

# NETWORK ANALYSIS ASSIGNMENT

## Rhithick Murali – 108119093 ECE

### DESCRIPTION:

The Program does 3 tasks:

- 1. Conversion of T to Pi and Pi to T:**
- 2. Conversion of one parameter to all other parameters (ABCD, Z, Y, S, h)**
- 3. Series RLC Circuit Solver.**

Normally one can convert from one parameter to any other parameter provided if they know inter-relationship formula. Otherwise one should derive using the equations and then convert. Instead of going through such tedious works and keeping the fact of doing calculation mistake aside this CAD reduces the users effort. It uses the inter-relationship formula to convert from one parameter to all other parameters. The 5 parameters that is used are Impedence(Z), Admittance(Y), transmission line(ABCD), hybrid parameters(h) and Scattering Paramters(S). This program also analyzes series RLC circuit. The operations that can be done using this CAD are as follows:

#### *Network Conversion:*

1. Convert PI – network → T – network.
2. Convert T – network → PI – network.

#### *Port Conversion:*

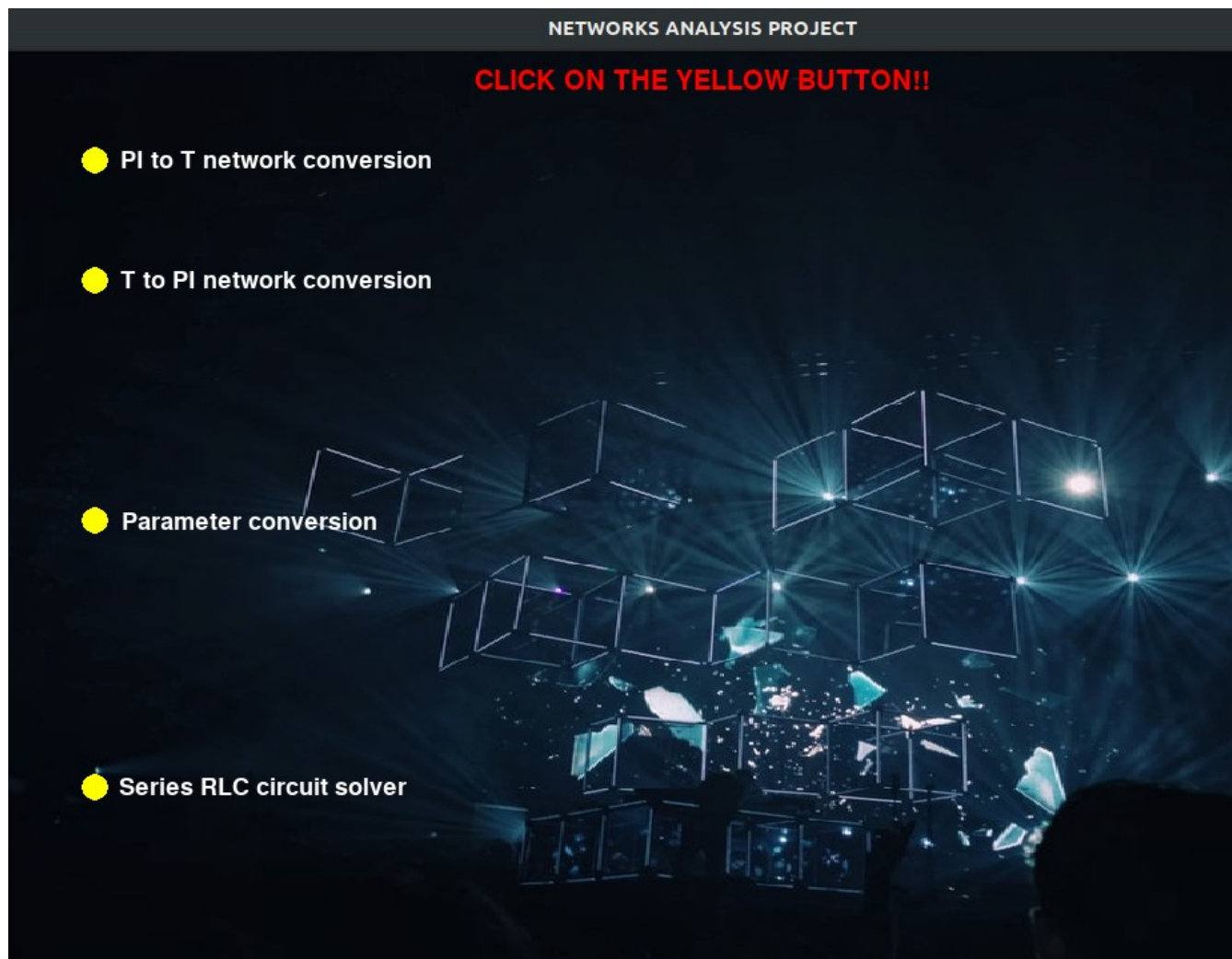
1. Convert Z parameter → Y , ABCD, h, S parameters.
2. Convert Y parameter → Z , ABCD, h, S parameters.
3. Convert ABCD parameter → Z , Y, h, S parameters.
4. Convert h parameter → Z , Y, ABCD, S parameters.
5. Convert S parameter → Z, Y, ABCD, h paramters.

#### *Circuit:*

1. Series RLC Circuit Analysis.  
Given R, L, C and f it would output:
  - a) Inductive Reactance.
  - b) Capacitive Reactance.
  - c) Impedance of the circuit.
  - d) Phase angle.
  - e) Resonant frequency
  - f) Q factor
  - g) Bandwidth
  - h) Graph of Impedance vs Frequency.

## PREVIEW:

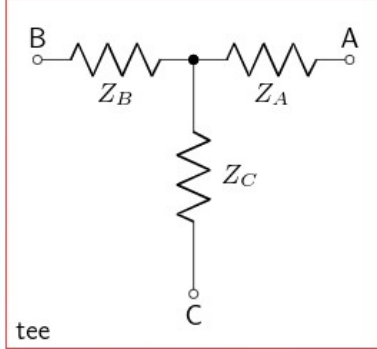
### 1) Main Page:



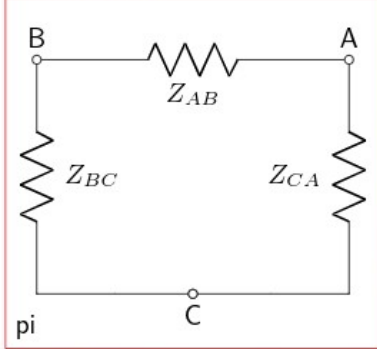
## 2) Port Conversion:

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PI to T network conversion



tee



pi

ENTER Zab(ohms):

ENTER Zbc(ohms):

ENTER Zca(ohms):

Za = 10.0 ohm

Zb = 10.0 ohm

Zc = 10.0 ohm

PRESS 0 TO RETURN TO MAIN PAGE!!

### 3) Parameter Conversion:

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Parameter Conversion

Y Z ABCD h S

Y11 = (-0.0028+0.0014j) Z11 21  
i 9

Y12 = (0.0062-0.0131j) Z12 12  
i 8

Y21 = (0.0617-0.0415j) Z21 32  
i 67

Y22 = (-0.0058+0.0221j) Z21 1  
i 3

Zo 50

A = (0.2306-0.2031j) h11 = (-285.3981-142.6926j) S11 = (-0.3398-0.2183j)

B = (-11.1591-7.5057j) h12 = (3.6268-2.8573j) S12 = (0.295+0.2443j)

C = (0.0058-0.0122j) h21 = (-23.5307+3.0399j) S21 = (0.6571+1.8554j)

D = (0.0418+0.0054j) h22 = (0.0994-0.3047j) S22 = (-0.8507-0.4316j)

PRESS 0 TO RETURN TO MAIN PAGE!!

### 4) Series RLC Circuit Solver:

Activities main.py Wed Nov 11, 12:46

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Series RLC Circuit Analysis

ENTER the Resistance of the RLC Circuit(ohm): 1000  
ENTER the Inductance of the RLC Circuit (mH): 250  
ENTER the Capacitance of the RLC Circuit (uF): 500  
ENTER the frequency of the sinusoidal wave(HZ): 100

$\omega = 628.0 \text{ rad/s}$   
 $\phi = 0.153 \text{ rad} = 8.766 \text{ deg}$   
 $XL = 157.0 \text{ ohms}$   
 $XC = 3.18 \text{ ohms}$   
 $Z = 1011.76 \text{ ohms}$

Resonant frequency  $f_0 = 14.235 \text{ HZ}$   
Q-factor  $Q = 0.022$   
Bandwidth = 636.62 HZ

Figure 1

Resonance Graph

## 5) Code (partial for Z and ABCD):

```
parameter_page = False
previous = True
input_value2("Z11", 305, 150, 335 ,150, GREEN, zreal, zimag)
if running: input_value2("Z12", 305, 250, 335 ,250, GREEN, zreal, zimag)
if running: input_value2("Z21", 305, 350, 335 ,350, GREEN, zreal, zimag)
if running: input_value2("Z21", 305, 450, 335 ,450, GREEN, zreal, zimag)
if running: input_value2("Zo", 305, 550, 335, 550, GREEN, zzreal, zzimag)
if running:
    ztoy(yreal, yimag), ytot(treal, timag), ttoh(hreal, himag), ttos(sreal, simag)
    check(yreal), check(treal), check(hreal), check(sreal)
    ans = []
    addtolist()
    for i in range(4):
        draw_text2(ans[12+i], screen, 16, 50, 140 + 100*i, YELLOW)
    for i in range(4):
        draw_text2(ans[4+i], screen, 16, 55 + 500, 140 + 100*i, YELLOW)
    for i in range(4):
        draw_text2(ans[8+i], screen, 16, 55 + 750, 140 + 100*i, YELLOW)
    for i in range(4):
        draw_text2(ans[16+i], screen, 16, 55 + 1000, 140 + 100*i, YELLOW)
if not previous and X > 572 and X < 590 and Y > 70 and Y < 89:
    parameter_page = False
    previous = True
    input_value2("A", 555, 150, 585 ,150, GREEN, treal, timag)
    if running: input_value2("B", 555, 250, 585 ,250, GREEN, treal, timag)
    if running: input_value2("C", 555, 350, 585 ,350, GREEN, treal, timag)
    if running: input_value2("D", 555, 450, 585 ,450, GREEN, treal, timag)
    if running: input_value2("Zo", 555, 550, 585, 550, GREEN, zzreal, zzimag)
    if running:
        ttoy(yreal, yimag), ytoz(zreal, zimag), ttoh(hreal, himag), ttos(sreal, simag)
        check(yreal), check(zreal), check(hreal), check(sreal)
        ans = []
        addtolist()
```