ELECTRIC POWER RESEARCH INSTITUTE

Joias escondidas no OpenDSS

Universidade de São Paulo

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2º Encontro do Grupo de Usuários do OpenDSS Brasil
20/01/2020

Visão Geral

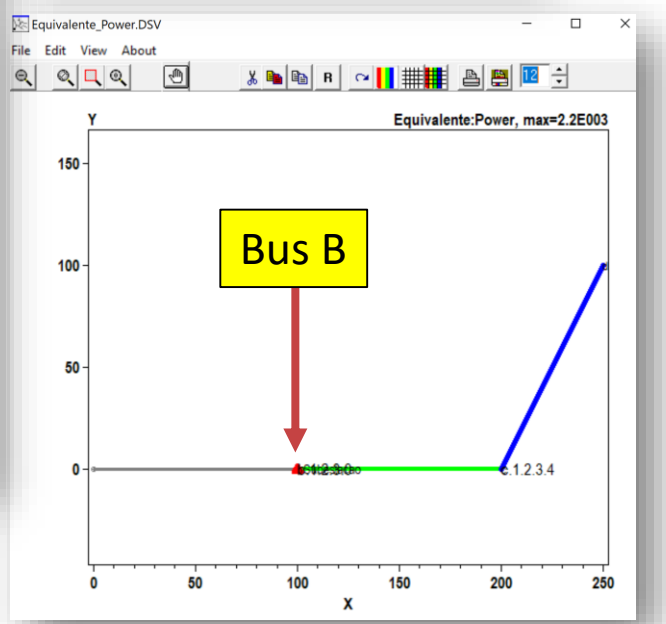
- Interpolate coordenadas
- Interpolate XYCurve
- Funções matemáticas do OpenDSS
- Comando Show Lineconstants
- Comando CvrtLoadshapes
- Comando AllowDuplicates
- FormEdit
- Bus Coordinates em Lat-Lon
- Comando NodeDiff
- Comando Vdiff
- Comando Zsc e Zsc10

Interpolate coordenadas

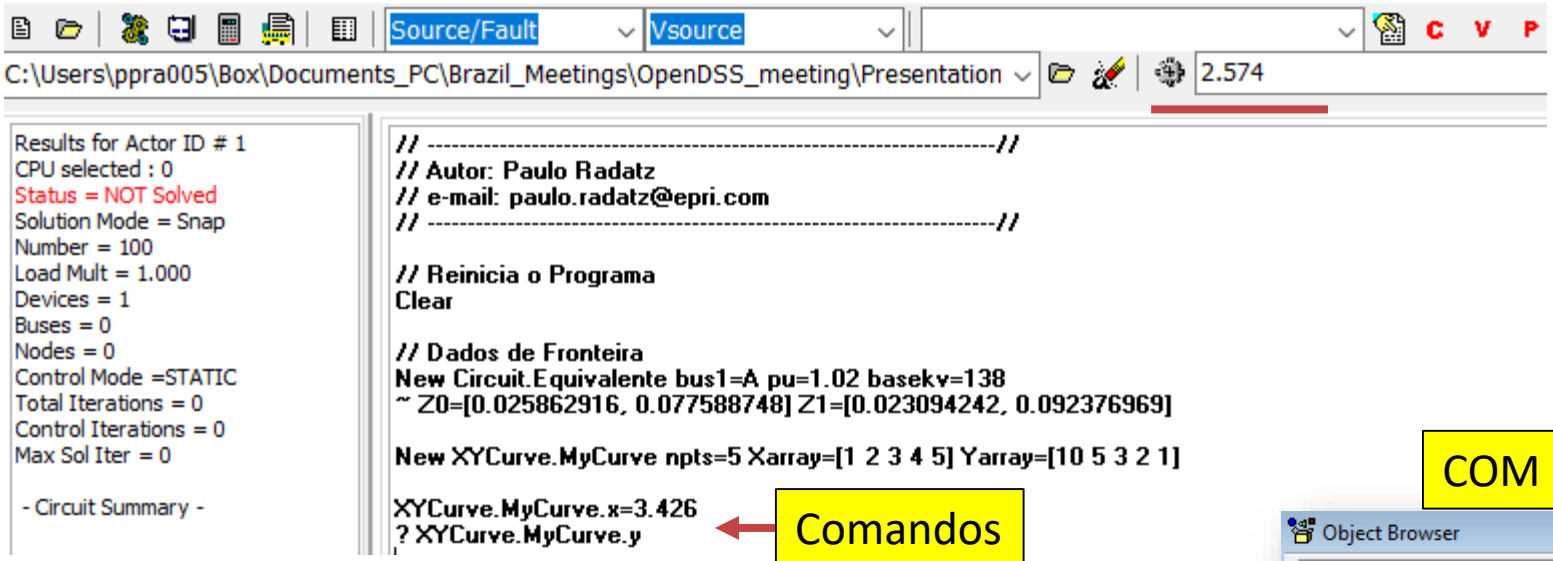
- Precisa de um Energymeter para criar a árvore do circuito

```
New Line.LinhaCD bus1=C.1.2.3 bus2=D.1.2.3 length=0.6 units=km linecode=MeuArranjo3

// Dados das Cargas
// Model=1 -> Potencia Constante
New Load.CargaC phases=1 bus1=C.1.4 kv=7.9674 kw=500 pf=0.92 model=1
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1

// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo terminal=1

// Definindo Tensoes de base
Set voltagebases=[138 13.8]
Calcvoltagebases

// SnapShot Mode
Set mode=SnapShot
Solve

// Coordenadas
BusCoords Coords-Sem-B.csv
interpolate

// Arquivos de Resultados
Show Voltage LN Nodes
Show Power Elements
Show Currents Elements
```

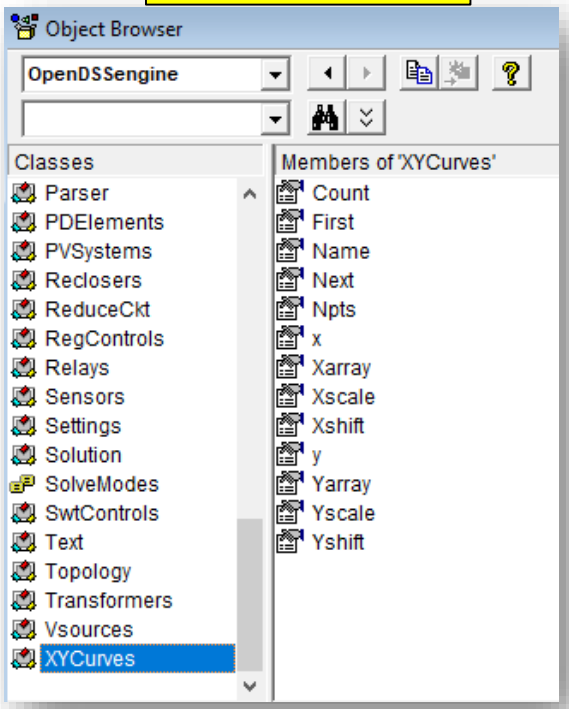
	A	B	C
	A	0	0
	C	200	0
	D	250	100



Interpolate XYCurve

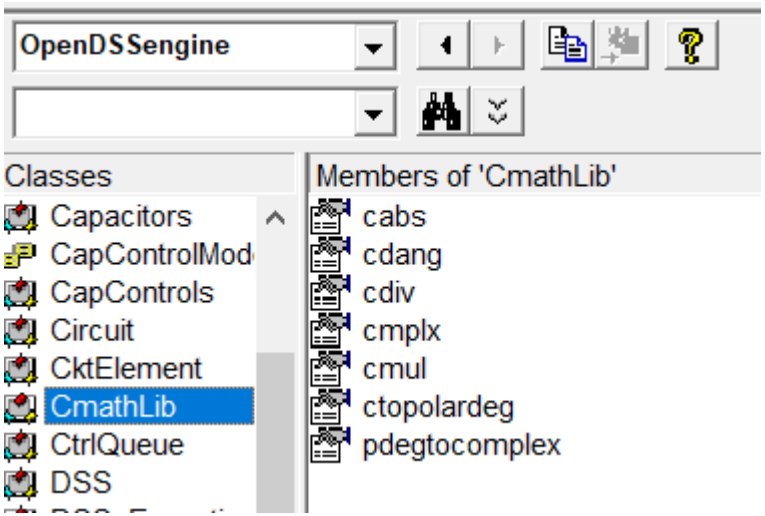


COM Interface



Funções matemáticas do OpenDSS

- Essas funções são úteis quando a linguagem de programação utilizada não tem suporte para números complexos




```
Set DSSCmath = DSSobj.CmathLib
```

Comando Show Lineconstants

- Esse comando calcula as impedâncias para todos os objetos LineGeometry definidos

```
// ------------------------------------------------------------------//
// Example from Kersting's Book - Kron Reduction
// ------------------------------------------------------------------//

New Wiredata.Phase GMR=0.0244 DIAM=0.721 RAC=0.306
~ NormAmps=530
~ Runits=mi radunits=in gmrunits=ft

New Wiredata.Neutral GMR=0.00814 DIAM=0.563 RAC=0.592
~ NormAmps=340
~ Runits=mi radunits=in gmrunits=ft

New Linegeometry.PoleExample nconds=4 nphases=3 reduce=Yes
~ cond=1 Wire=Phase x= -4 h=29 units=ft
~ cond=2 Wire=Phase x= -1.5 h=29 units=ft
~ cond=3 Wire=Phase x= 3 h=29 units=ft
~ cond=4 Wire=Neutral x= 0 h=25 units=ft

New Line.LineExample bus1=K bus2=L
~ Geometry=PoleExample
~ Length=1 units=mi
~ EarthModel=Carson

Show LineConstants 60 km 100.0
```

Comando

LineConstantsCode.DSS - Notepad

File Edit Format View Help

```
!--- OpenDSS Linecodes file generated from Show LINECONSTANTS command
!--- Frequency = 60 Hz, Earth resistivity = 100 ohm-m
!--- Earth Model = Deri

New Linecode.poleexample nphases=3  Units=km
~ Rmatrix=[0.280704  |0.0963664  0.286298  |0.0948461  0.0976331  0.283121  ]
~ Xmatrix=[0.671384  |0.313128  0.65259  |0.240654  0.264594  0.663218  ]
~ Cmatrix=[9.35361  |-3.02853  9.85871  |-1.16006  -1.92802  8.89163  ]
```

```
----------------------------------------------
Geometry Code = poleexample

R MATRIX, ohms per km
0.280704,
0.0963664, 0.286298,
0.0948461, 0.0976331, 0.283121,

jX MATRIX, ohms per km
0.671384,
0.313128, 0.65259,
0.240654, 0.264594, 0.663218,

Susceptance (jB) MATRIX, S per km
3.52623E-006,
-1.14173E-006, 3.71665E-006,
-4.37331E-007, -7.26846E-007, 3.35207E-006,

L MATRIX, mH per km
1.7809,
0.830599, 1.73105,
0.638355, 0.701857, 1.75924,

C MATRIX, nF per km
9.35361,
-3.02853, 9.85871,
-1.16006, -1.92802, 8.89163,
```

```
------------------------------------------------------------------------
-------------------Equiv Symmetrical Component --------------------
------------------------------------------------------------------------


Z1, ohms per km = 0.187093 + j 0.389605 (L1 = 1.03346 mH)
Z0, ohms per km = 0.475938 + j 1.20798 (L0 = 3.20427 mH)

C1, nF per km = 11.4069
C0, nF per km = 5.29025

Surge Impedance:
  Positive sequence = 300.998 ohms
  Zero sequence     = 778.263 ohms
  Common Mode       = 259.253 ohms

Propagation Velocity (Percent of speed of light):
  Positive sequence = 97.1515
  Zero sequence     = 81.0171
```

Comando CvrtLoadshapes

```
New Line.LinhaCD bus1=C.1.2.3 bus2=D.1.2.3 length=0.6 units=km linecode=MeuArranjo3

// Dados das Curvas de Carga
New Loadshape.industrial npts=24 interval=1
~ mult=(0.1 0.1 0.2 0.3 0.3 0.4 0.6 1.2 1.8 1.8 1.9 1.9 1.4 1.6 1.8 1.7 1.7 1.1 0.8 0.6 0.5 0.4 0.2 0.2)
New Loadshape.residencial npts=24 interval=1
~ mult=(0.6 0.5 0.4 0.4 0.5 0.8 1.0 0.8 0.8 0.9 1.0 1.0 1.1 0.9 0.9 0.9 1.0 1.2 1.5 1.5 1.7 1.5 1.2 0.8)

// Dados das Cargas
// Model=1 -> Potencia Constante
New Load.CargaC phases=1 bus1=C.1.4 kv=7.9674 kw=500 pf=0.92 model=1 daily=residencial
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1 daily=industrial

cvrtloadshapes type=sng
!cvrtloadshapes type=dbl
```

Comando

ReloadLoadshapes.DSS - Notepad

File Edit Format View Help

```
New Loadshape.default Npts=24 Interval=1 mult=[sngfile=default_P.sng]
New Loadshape.industrial Npts=24 Interval=1 mult=[sngfile=industrial_P.sng]
New Loadshape.residencial Npts=24 Interval=1 mult=[sngfile=residencial_P.sng]
```

Carrega mais rápido em memória

Comando AllowDuplicates

- Permite nomes duplicados para o mesmo objeto

```
// Dados dos Trechos
New Line.LinhaBC bus1=B.1.2.3.0 bus2=C.1.2.3.4 length=0.8 units=km
New Line.LinhaCD bus1=C.1.2.3 bus2=D.1.2.3 length=0.6 units=km

Set allowduplicates=Yes

// Dados das Cargas
// Model=1 -> Potencia Constante
New Load.CargaD phases=1 bus1=C.1 kv=7.9674 kw=500 pf=0.92 model=1
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1

// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo

// Definindo Tensoes de base
Set voltagebases=[138 13.8]
Calcvoltagebases

// SnapShot Mode
Set mode=SnapShot
Solve
```

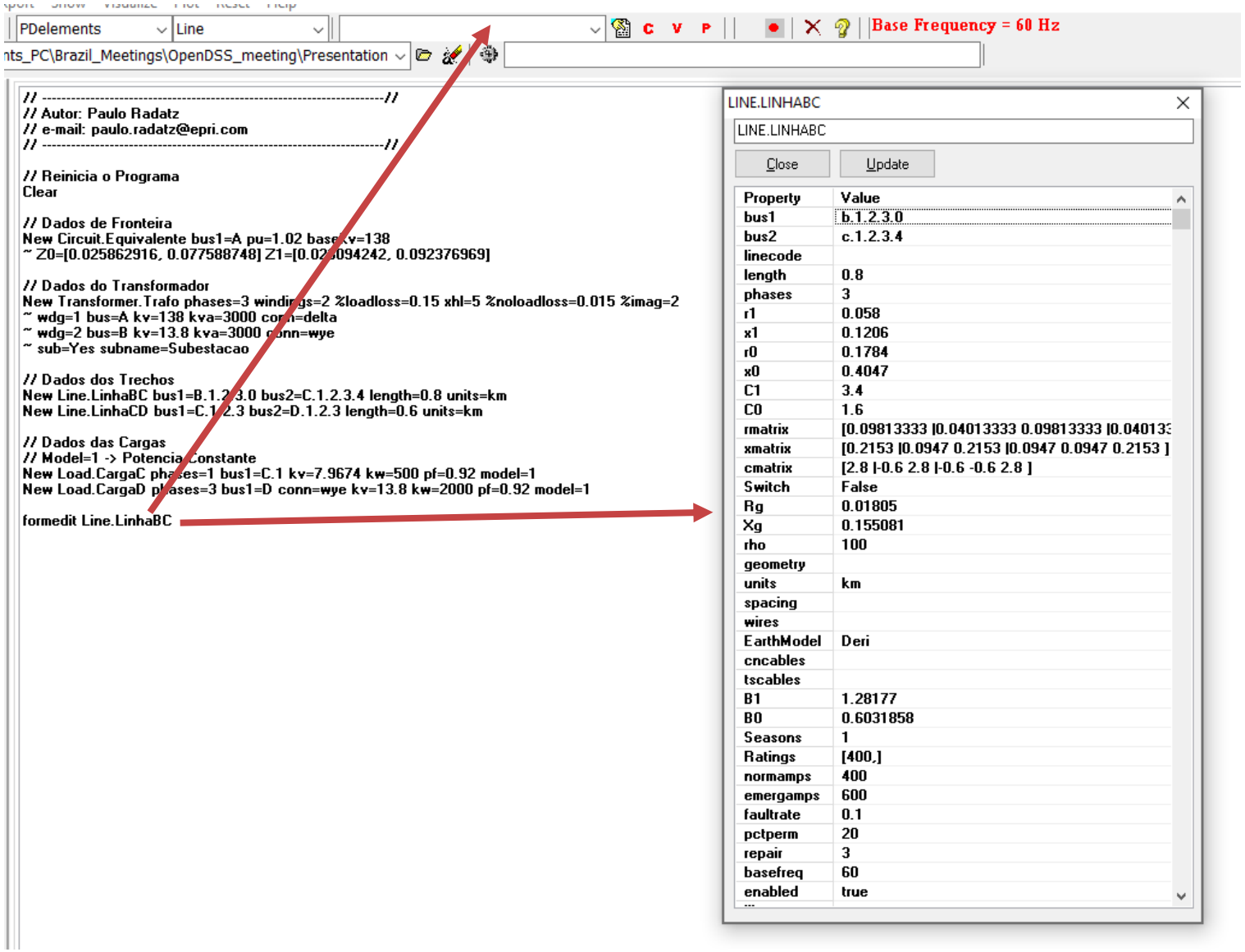
Comando

Equivalente_Power_elem_kVA.txt - Notepad

File Edit Format View Help

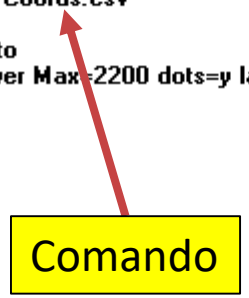
```
Power Conversion Elements

  Bus Phase     kW   +j  kvar          kVA          PF

ELEMENT = "Load.CARGAD"
C         1     500.0 +j  212.9       543.5        0.9200
C         0       0.0 +j    0.0         0.0        1.0000
  TERMINAL TOTAL    500.0 +j    212.9       543.5        0.9200

ELEMENT = "Load.CARGAD"
D         1     666.7 +j  283.9       724.6        0.9200
D         2     666.7 +j  284.0       724.6        0.9200
D         3     666.7 +j  284.0       724.6        0.9200
D         0       0.0 +j    0.0         0.0        1.0000
  TERMINAL TOTAL   2000.0 +j    851.9      2173.9        0.9200


Total Circuit Losses =    7.6 +j  202.8
```

FormEdit

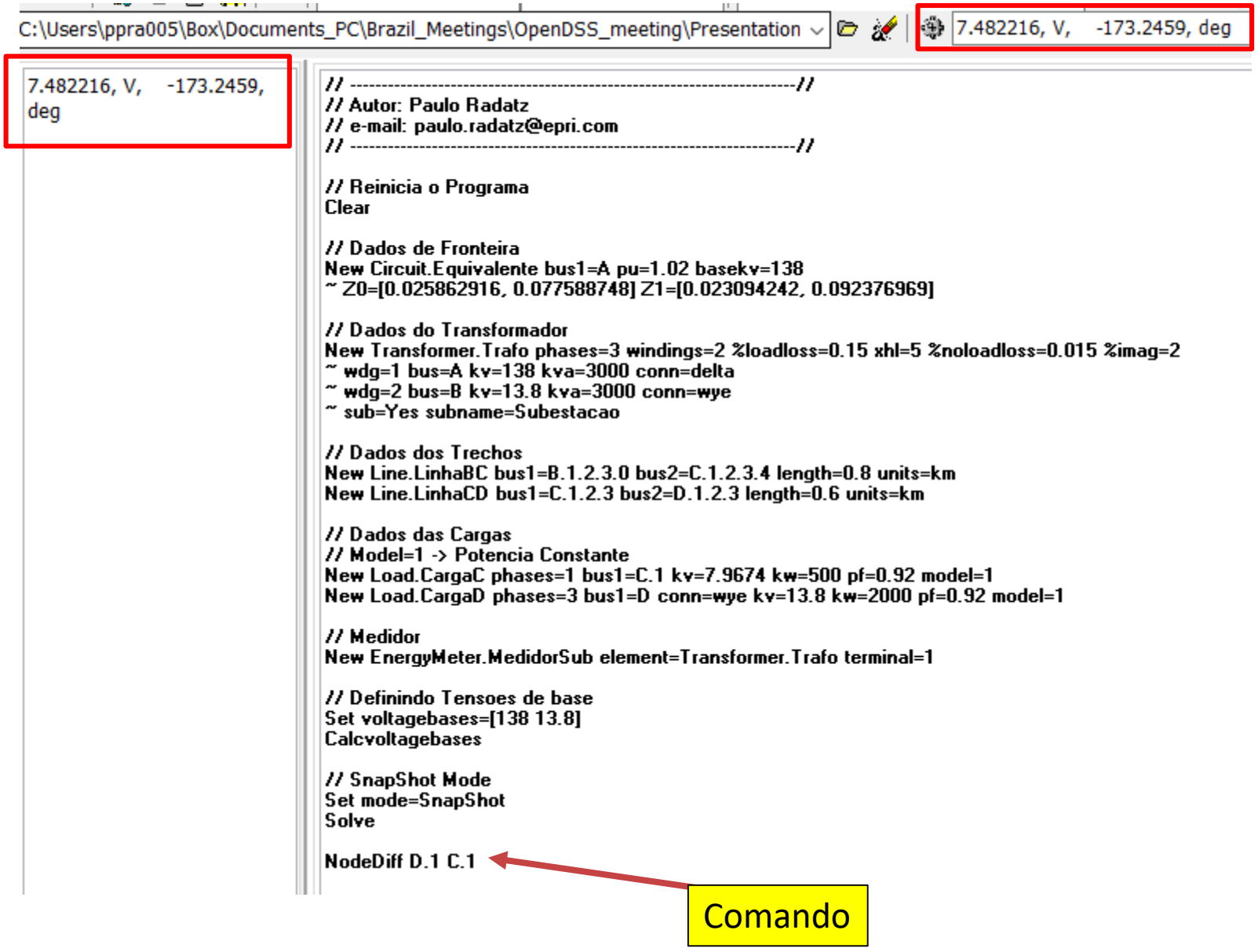


Bus Coordinates em Lat-Lon

```
New Line.LinhaCD bus1=C.1.2.3 bus2=D.1.2.3 length=0.6 units=km

// Dados das Cargas
// Model=1 -> Potencia Constante
New Load.CargaC phases=1 bus1=C.1 kv=7.9674 kw=500 pf=0.92 model=1
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1

// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo terminal=1

// Definindo Tensoes de base
Set voltagebases=[138 13.8]
Calcvoltagebases

// SnapShot Mode
Set mode=SnapShot
Solve

// Coordenadas
LatLongCoords Coords.csv

// Plot o Circuito
Plot circuit Power Max=2200 dots=y labels=y subs=y C1=Blue
```



Comando NodeDiff



Comando Vdiff

```
~ sub=Yes subname=Subestacao

// Dados dos Trechos
New Line.LinhaBC bus1=B.1.2.3.0 bus2=C.1.2.3.4 length=0.8 units=km
New Line.LinhaCD bus1=C.1.2.3 bus2=D.1.2.3 length=0.6 units=km

// Dados das Cargas
// Model=1 -> Potencia Constante
New Load.CargaC phases=1 bus1=C.1 kv=7.9674 kw=500 pf=0.92 model=1
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=

// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo terminal=1

// Definindo Tensoes de base
Set voltagebases=[138 13.8]
Calcvoltagebases

// SnapShot Mode
Set mode=SnapShot

Solve
Save voltages

set loadmult=0.5
solve
Vdiff
```

Equivalente_VDIFF.txt - Notepad

File Edit Format View Help

```
a.1,     0.00, %
a.2,     0.00, %
a.3,     0.00, %
b.1,     1.52, %
b.2,     0.81, %
b.3,     0.80, %
c.1,     1.64, %
c.2,     0.82, %
c.3,     0.86, %
d.1,     1.68, %
d.2,     0.85, %
d.3,     0.89, %
```

Comando Zsc e Zsc10

```
// Model=1 -> Potencia Constante
New Load.CargaC phases=1 bus1=C.1 kv=7.9674 kw=500 pf=0.92 model=1
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1

// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo terminal=1

// Definindo Tensoes de base
Set voltagebases=[138 13.8]
Calcvoltagebases

Solve

set Bus=D
ZscRefresh

! Um por vez
Zsc

Zsc10
```

```
0.42221, 3.3475,   0.064019,
0.12136,   0.064019,
0.12136,   0.064019,
0.12136,   0.34693, 3.399,
0.062877, 0.12315,
0.064019, 0.12136,
0.062877, 0.12315,
0.34693, 3.399,
```

```
Z1, 0.30838, 3.2599,
Z0, 0.4993, 3.6257,
```

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