impedance and keep recycling until all your impedances are in, then select 2 to Calculate the Current source and total Impedance.

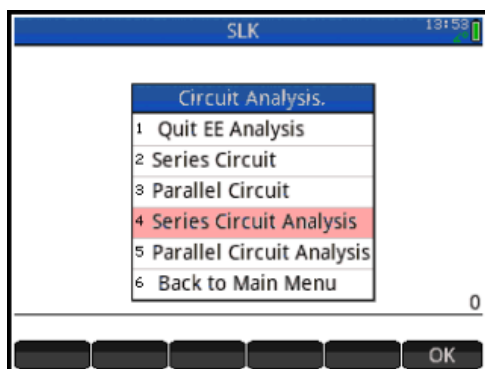


Result of adding $5+8i + 10+15i = 15+23i$ with a current of $703E-3-1.12A$

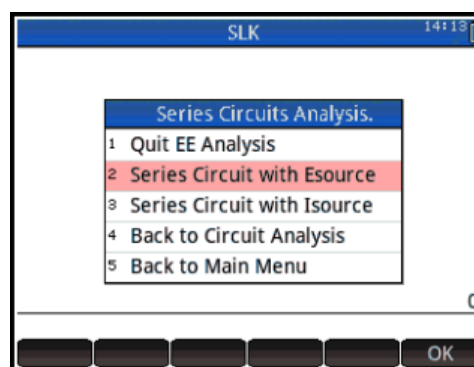
Note: You can enter as many Impedances as you want. The Impedances will be accumulated and added as you go. When you have entered all your Impedances, press [OK], the next step will solve for IS and Total Imp.

4 Series Circuits Analysis. (sub menu)

This type of circuit analysis varies from the previous one above in that you can enter up to 6 impedances and a voltage and calculate the total current and the voltage drop across each impedances.



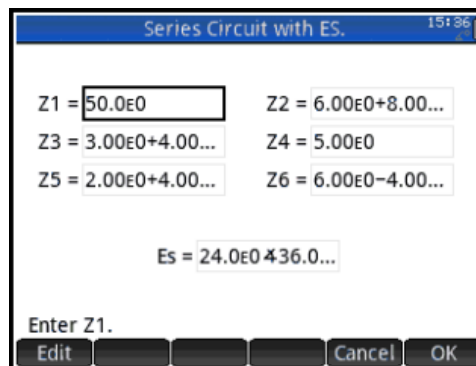
Select 4 Series Circuit Analysis.



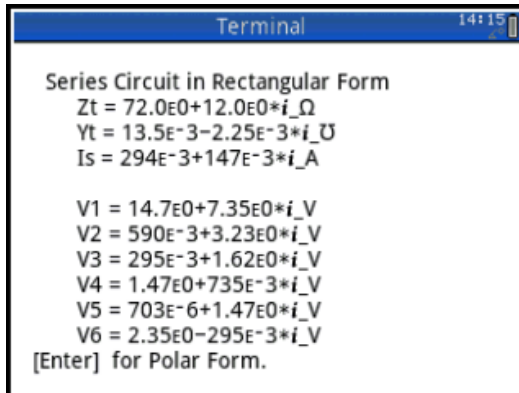
Select 2 Series Circuit with Esource

On the right panel, you can enter up to 6 impedances, and Es 24 V∠36. The result will be displayed in two screens, see below...Rectangular and Polar. You can also choose Isource instead of Esource.

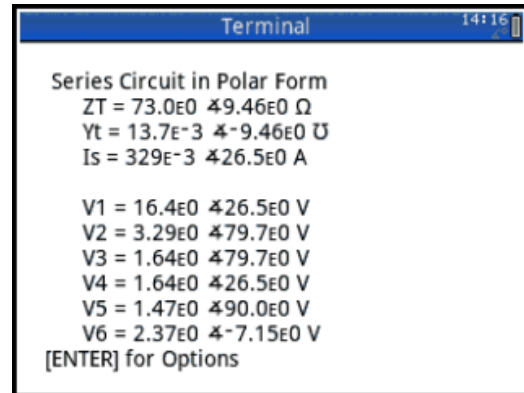
Example



Input data



Result in Rectangular form



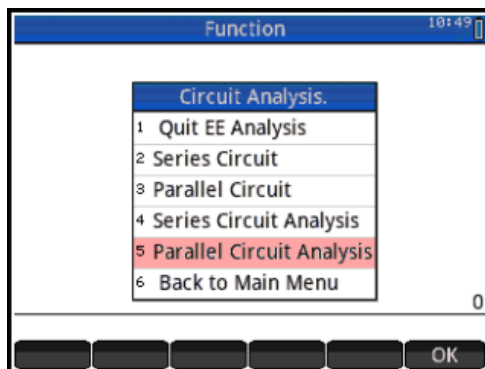
Result in Polar Form

On the right panel, you can enter up to 6 impedances, made up of resistances or reactances or both such as Z_2 and Z_3 and a voltage like 24_{v} or $24 \text{ V} \angle 36$. The result will be displayed in two screens, ...Rectangular and Polar.

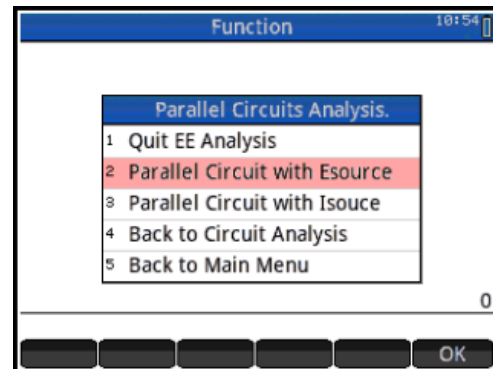
5 Parallel Circuits Analysis. (sub menu).

No change

This type of circuit analysis varies from the previous one above in that you can enter up to 6 impedances and a voltage and calculate the total current and the voltage drop across each impedances.



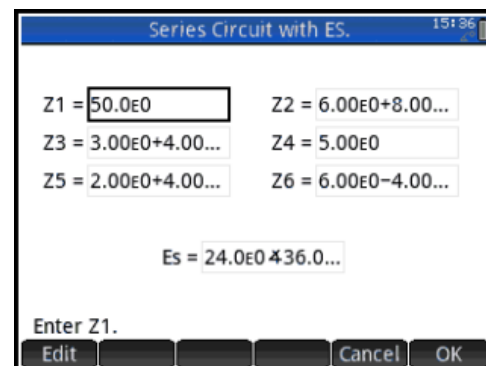
Select 4 Series Circuit Analysis.



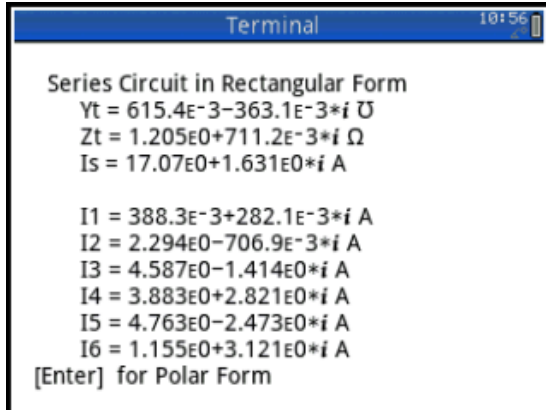
Select 2 Series Circuit with Esource

On the right panel, you can enter up to 6 impedances, displayed in two screens, see below...Rectangular and Polar. You can also choose Isource instead of Esource as in the previous Series Circuit.

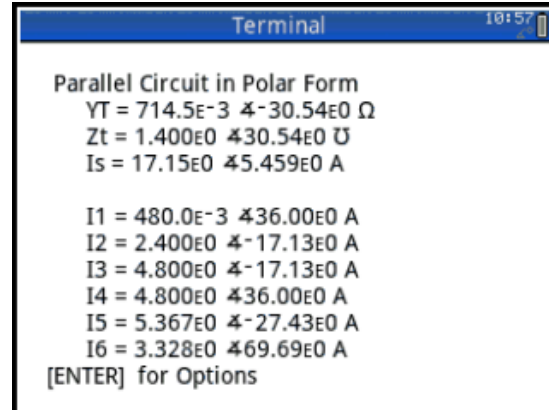
Example



Input data

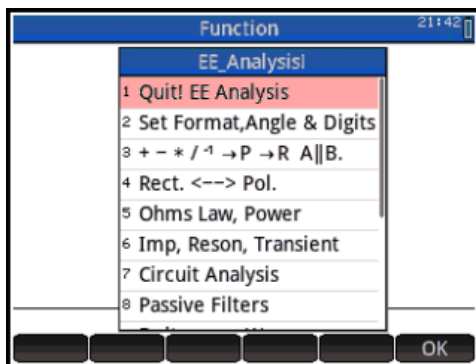


Result in Rectangular form

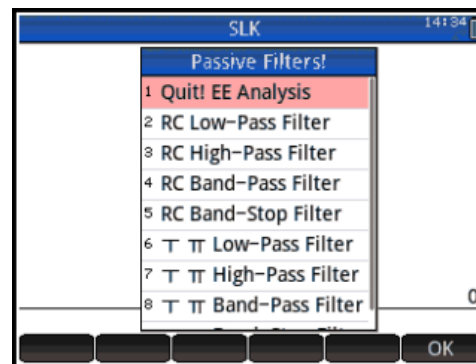


Result in Polar Form

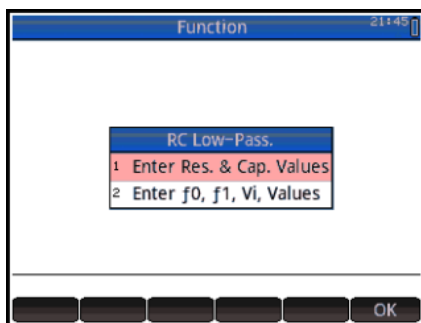
8. Passive Filters Using RC Circuits and (T and Π Circuits New)



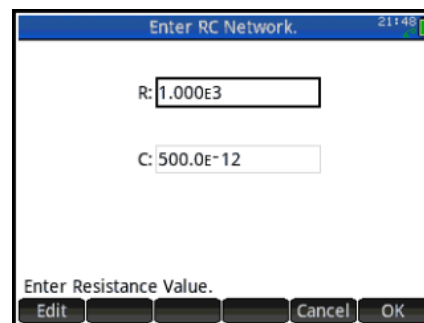
Select 8 Passive Filters



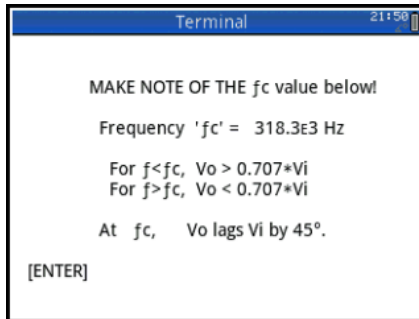
Select 2 RC Low-Pass Filter



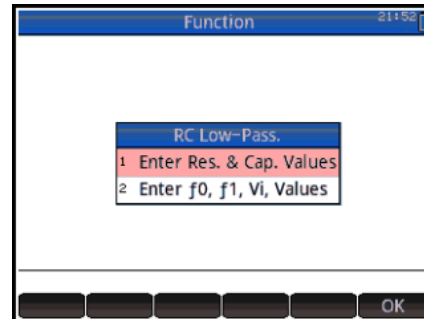
Select 1 Enter Res & Cap.....



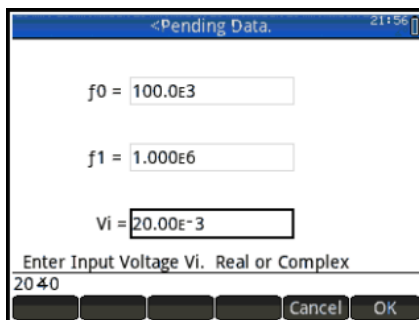
R = 1K. and C = 500_pF. [OK]



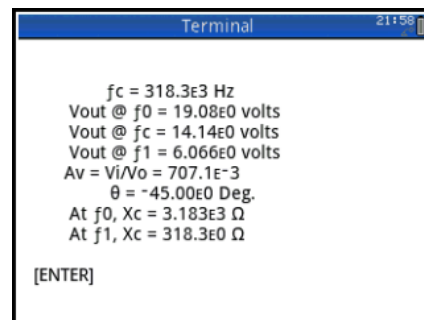
Center Frequency = 318.3_kHz



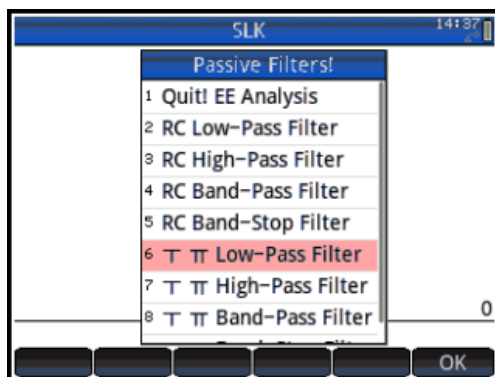
Select 2 Enter f_0 and f_1 values. [OK]



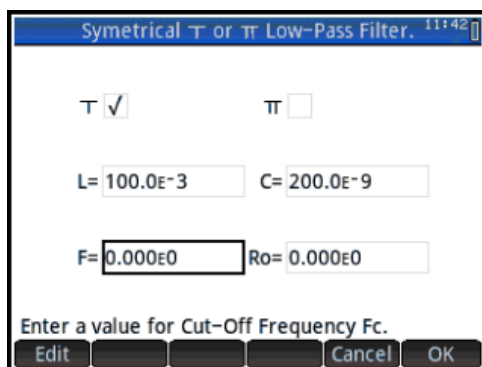
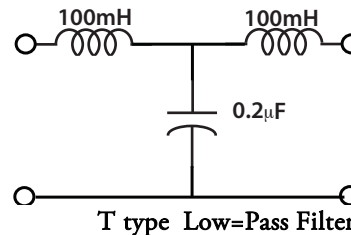
f_0 = 1kHz, f_1 = 1MHz, V_i = 20E-3V $\angle 0$ [OK].



Result for RC Low-Pass Filter. [Enter]

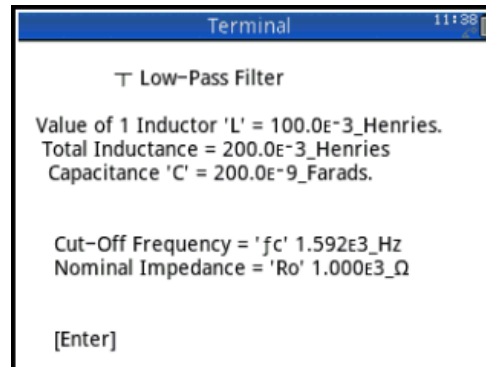


Select 6

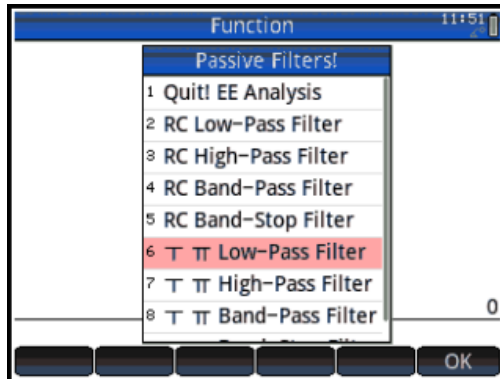


Input value of 1 Ind. & value of the Capacitor.

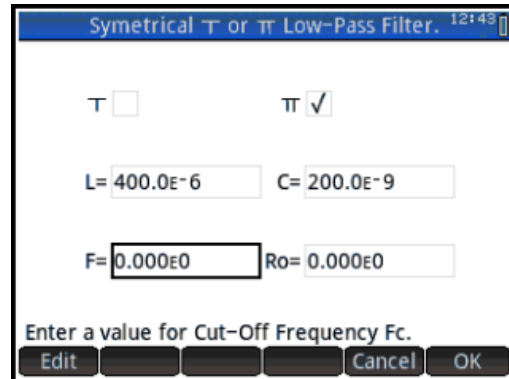
If you enter the Cut-Off Frequency and Ro, L and C will be calculated.



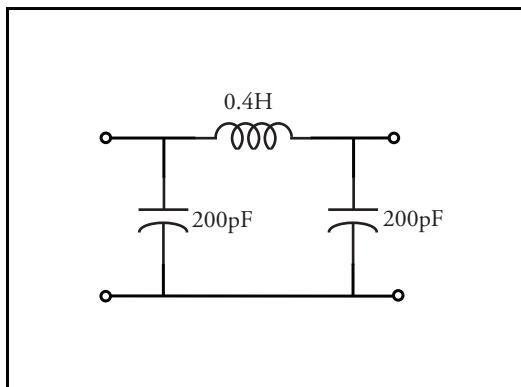
Calculate Cut-Off Frequency and Nominal Ro.



Select 6

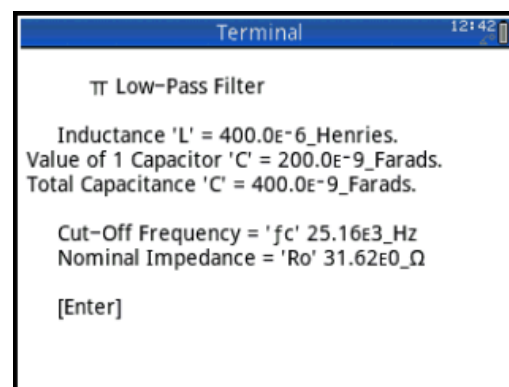


Select T and input L, C and [OK]



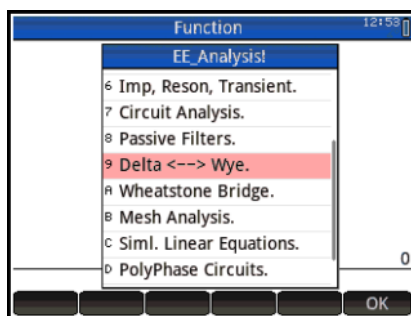
T Low-Pass Filter

If you enter the Cut-Off Frequency and Ro, L and C will be calculated.

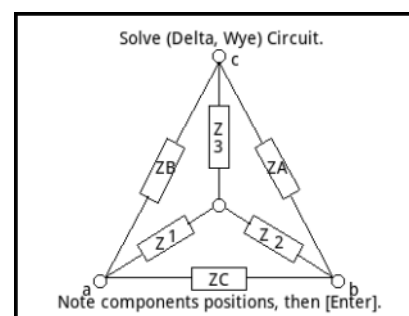


Result Solve for Cut-Off Frequency and Ro.

9. Delta to Wye and Wye to Delta transformation.



Select 9 Delta<-->Wye



Note: Z1<->ZA, Z2<->ZB & Z3<->ZC

Delta <--> Wye 13:40

Z3= $3+4*i$

Z1= $3+4*i$ Z2= $3+4*i$

ZB= ZA=

ZC=

Enter value for ZB, (R,±X).

Edit Cancel OK

Wye (Z1,Z2,Z3)

Terminal 13:40

ZA Rec= [9,12]
Pol= 15 453.1301023542 Ω

ZB Rec= [9,12]
Pol= 15 453.1301023542 Ω

ZC Rec= [9,12]
Pol= 15 453.1301023542 Ω

Press [Enter] to continue

Converted to Delta.

A Wheatstone Bridge

Function 14:13

EE_Analysist

- 8 Passive Filters
- 9 Delta <--> Wye
- A Wheatstone Bridge
- B Mesh Analysis
- C Siml. Linear Equations
- D Sinusoidal
- E PolyPhase Circuits
- F Transformers

OK

Select A Wheatstone Bridge

Thevenin Bridge 14:14

Z1= $3.000+4.000*i$ Z3= $3.000+5.000*i$

Es= $20.000\angle 24^\circ$ ZL= $10.000\angle 0^\circ$

Z2= $2.000+3.000*i$ Z4= $2.000+8.000*i$

Enter value for Z1, (R,±X).

Edit Cancel OK

The $10M\Omega$ as ZL, used as an open.

Terminal 14:22

Is = [-2.605E-7, -2.444E-7] A
3.572E-7 \angle -136.830 A

Va = [7.544, 3.655] V
8.383 \angle 25.848 V

Vb = [10.149, 6.099] V
11.841 \angle 31.001 V

VL = [-2.605, -2.444] V
3.572 \angle -136.830 V

[Enter]

B Mesh Analysis. 2 Loops and 3 Loops.

Function 15:06

EE_Analysist

- 8 Passive Filters
- 9 Delta <--> Wye
- A Wheatstone Bridge
- B Mesh Analysis
- C Siml. Linear Equations
- D Sinusoidal
- E PolyPhase Circuits
- F Transformers

OK

Select B

Function 15:07

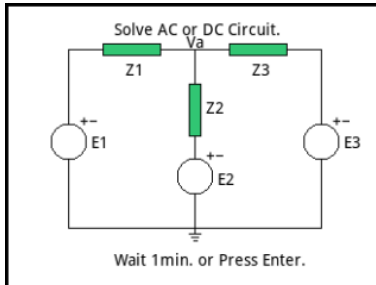
Mesh Analysis.

- 1 Quit EE Analysis
- 2 Mesh Analysis 2 Loops.
- 3 Mesh Analysis 3 Loops
- 4 Back to Main Menu

OK

Select 2

Mesh Analysis 2 Loops.



In the circuit \leftarrow , at least one voltage source must be used. Leave the values of the unused V sources at 0_V. Always used the E polarity at the top side + or - of the Esource.

Mesh Analysis 2 Loops 15:22

Z1= 1.000+2.000*i Z3= 6.000+i
Z2= 4.000-8.000*i

E1= 8.000 420.000 E3= 0.000
E2= 10.000 4180...

Enter value for Z1, (R,±X).

Edit Cancel OK

Note: E2, = $-10\angle 0 = 10\angle 180$.

Terminal 15:23

I1 = [0.909,0.512]
1.043 429.377

I2 = [0.068,-1.272]
1.274 4-86.946

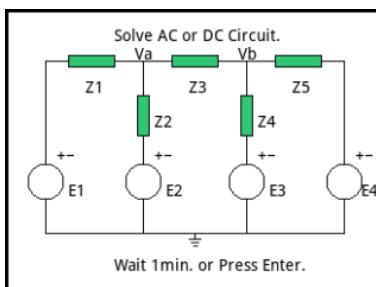
IZ2 = [0.841,1.784]
1.972 464.758

Va = [7.660,-3.952]
8.619 4-27.290

Press [ENTER] to_continue

Result

Mesh Analysis 3 Loops



Use 1 to 4 E voltages and enter the top polarity for each voltages. (+ -)

Mesh Analysis 3 Loops 19:05

Z1= 3.000+... Z3= 6.000+... Z5= 8.000+...

Z2= 5.000+... Z4= 7.000+...

E1= 10.000 E4= 16.000
E2= 8.000 E3= 12.000

Enter value for Z1, (R,±X).

Edit Cancel OK

$Z_1 = 3+4i$, $Z_2 = 5+6i$, $Z_3 = 6+7i$, $Z_4 = 7+8i$, $Z_5 = 8+9i$.
 $E_1 = 10\angle 0$, $E_2 = 8\angle 0$, $E_3 = 12\angle 0$, $E_4 = 16\angle 0$

Terminal 19:14

I1 = [-0.004,9.562E-5] 0.004 4178.490 A
I2 = [-0.170,0.197] 0.260 4130.808 A
I3 = [-0.197,0.224] 0.298 4131.269 A

IZ2 = [0.166,-0.197] 0.258 4-49.789 A
IZ4 = [0.027,-0.027] 0.038 4-45.608 A

Va = [10.011,0.014] 10.011 40.081 V
Vb = [12.408,0.023] 12.408 40.106 V

Press [ENTER] to_continue

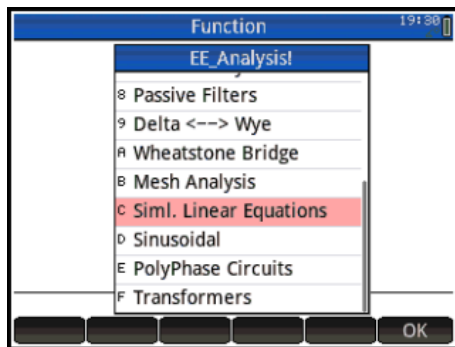
Result

Note:

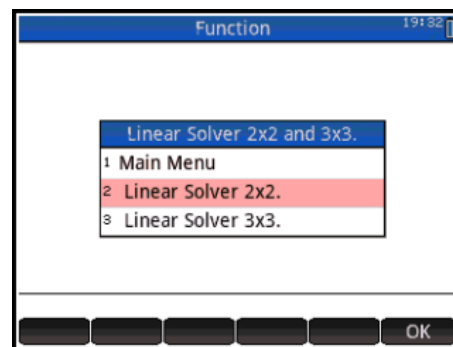
$$V_a = Z_2 * I_{Z2} + E_2.$$

$$V_b = Z_4 * I_{Z4} + E_3.$$

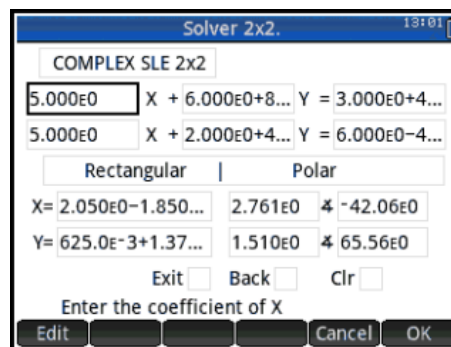
C. Simultaneous Linear Equation Solver 2x2 and 3x3.



Select C.

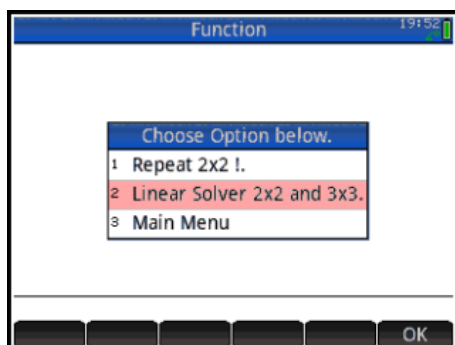


Select 2 SLE 2x2

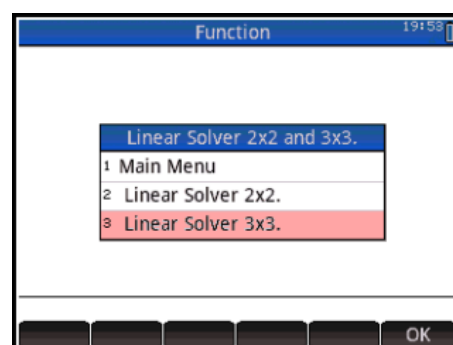


Input $5x + 6+8iy = 3+4i$

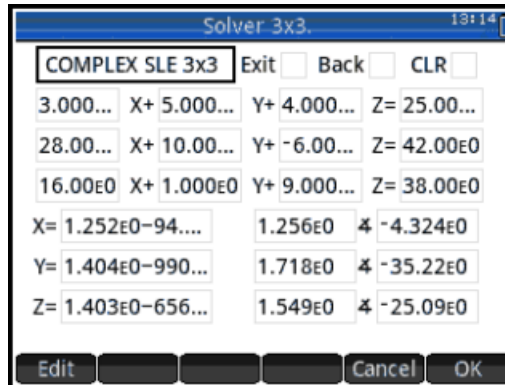
$5x + 2+4iy = 6-4i$



Select. 2



Select 3. SLE 3x3

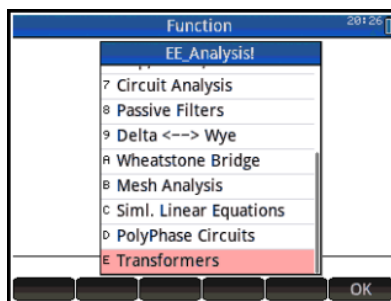


$$\begin{aligned} 3+4ix + 5+6y + 4\angle 36z &= 25\angle 22 \\ 28+5ix + 10\angle 24y + 3+4iz &= 42 \\ 16x + 1y + 9+6z &= 38 \end{aligned}$$

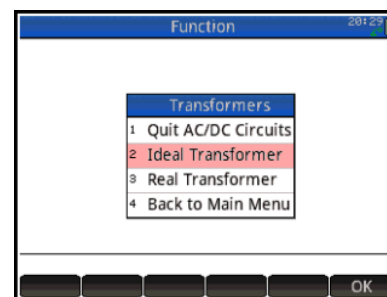
D Polyphase Circuits

For the Polyphase Circuits, download the separate document (.PDF)
<https://www.hpmuseum.org/forum/thread-14652.html>

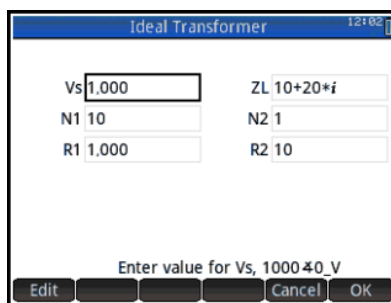
E. Ideal Transformer



Select E. Transformers

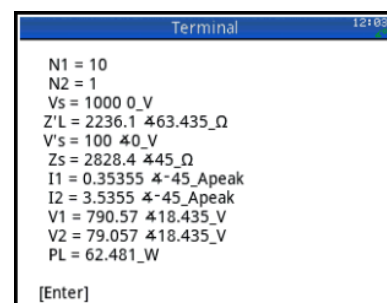


Select 2 Ideal Transformer

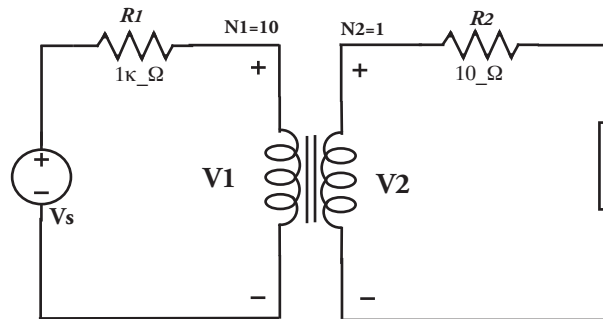


Press [OK]

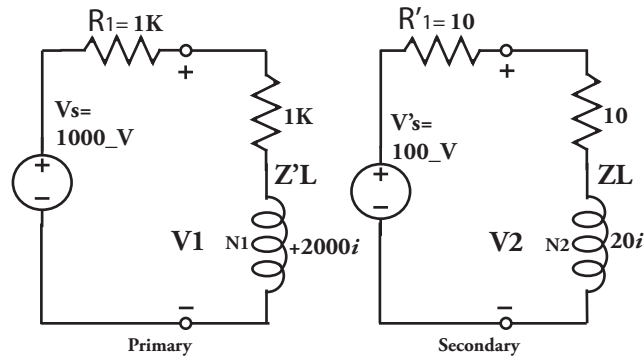
Ideal Transformer



Result

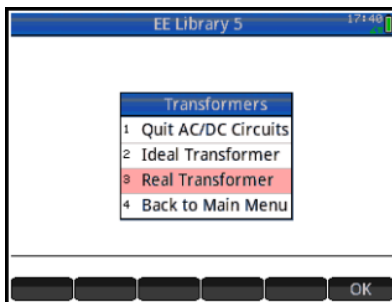


Ideal Transformer. Equivalent Circuit.



Laminated Iron Core

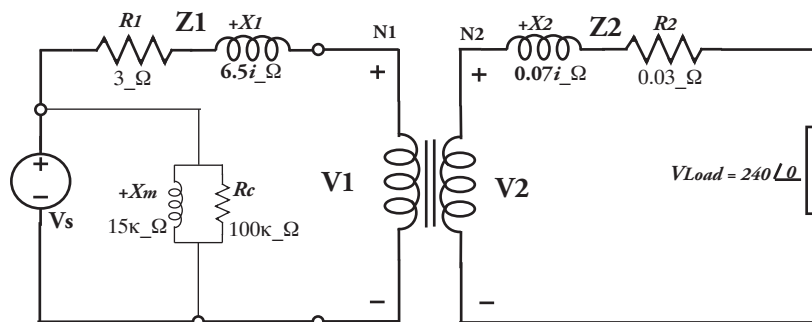
E- Real Transformer



Select 3 Real Transformer

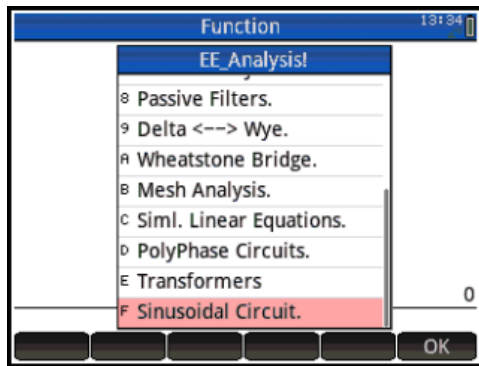


Circuit Inputs

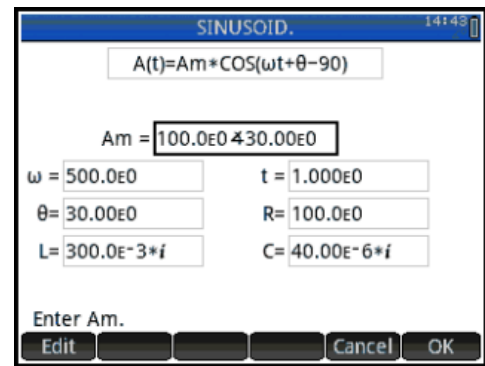


Real Transformer Equivalent Circuit

F. Sinusoid Circuit



Select F



Input Data. $A(t) = 100 \cdot \cos(500 \cdot t + (30 - 90))$

