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ECE 524 - HWK 7

In [1]:
```
# Import Libraries
import numpy as np
import matplotlib.pyplot as plt
import eepower as eep
from eepower import p,n,u,m,k,M
```

Problem 1

In [55]:

```
# Define givens
Vsrc = 345*k #transformer is Y-G
N = 345/69
Srat = 100*M
Xleak = 10/100
XoR = 12
Cphsgrnd = 7.5*n # HV side

# A)
Rloss = Xleak / XoR
leak = Rloss+1j*Xleak * eep.zpu(S=Srat,VLN=Vsrc)
print("Leakage:",leak,"Ω")
Imax = Vsrc / leak
print("Worst Case Peak Fault Current:",abs(Imax),"A (High-Side)")
print("Worst Case Peak Fault Current:",abs(Imax/k)*N,"kA (Low-Side)")
print("Angle of Inception:",np.degrees(np.angle(Imax)),"°\n")

# B)
Lleak = eep.reactance(Xleak * eep.zpu(S=Srat,VLN=Vsrc))
print("Leakage Inductance:",Lleak/m,"mH")
oscfreq = eep.fault.natfreq(C=Cphsgrnd,L=Lleak)
print("Oscillation Frequency:",oscfreq,"Hz")
print("Oscillation T-cycle:",(1/oscfreq)/m,"msec")
pkV = eep.fault.pktransrecvolt(Cphsgrnd,Lleak,VLN=Vsrc)[0]
print("Peak Voltage:",pkV/k,"kV\n")

print("7.5nF",Cphsgrnd*u/n,"uF")
```

```
Leakage: (0.008333333333333333+357.07500000000005j) Ω
Worst Case Peak Fault Current: 966.1835746161103 A (High-Side)
Worst Case Peak Fault Current: 4.830917873080551 kA (Low-Side)
Angle of Inception: -89.9986628444 °

Leakage Inductance: 947.170855076 mH
Oscillation Frequency: 1888.31888658 Hz
Oscillation T-cycle: 0.529571571362 msec
Peak Voltage: 975.809971318 kV

7.5nF 7.500000000000001e-06 uF
```

Problem 2

In [50]:

```
# Define givens
Srat = 300*M
ZHX = 9.46j/100   # 300 MVA
ZHY = 4.236j/100  # 30 MVA
ZXY = 3.184j/100  # 30 MVA
ExLoss = 918.75*k
ExI = 2.56

# Convert to common base
ZHX *= Srat/(300*M)
ZHY *= Srat/(30*M)
ZXY *= Srat/(30*M)

# Find supportive components
ZH = 0.5*(ZHX+ZHY-ZXY)
ZX = 0.5*(ZHX+ZXY-ZHY)
ZY = 0.5*(ZHY+ZXY-ZHX)
print("ZH:",ZH,"Ω-pu")
print("ZX:",ZX,"Ω-pu")
print("ZY:",ZY,"Ω-pu")

# Evaluate PU-Bases and Inductances
ZH *= eep.zpu(S=Srat,VLN=525*k)
ZX *= eep.zpu(S=Srat,VLN=241.5*k)
ZY *= eep.zpu(S=Srat,VLL=34.5*k)
LH = eep.reactance(ZH)
LX = eep.reactance(ZX)
LY = eep.reactance(ZY)
print("H-Winding Inductance:",LH/m,"mH")
print("X-Winding Inductance:",LX/m,"mH")
print("Y-Winding Inductance:",LY/m,"mH")

# Evaluate Rm
Rm = ((525*k)**2/ExLoss)
print("Magnetizing Resistance:",Rm,"Ω")
```

```
ZH: 0.09989999999999999j Ω-pu
ZX: -0.005299999999999971j Ω-pu
ZY: 0.3237j Ω-pu
H-Winding Inductance: 730.3869018085658 mH
X-Winding Inductance: 0.8581411766990243 mH
Y-Winding Inductance: 3.406657842088726 mH
Magnetizing Resistance: 300000.0 Ω
```

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