

# Joe Stanley

## ECE522 - EXAM1

```
In [1]: 1 # Import Necessary Libraries
2 import numpy as np
3 import matplotlib.pyplot as plt
4 from scipy.optimize import fsolve
5 import electricpy as ep
6 from electricpy.constants import *
7
8 # Set Boolean Control for Report Style
9 debug = True
```

### Problem II:

Repeat Parts B and C of Problem I for the situation where the parameter  $L/r$  in the "slip calculator" is in error by +25%.

*Comment on the effect on steady state performance of such "detuning" of the controller.*

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Since we know:  $s = \frac{\omega_{es} - \omega_r}{\omega_{es}}$ , we can manipulate the equation into the form:  $(\omega_{es} - \omega_r) = s \cdot \omega_{es}$ . In this form, we can substitute it into our equations to solve.

**Part 'B' (since we're only repeating parts B and C of problem 1):**

In [4]:

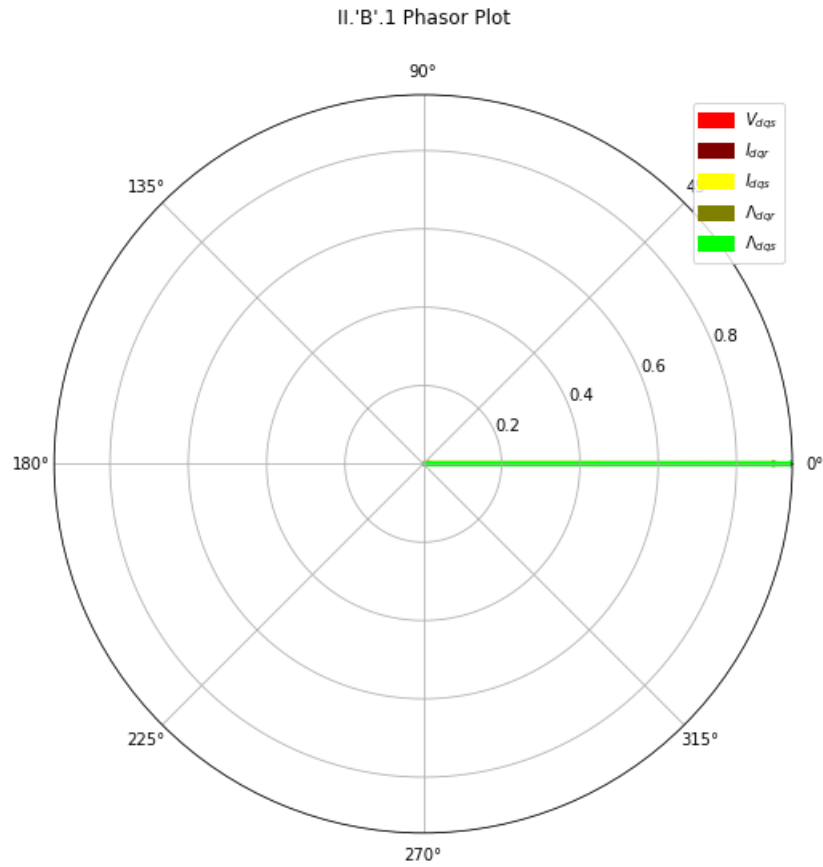
```
1  # Define Provided Machine Parameters
2  rs = 0.03 #pu
3  Lls = 0.1 #pu
4  Lm = 2.0 #pu
5  LLr = 0.1 #pu
6  rr = 0.03 #pu
7
8  # Define Rated Criteria
9  VdqsMag = 1
10 wes = 1
11 Tem = 0
12
13 # Calculate Additional Inductance Terms
14 Ls = Lls + Lm
15 Lr = LLr + Lm
16
17 #####
18 # Read Data Calculated from Problem 1
19 with open("constants.txt",'r') as file:
20     s_rated = float(file.readline())
21     w_rated = float(file.readline())
22     lamdr_rated = float(file.readline())
23 print("S-rated:",s_rated,"tw-rated:",w_rated,"\tLambda-rated:",lamdr_rated)
24 #####
25
26 texlabels = [
27     "$V_{dqs}$",
28     "$I_{dqr}$",
29     "$I_{dqs}$",
30     "$\\Lambda_{dqr}$",
31     "$\\Lambda_{dqs}$",
32 ]
33 labels = [
34     "Vdqs:",
35     "Idqr:",
36     "Idqs:",
37     "λdqr:",
38     "λdqs:",
39 ]
40
41 #####
42 # "B".1)
43 wr = 0.0
44 LAMdr = lamdr_rated
45
46 # Generate Phasor Plot
47 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,Lls,s_err=0.25)
48 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
49 print("w-slip:",wslip,"\tw-es",wes)
50 clist *= ep.phs(-np.angle(clist[3],deg=True))
51 ep.phasorplot(clist,"II.'B'.1 Phasor Plot",texlabels,filename="II-B-1",size=8,linewidth=3,plot=debug)
52
53 #####
54 # "B".2)
55 wr = w_rated
56 LAMdr = lamdr_rated
57
58 # Generate Phasor Plot
59 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,Lls,s_err=0.25)
60 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
61 print("w-slip:",wslip,"\tw-es",wes)
62 clist *= ep.phs(-np.angle(clist[3],deg=True))
63 ep.phasorplot(clist,"II.'B'.2 Phasor Plot",texlabels,filename="II-B-2",size=8,linewidth=3,plot=debug)
64
65 #####
66 # "B".3)
67 wr = 2*w_rated
68 LAMdr = lamdr_rated/2
69
70 # Generate Phasor Plot
71 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,Lls,s_err=0.25)
```

```

72 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
73 print("w-slip:",wslip,"\tw-es",wes)
74 clist *= ep.phs(-np.angle(clist[3],deg=True))
75 ep.phasorplot(clist,"II.'B'.3 Phasor Plot",texlabels,filename="II-B-3",size=8,linewidth=3,plot=debug

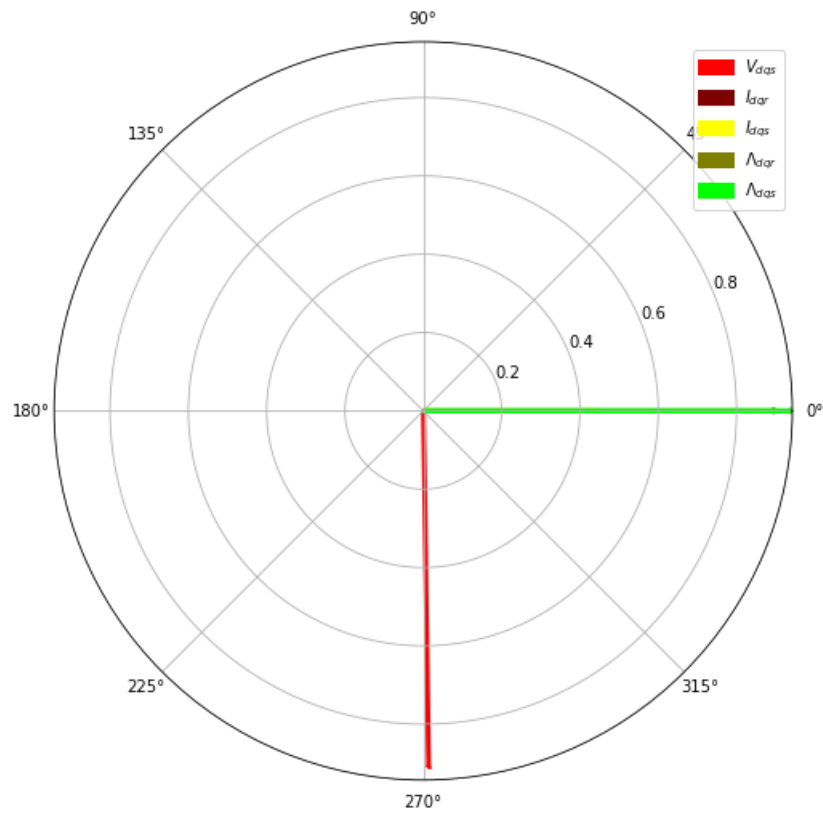
```

S-rated: 0.03723079497495241       $\omega$ -rated: 0.9627692050250476      Lambda-rated: 0.8976550377456242  
w-slip: 0.0      w-es 0.0



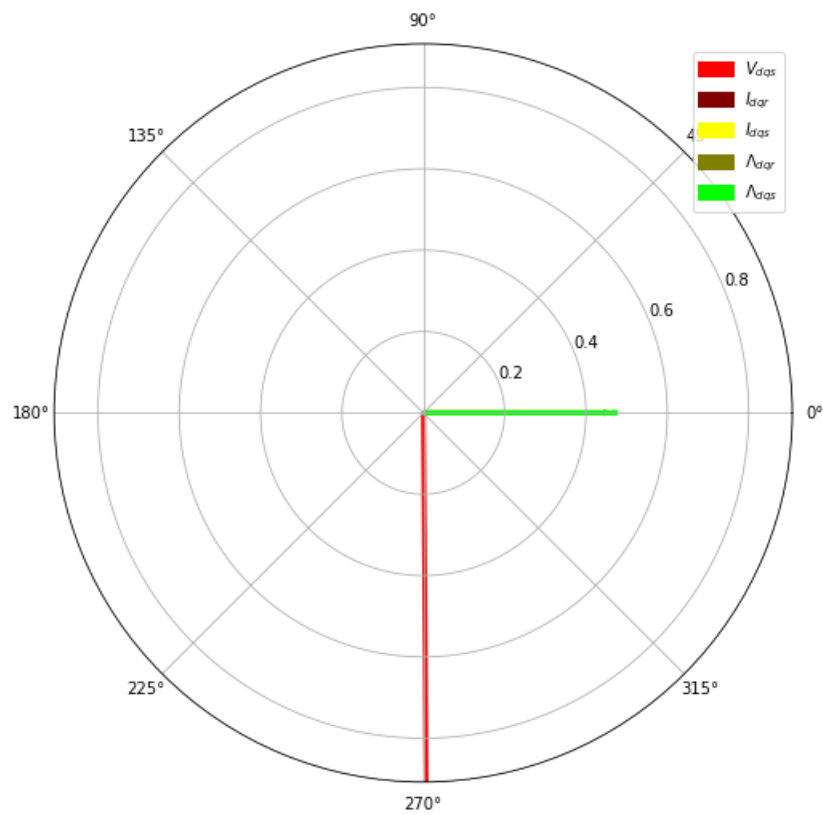
w-slip: 0.0      w-es 0.9627692050250476

II.'B'.2 Phasor Plot



w-slip: 0.0      w-es 1.9255384100500952

II.'B'.3 Phasor Plot



**Part 'C' (since we're only repeating parts B and C of problem 1):**

## Comments and Analysis:

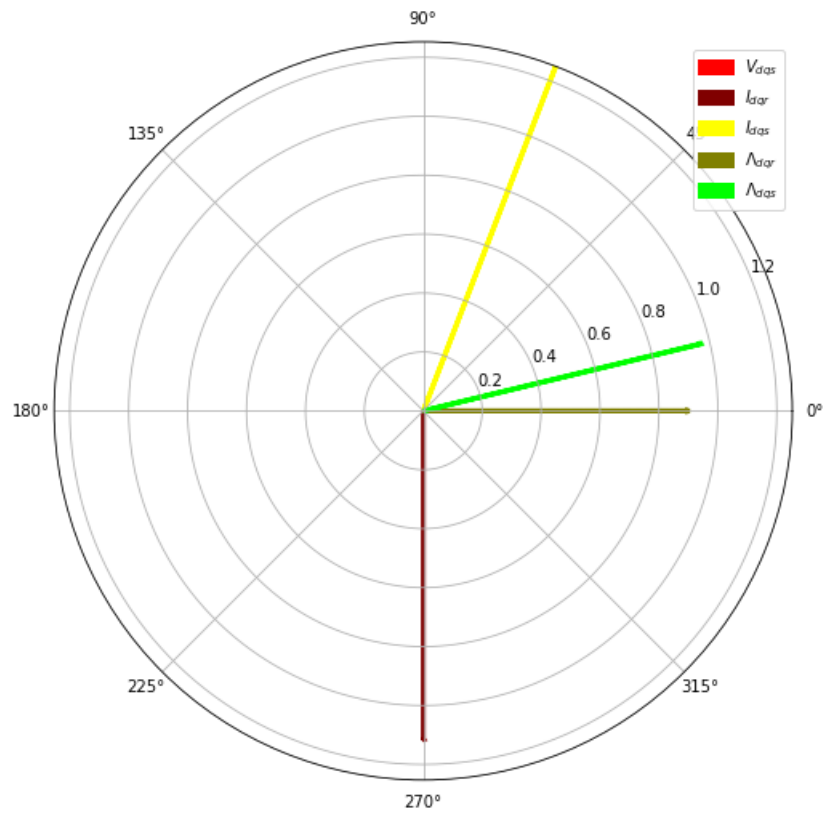
From comparison, it seems clear that these results are not too dissimilar from those found in the previous problem (problem I). Perhaps the only truly notable difference is that magnitude difference between the results. Angle differences and general relations between the vectors appear to be largely the same between the Problem I results and these Problem II results.

In [6]:

```
1 #####
2 # "C".1)
3 Tem = 1.0
4 wr = 0.0
5 LAMdr = lamdr_rated
6
7 # Generate Phasor Plot
8 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,LLs,s_err=0.25)
9 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
10 print("w-slip:",wslip,"\tw-es",wes)
11 clist *= ep.phs(-np.angle(clist[3],deg=True))
12 ep.phasorplot(clist,"II.'C'.1 Phasor Plot",texlabels,filename="II-C-1",size=8,linewidth=3,plot=debug)
13
14 #####
15 # "C".2)
16 Tem = 1.0
17 wr = w_rated
18 LAMdr = lamdr_rated
19
20 # Generate Phasor Plot
21 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,LLs,s_err=0.25)
22 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
23 print("w-slip:",wslip,"\tw-es",wes)
24 clist *= ep.phs(-np.angle(clist[3],deg=True))
25 ep.phasorplot(clist,"II.'C'.2 Phasor Plot",texlabels,filename="II-C-2",size=8,linewidth=3,plot=debug)
26
27 #####
28 # "C".3)
29 Tem = 0.5
30 wr = 2*w_rated
31 LAMdr = lamdr_rated/2
32
33 # Generate Phasor Plot
34 Vdqs,Idqr,Idqs,LAMdqr,LAMdqs,wslip,wes = ep.imfoc_control(Tem,LAMdr,wr,rr,rs,Lm,LLr,LLs,s_err=0.25)
35 clist = np.array([Vdqs,Idqr,Idqs,LAMdqr,LAMdqs])
36 print("w-slip:",wslip,"\tw-es",wes)
37 clist *= ep.phs(-np.angle(clist[3],deg=True))
38 ep.phasorplot(clist,"II.'C'.3 Phasor Plot",texlabels,filename="II-C-3",size=8,linewidth=3,plot=debug)
```

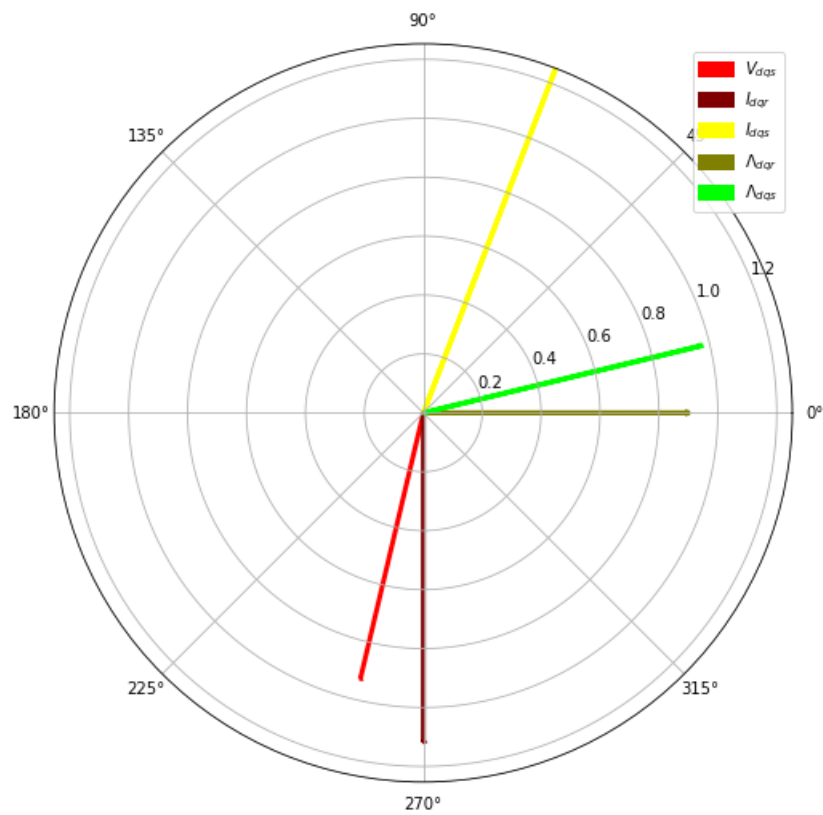
w-slip: 0.029784635979819975      w-es 0.029784635979819975

II.'C'.1 Phasor Plot

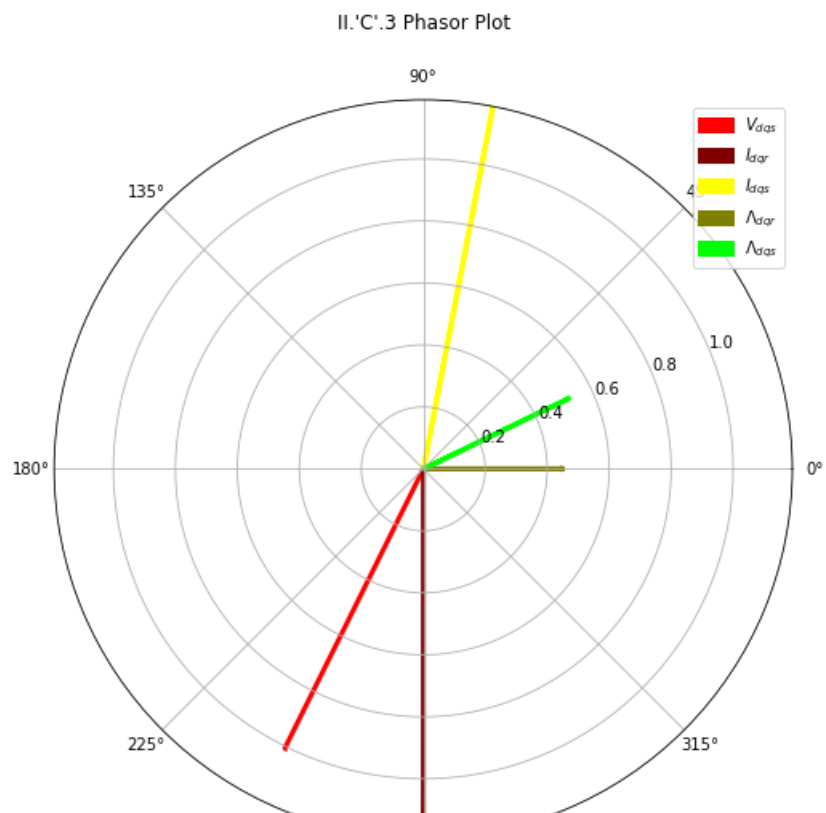


w-slip: 0.029784635979819975    w-es 0.9925538410048675

II.'C'.2 Phasor Plot



w-slip: 0.05956927195963995    w-es 1.985107682009735



## Comments:

We see the same behavior as the first problem!

In [ ]:

1