**AOOP Homework 5**

Please define at least three classes to solve AC circuit problems:

including series and parallel RLC network, time domain and frequency domain transform.

You can specify the problem by yourself but provide cin, cout operator overloading

Complex Number can be expressed in the following two forms:

1. Z = X + j Y (rectangular form)

2. Z = A∠θ (polar form)

where A is the magnitude, θis the phase angle

3. X = A cosθ Y = A sinθ

 A =  θ= ( Y / X )

Example:

Given magnitudes ,  and phase angles,  of two ac currents  and .

Find the magnitude  and phase shift of the current that is the sum of  and .

Assume: 1. =  = 2A,  = = 

2.  and  have the same frequency

Solution: Adding currents in rectangular form

i =  +  = (  + ) + j( + ) =  + j 

 =  cos + cos = 2(cos + cos) = 2

 =  sin + sin = 2(sin + sin) = 2

Total current: i = 2 + j2

Using rectangular to polar transformation 🡺

i = ∠ = ∠(2/2) = 2.828 ∠

 =2.828A,  = 

※**等效阻抗(impedance)的計算**:

**阻抗是直流電路電阻觀念的延伸。電阻是電壓和電流的比值，**

**而阻抗則納入了頻率的因素。**

**因此我們以複數來表示交流電路中的阻抗**。

1. **純電阻的阻抗** (***jω***) =  = R

2. **純電容的阻抗** ( ***jω***) = 

( 其中C為電容常數, 是虛數會隨頻率不同而改變 )

3. **純電感的阻抗 ( *jω*) =  *jωL***

( 其中*L*為電感常數, 是純虛數會隨頻率不同而改變 )

* **串聯電路的等效阻抗:**

**兩個阻抗 和 串聯**，**等效阻抗 等於兩個複數相加**。

**我們可以利用＋的operator代表串聯運算:**

 串聯  可簡寫成 ＋

等效阻抗 = ( ***jω***) ＋ ( ***jω***)

※**並聯電路的等效阻抗:**

兩個阻抗和並聯，我們可以利用 **|| 的operator代表並聯運算**:

 並聯  可簡寫成  || 

等效阻抗 = ( ***jω***) || ( ***jω***)

 =  +  =

* **混合電路的等效阻抗:**

我們利用operator overloading 定義＋的operator代表串聯運算

|| 的operator代表並聯運算。如此任何阻抗的組合方式就可以

使用此兩個operator得到等效阻抗的值。



等效阻抗就可直接寫成

( ***jω***) = ( ***jω***) +(( ***jω***) || ( ***jω***) )





Example:

R1

R2

R2

L

C

R1 **= 200**

R2 **= 100**

C = 3**0μ*F***

L = **100 *mH***

If *ω* = rad／sec , we have the following:

double Omega = 1.0e04, C=30e-06, L=0.01;

Complex ZC( 0, -1/(Omega\*C);

Complex ZL( 0, Omega\*L);

Complex R1(200, 0), R2(100,0);

Complex ;

 = ( R1 + ZL ) +( R2 || ZC ) ;

.displayRectangular( );

.displyPhasor( )

ref: AC circuits http://cc.ee.ntu.edu.tw/~thc/course\_ckt/note/chap6.pdf