Example 4.1.

November 20, 2016

1 Example 4.1

Notebook ini memuat perhitungan yang dibahas dalam Example 4.1 yang ada pada halaman 92-95 buku [1]. ## Pustaka [1] Kersting, W. Distribution system modeling and analysis CRC Press, 2002

```
In [1]: # konduktor phasa
        GMR=0.0244 # ft
        r = 0.306 # ohm/mile Resistance
        # konduktor netral
        GMRn=0.00814 # ft
        rn= 0.5920
        # jarak antar konduktor
        Dab=2.5 # ft
        Dbc=4.5 # ft
        Dca=7 # ft
        Dan=5.6569 # ft
        Dbn=4.272 # ft
        Dcn=5.0 # ft
```

```
In [2]: # z_ii = r_i + 0.09530 + j0.12134 (ln (1/GMRi) + 7.93402)
```

```
In [3]: from scipy import log
        def hitungzii(r,gmr):
            # menghitung self impedance
            zii=r+0.0953+0.12134j*(log(1/gmr) + 7.93402)
            return zii
```

```
In [4]: hitungzii(r,GMR)
```

```
Out[4]: (0.4013+1.413270295078513j)
```

```
In [5]: # self impedance
        zaa=hitungzii(r,GMR)
        zbb=hitungzii(r,GMR)
        zcc=hitungzii(r,GMR)
        znn=hitungzii(rn,GMRn)
        print(zaa)
```

```
print(zbb)
print(zcc)
print(znn)
```

```
(0.4013+1.413270295078513j)
(0.4013+1.413270295078513j)
(0.4013+1.413270295078513j)
(0.6873+1.5464764919087395j)
```

```
In [6]: def hitungzij(Dij):
            # hitung mutual impedance
            zij=0.09530 + 0.12134j*(log(1/Dij) + 7.93402)
            return zij
```

```
In [7]: zab=hitungzij(Dab)
        zbc=hitungzij(Dbc)
        zca=hitungzij(Dca)
        zan=hitungzij(Dan)
        zbn=hitungzij(Dbn)
        zcn=hitungzij(Dcn)

        zba=zab
        zcb=zbc
        zac=zca
        zna=zan
        znb=zbn
        znv=zcn
```

```
In [8]: import numpy as np
        # z adalah matriks impedansi primitif
        z=np.mat([[zaa,zab,zac,zan],[zba,zbb,zbc,zbn],[zca,zcb,zcc,zcn],[zan,zbn,zc
        print(z)
```

```
[[ 0.4013+1.4132703j   0.0953+0.85153127j  0.0953+0.72659725j
   0.0953+0.75244681j]
 [ 0.0953+0.85153127j  0.4013+1.4132703j   0.0953+0.78020924j
   0.0953+0.78651834j]
 [ 0.0953+0.72659725j  0.0953+0.78020924j  0.4013+1.4132703j
   0.0953+0.76742479j]
 [ 0.0953+0.75244681j  0.0953+0.78651834j  0.0953+0.76742479j
   0.6873+1.54647649j]]
```

```
In [9]: zij=np.mat([[zaa,zab,zac],[zba,zbb,zbc],[zca,zcb,zcc]])
        print(zij)
```

```
[[ 0.4013+1.4132703j   0.0953+0.85153127j  0.0953+0.72659725j]
 [ 0.0953+0.85153127j  0.4013+1.4132703j   0.0953+0.78020924j]
 [ 0.0953+0.72659725j  0.0953+0.78020924j  0.4013+1.4132703j ]]
```

```
In [10]: zin=np.mat([[zan],[zbn],[zcn]])
         print(zin)
```

```
[[ 0.0953+0.75244681j]
 [ 0.0953+0.78651834j]
 [ 0.0953+0.76742479j]]
```

```
In [11]: znj=np.mat([zan,zbn,zcn])
         print(znj)
```

```
[[ 0.0953+0.75244681j  0.0953+0.78651834j  0.0953+0.76742479j]]
```

```
In [12]: znn=np.mat([znn])
         print(znn)
```

```
[[ 0.6873+1.54647649j]]
```

```
In [13]: from scipy import linalg
         znn_inv=linalg.inv(znn)
```

```
In [14]: zabc=zij-zin*znn_inv*znj
         print(zabc)
```

```
[[ 0.45755083+1.07803538j  0.15594993+0.50167375j  0.15348470+0.38493418j]
 [ 0.15594993+0.50167375j  0.46662762+1.04816333j  0.15800626+0.423648j  ]
 [ 0.15348470+0.38493418j  0.15800626+0.423648j    0.46147239+1.06505793j]]
```

```
In [15]: a=np.cos(2*np.pi/3)+1j*np.sin(2*np.pi/3)
         As=np.mat([[1,1,1],[1,a*a,a],[1,a,a*a]])
         Asinv=linalg.inv(As)
         print(As)
         print(Asinv)
```

```
[[ 1.0+0.j          1.0+0.j          1.0+0.j        ]
 [ 1.0+0.j         -0.5-0.8660254j -0.5+0.8660254j]
 [ 1.0+0.j         -0.5+0.8660254j -0.5-0.8660254j]]
[[ 0.33333333 -8.32667268e-17j  0.33333333 +5.55111512e-17j
   0.33333333 +2.77555756e-17j]
 [ 0.33333333 +1.11022302e-16j -0.16666667 +2.88675135e-01j
  -0.16666667 -2.88675135e-01j]
 [ 0.33333333 +5.55111512e-17j -0.16666667 -2.88675135e-01j
  -0.16666667 +2.88675135e-01j]]
```

```
In [16]: z012=Asinv*zabc*As
         print(z012)
```

```
[[ 0.77351087+1.93725617j  0.02556005+0.01149374j -0.03208546+0.01589341j]
 [-0.03208546+0.01589341j  0.30606999+0.62700024j -0.07225043-0.00602727j]
 [ 0.02556005+0.01149374j  0.07230292-0.00589751j  0.30606999+0.62700024j]]
```