Tipos de Simulação

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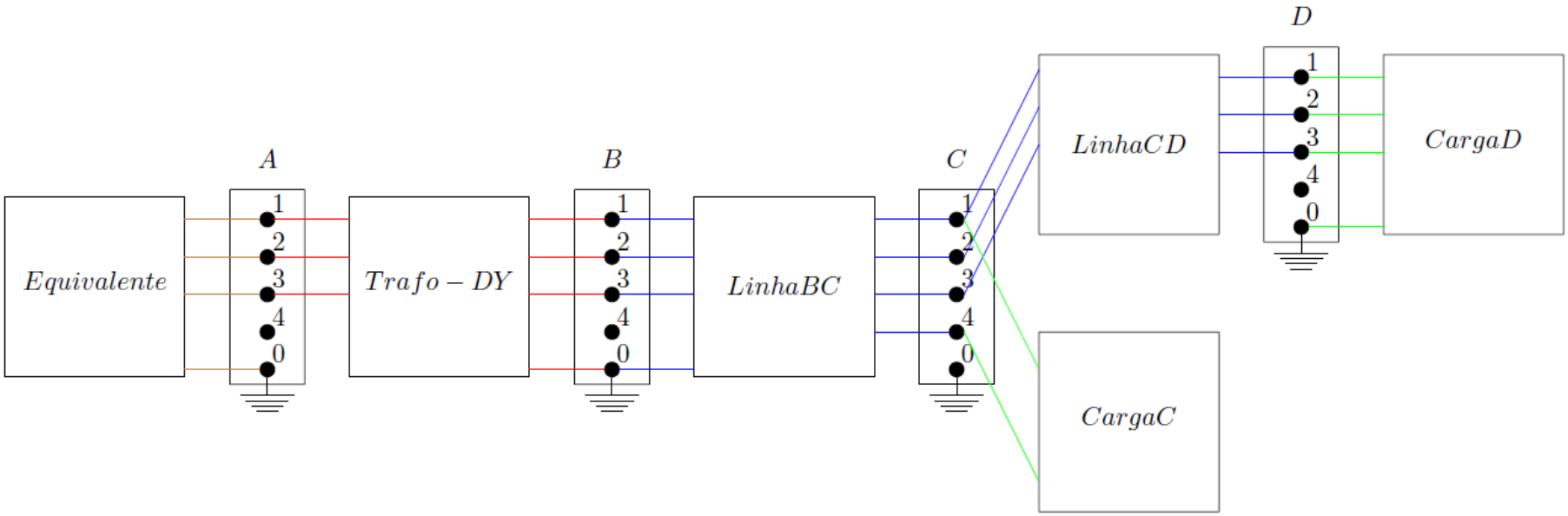
1º Encontro do Grupo de Usuários do OpenDSS Brasil
05/09/2017

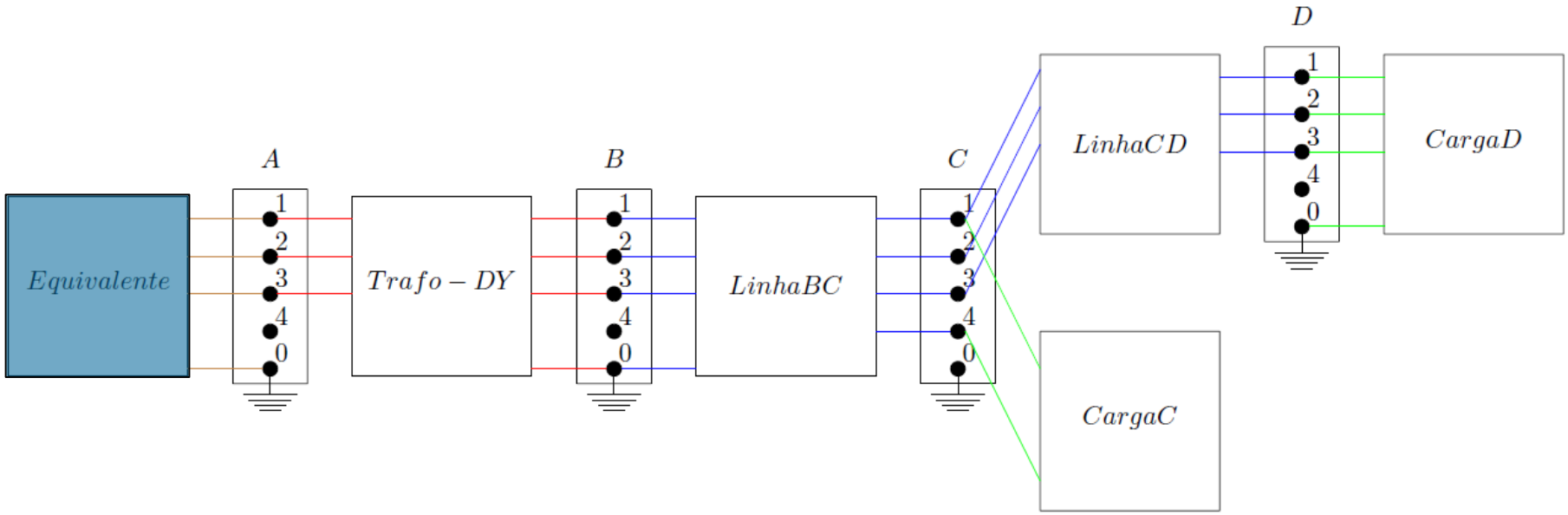
Visão Geral

- Descrição do Circuito Utilizado
- Modo *SnapShot*
- Elemento *Fault* no Modo *SnapShot*
- Modo *FaultStudy*
- Modo *Harmonic*
- Modo *QSTS(Daily)*
- Referências

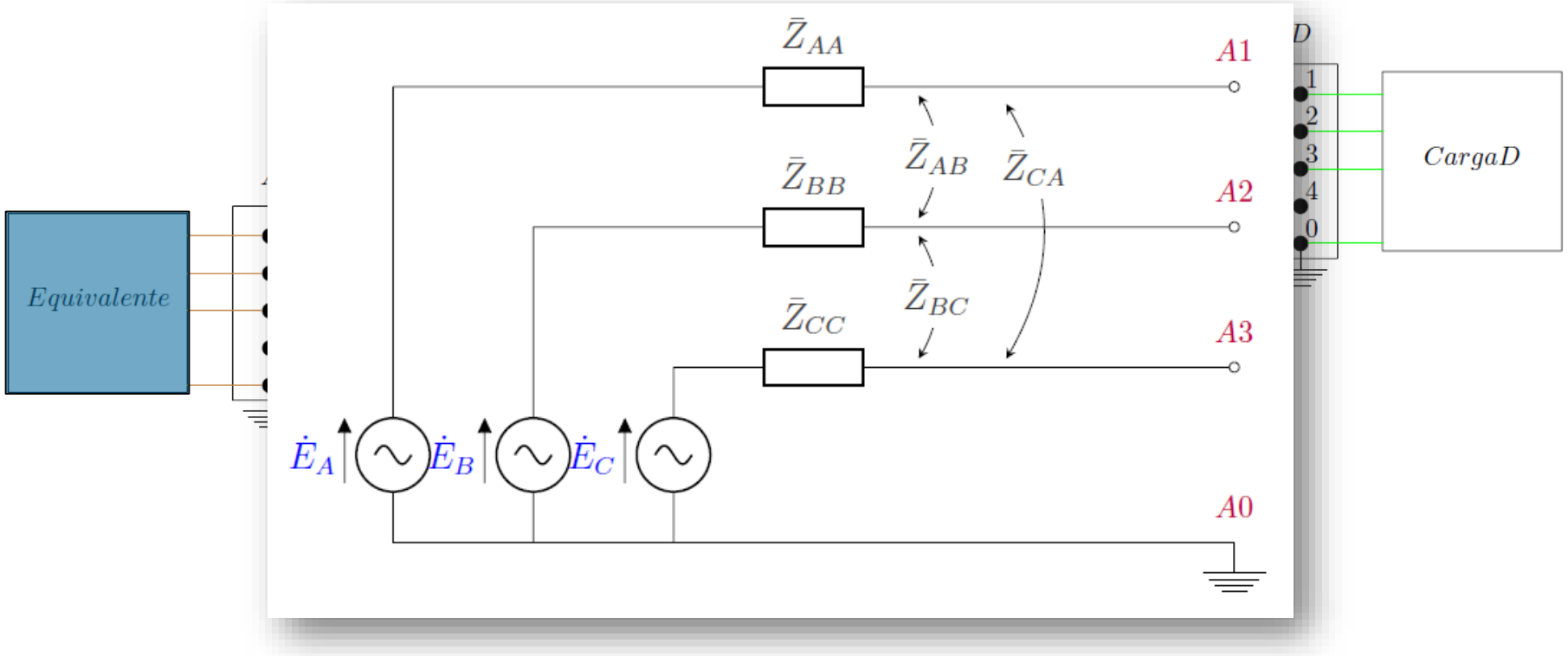
Descrição do Circuito Utilizado



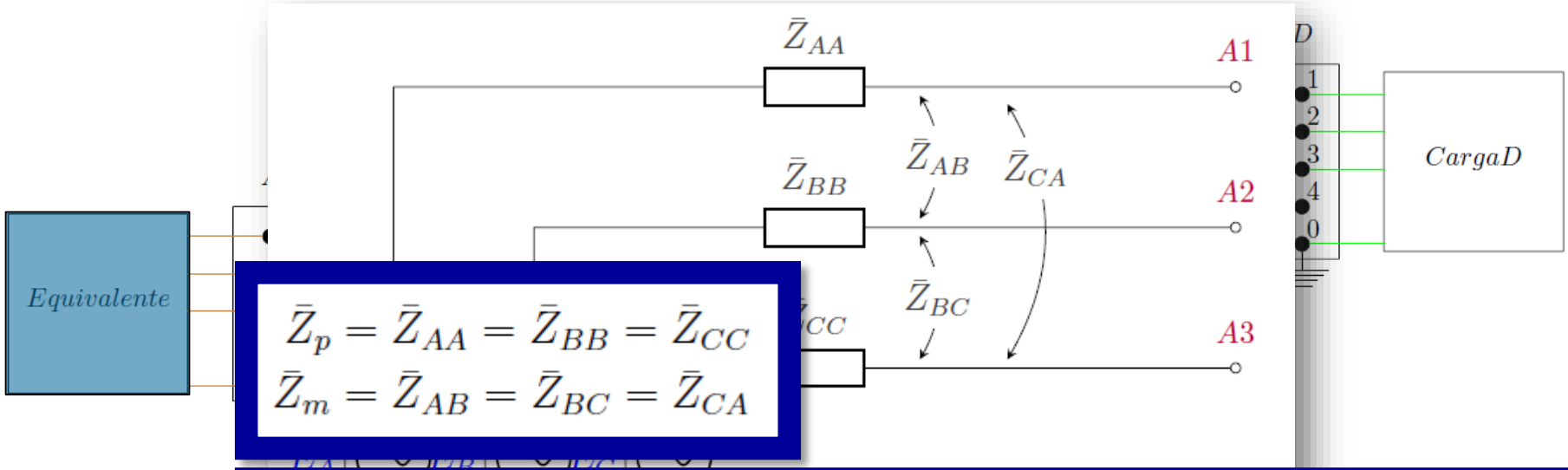
Descrição do Circuito Utilizado



Descrição do Circuito Utilizado



Descrição do Circuito Utilizado

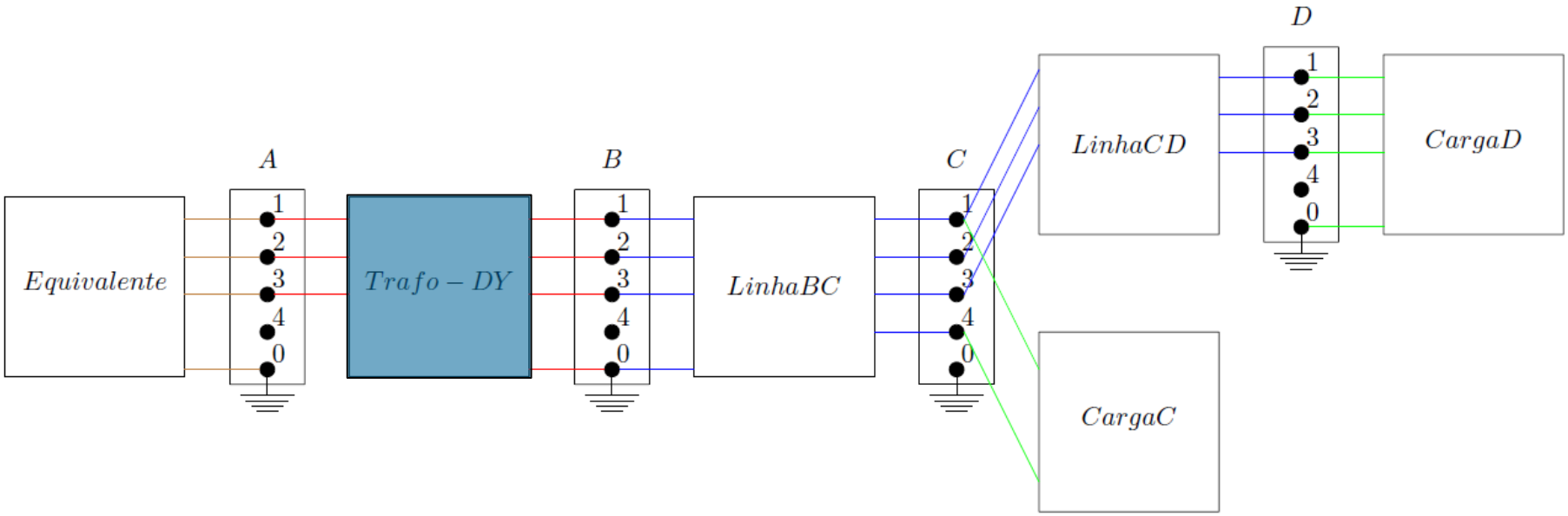


$$\bar{Z}_p = \bar{Z}_{AA} = \bar{Z}_{BB} = \bar{Z}_{CC}$$
$$\bar{Z}_m = \bar{Z}_{AB} = \bar{Z}_{BC} = \bar{Z}_{CA}$$

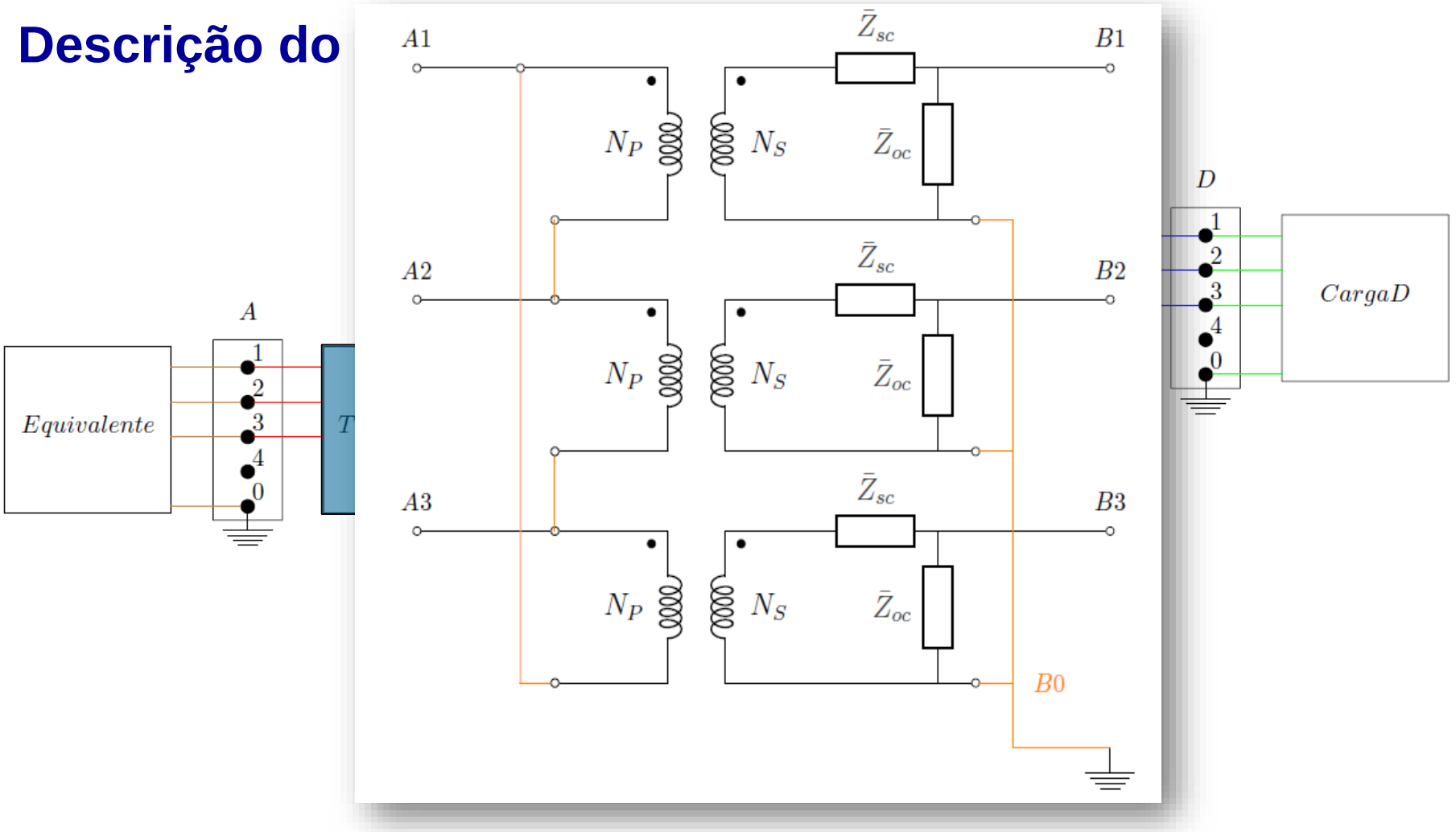
$$\bar{\mathbf{Z}}_{012} = \begin{bmatrix} \bar{Z}_p + 2 \times \bar{Z}_m & 0 & 0 \\ 0 & \bar{Z}_p - \bar{Z}_m & 0 \\ 0 & 0 & \bar{Z}_p - \bar{Z}_m \end{bmatrix} = \begin{bmatrix} \bar{Z}_0 & 0 & 0 \\ 0 & \bar{Z}_1 & 0 \\ 0 & 0 & \bar{Z}_2 \end{bmatrix}$$

```
// Dados de Fronteira
New Circuit.Equivalente bus1=A pu=1.02 basekv=138
~ Z0=[0.025862916, 0.077588748] Z1=[0.023094242, 0.092376969]
```

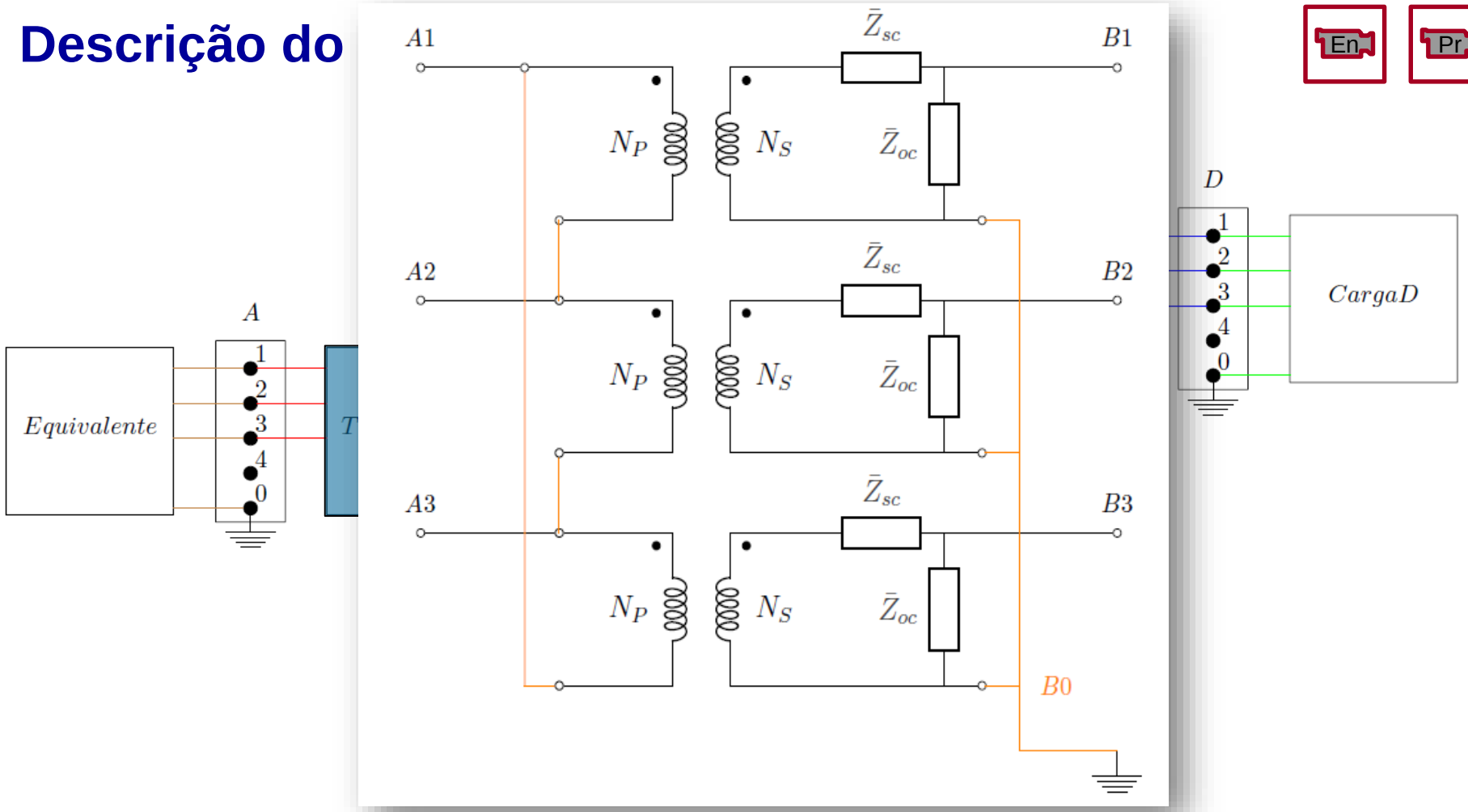
Descrição do Circuito Utilizado



Descrição do

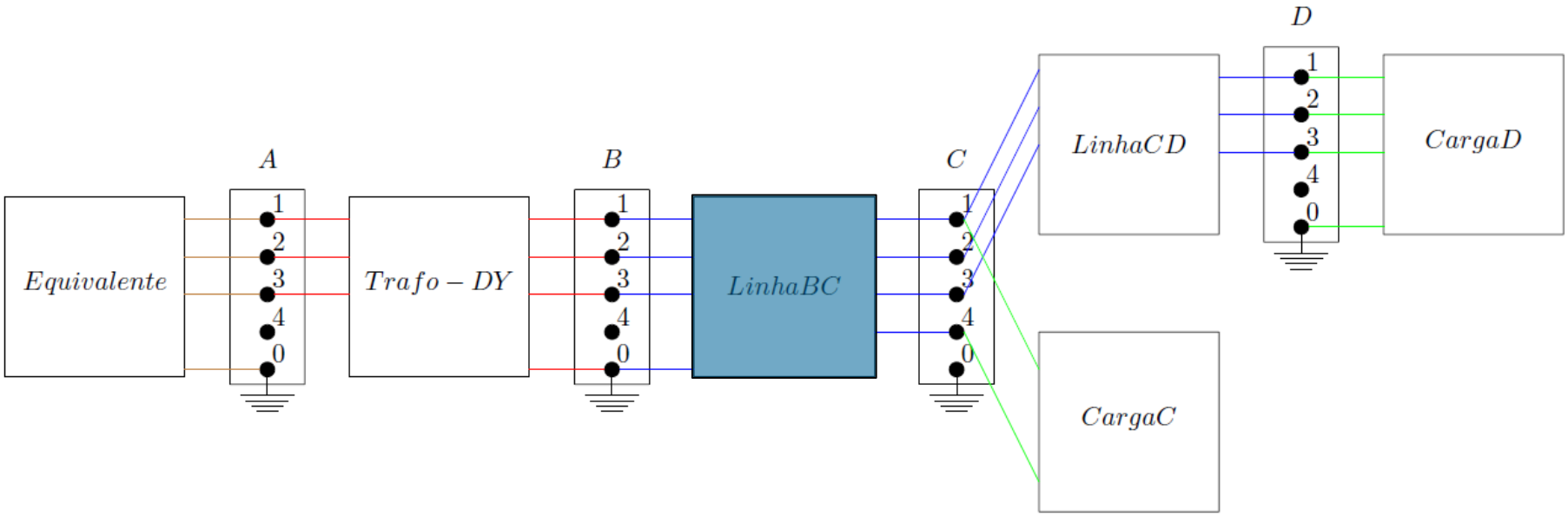


Descrição do

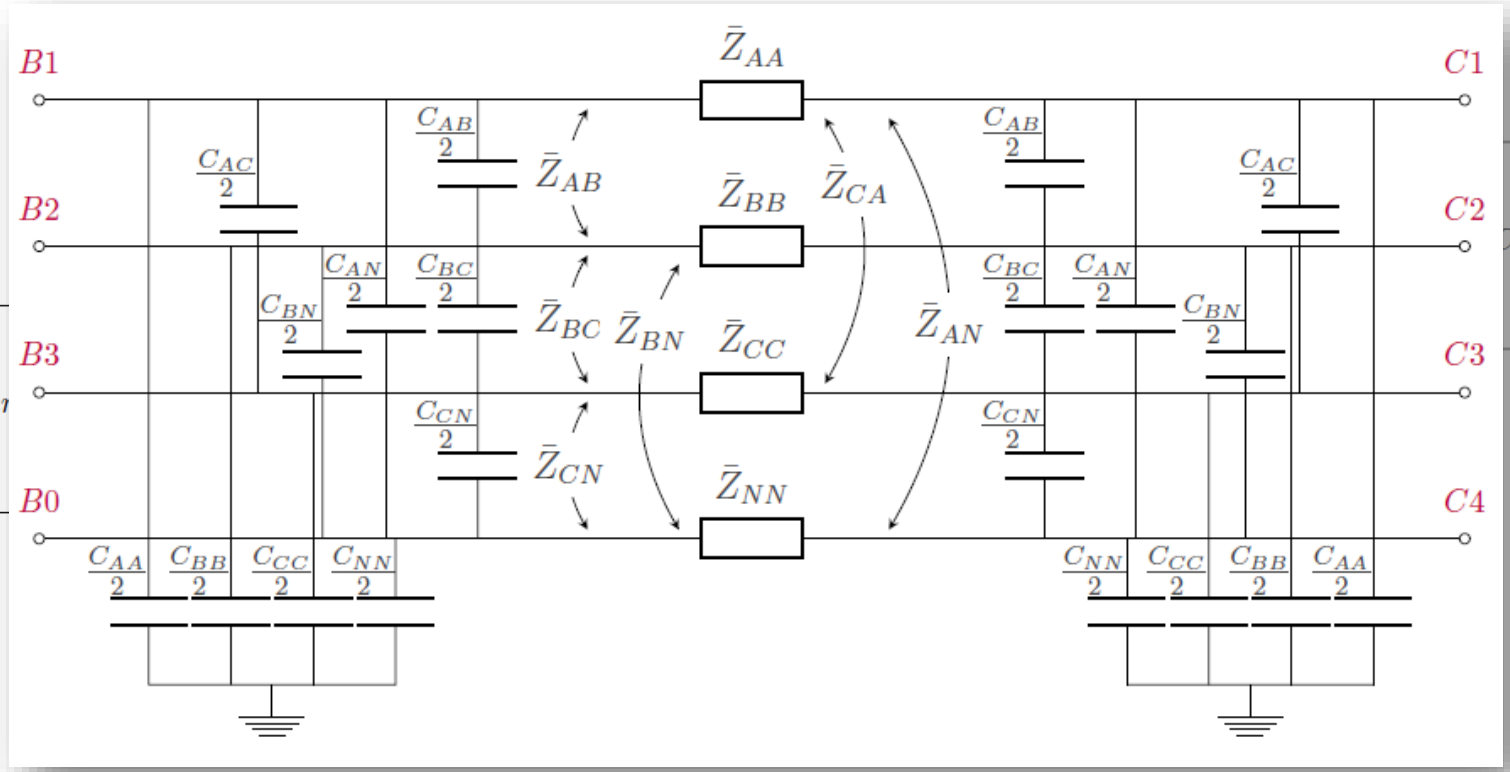



```
// Dados do Transformador
New Transformer.Trafo phases=3 windings=2 %loadloss=0.15 xhl=5 %noloadloss=0.015 %imag=2
~ wdg=1 bus=A kv=138 kva=3000 conn=delta
~ wdg=2 bus=B kv=13.8 kva=3000 conn=wye
```

Descrição do Circuito Utilizado



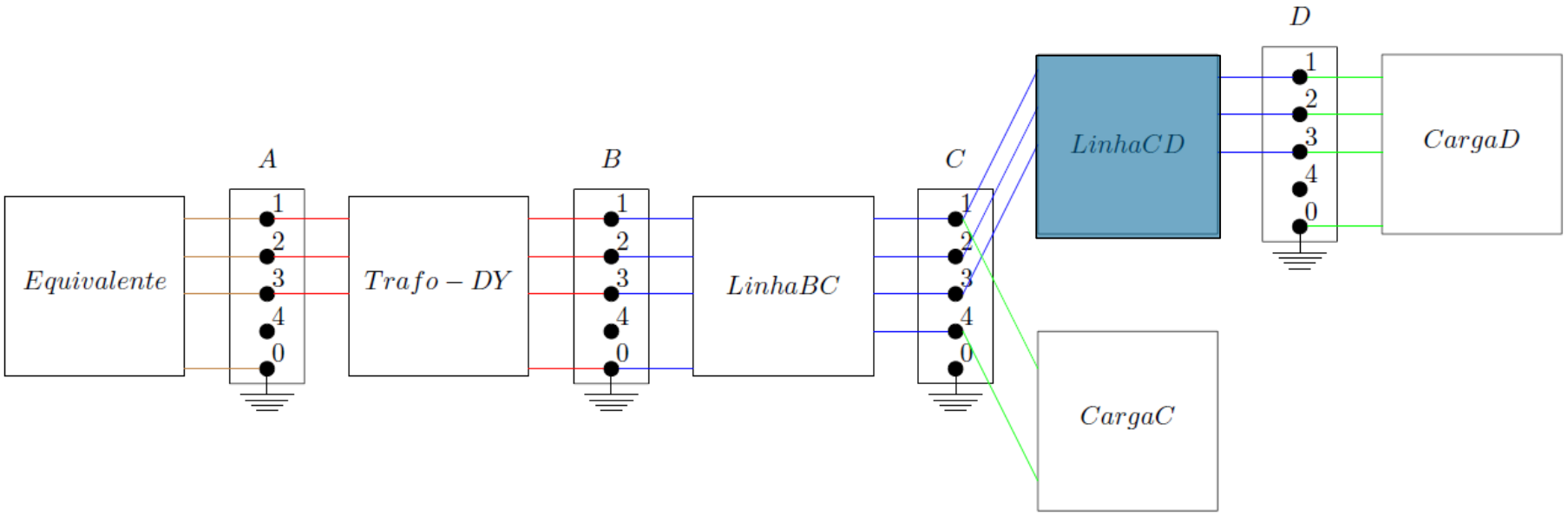
Descrição do Circuito Utilizado



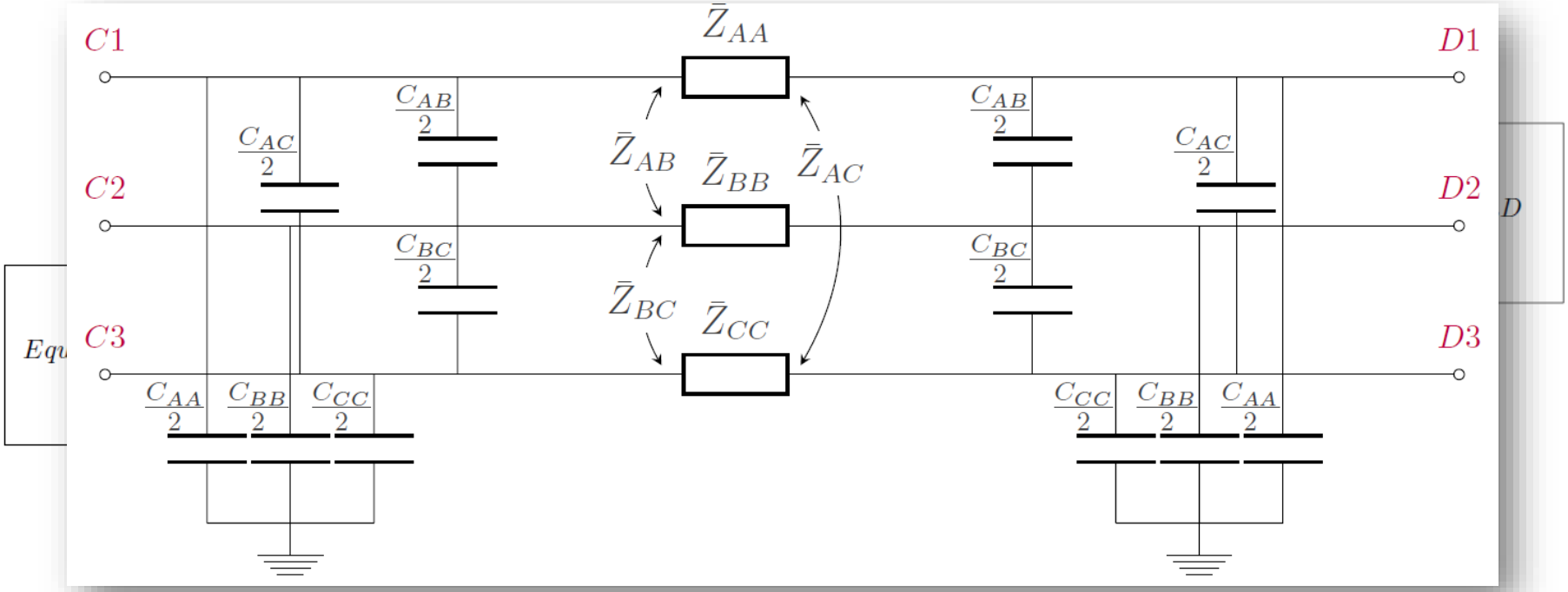

```
// Dados dos Arranjos
New Linecode.MeuArranjo4 nphases=4 basefreq=60 units=km
~ rmatrix = [0.249 |0.059 0.249 |0.059 0.059 0.249 |0.059 0.059 0.059 0.427]          !ohm/km
~ xmatrix = [0.878 |0.529 0.878 |0.451 0.484 0.878 |0.467 0.488 0.476 0.960]          !ohm/km
~ cmatrix = [9.353 |-3.028 9.858 |-1.160 -1.928 8.891 |-1.393 -1.772 -1.782 8.809] !nF/km
~ neutral=4 kron=No

// Dados dos Trechos
New Line.LinhaBC bus1=B.1.2.3.0 bus2=C.1.2.3.4 length=0.8 units=km linecode=MeuArranjo4
```

Descrição do Circuito Utilizado



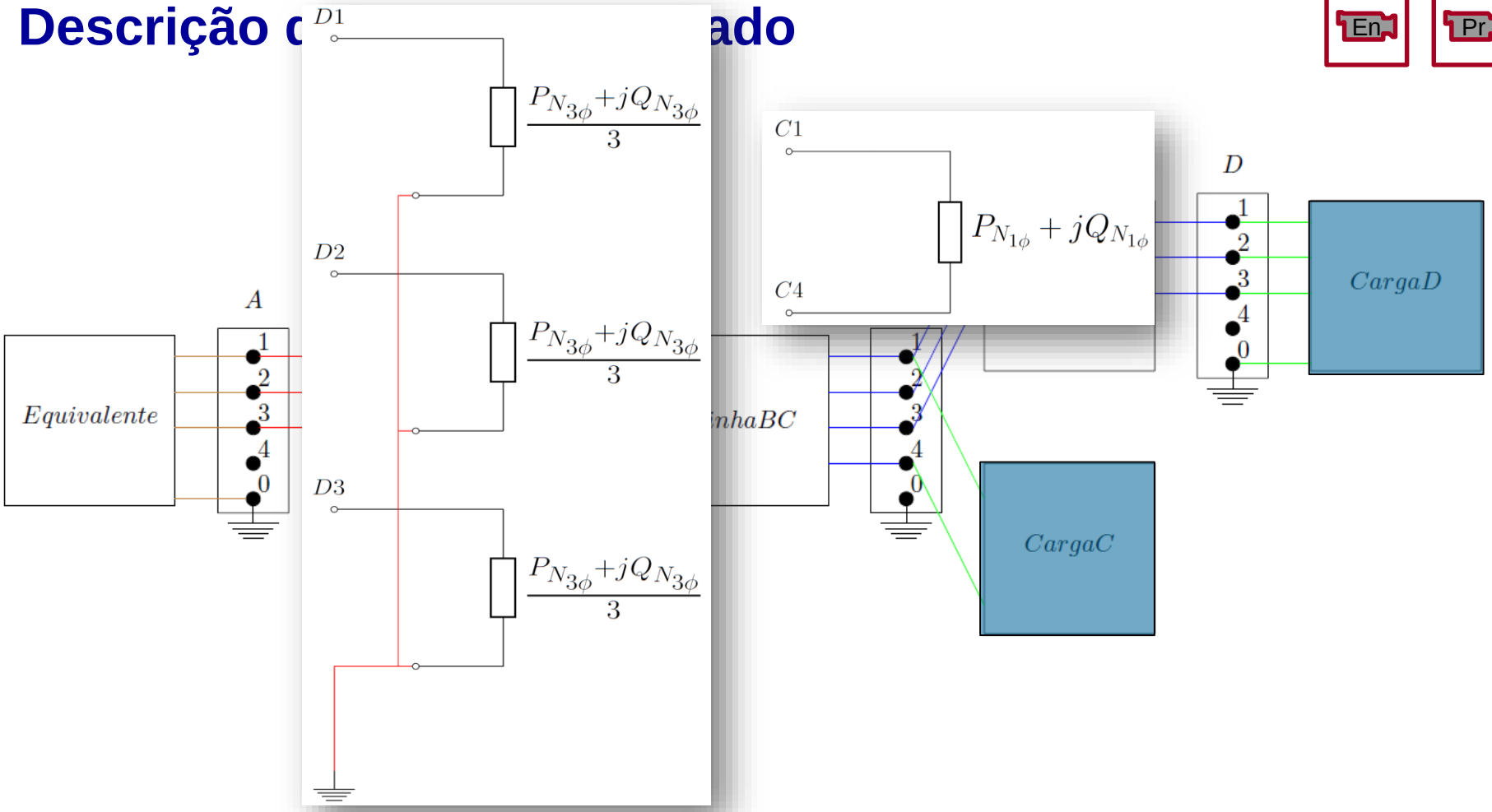
Descrição do Circuito Utilizado




```
// Dados dos Arranjos
New Linecode.MeuArranjo3 nphases=3 basefreq=60 units=km
~ rmatrix = [0.249 |0.059 0.249 |0.059 0.059 0.249]      !ohm/km
~ xmatrix = [0.878 |0.488 0.878 |0.488 0.488 0.878]      !ohm/km
~ cmatrix = [8.932 |-2.290 8.932 |-2.290 -2.290 8.932]   !nF/km

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

Descrição d ado




```
// 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
```

Modo *SnapShot*

- Realiza o fluxo de potência para uma condição especifica de carga
- Comandos para a simulação:

```
// 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 Coordenadas.csv
```

Modo *SnapShot*

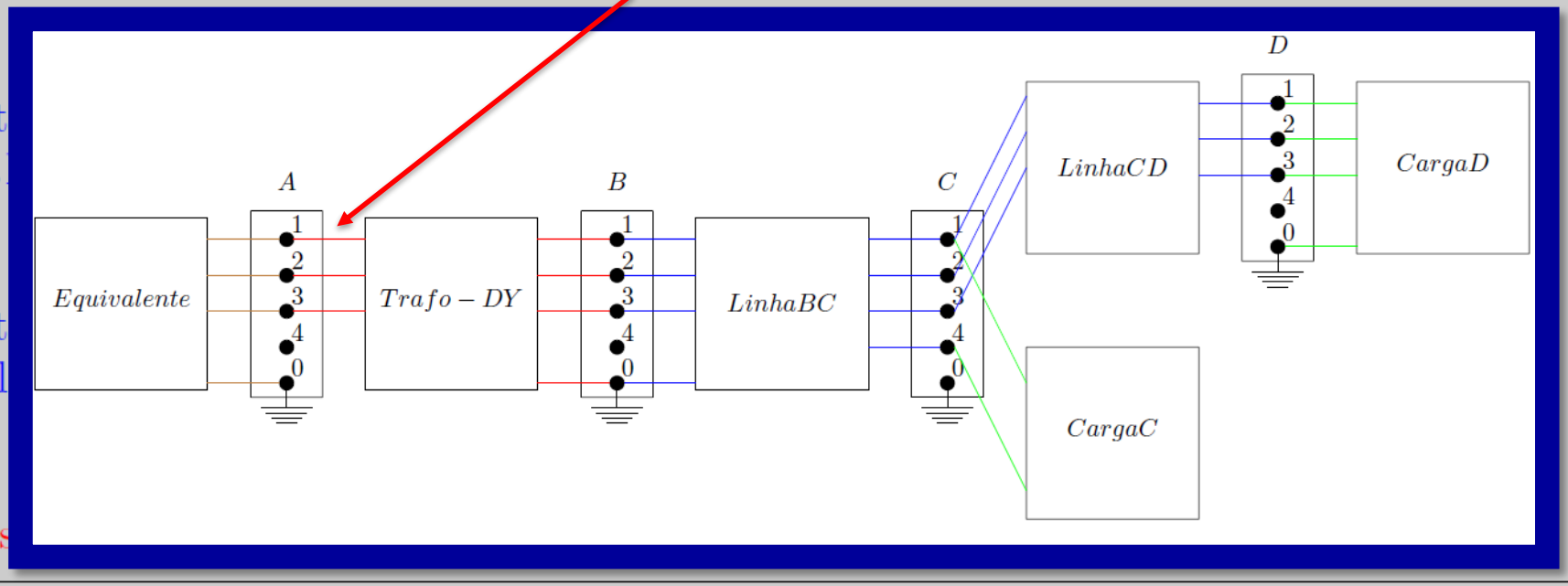
- Realiza o fluxo de potência para uma condição especifica de carga
- Comandos para a simulação:

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

//
Set
Ca

//
Set
Sol

//
Bus
```



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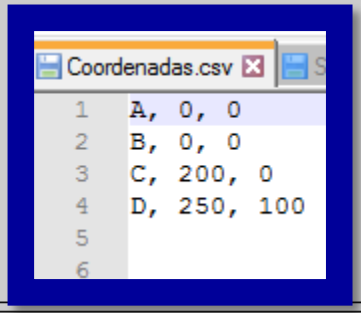


Modo *SnapShot*

- Alguns resultados:

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

// Perfil de Tensao
Plot Profile

// Plot o Circuito
Plot circuit power max=2200 dots=n labels=n subs=y C1=Blue
```

Modo *SnapShot*

- Alguns resultados:

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

// Perfil de Tensao
Plot Profile

// P
Plot                                                    Blue
```

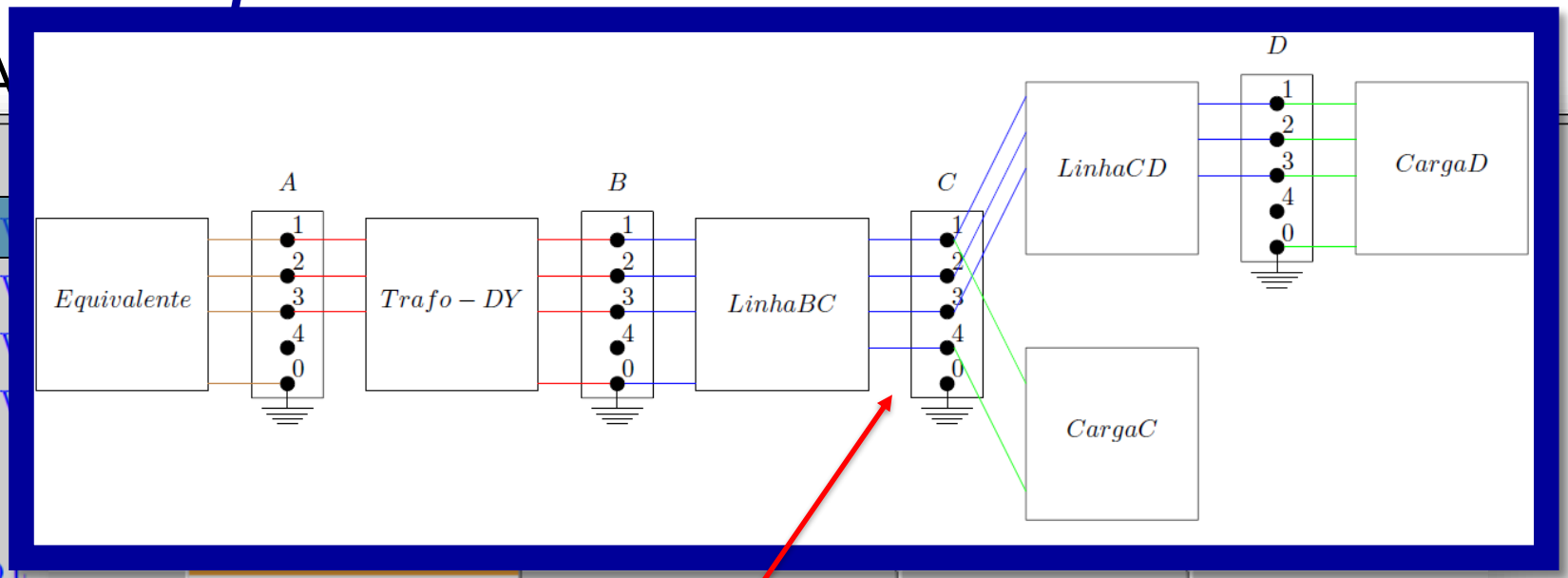
apShot.dss | Equivalente_VLN_Node.Txt | Equivalente_Power_elem_kVA.txt | Equivalente_Losses.Txt | Equivalente_Curr_Elem.Txt

LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus	Node	VLN (kV)	Angle	pu	Base kV	Node-Node	VLL (kV)	Angle	pu
A ..	1	81.267 /_	0.0	1.02	138.000	1-2	140.76 /_	30.0	1.02
-	2	81.267 /_	-120.0	1.02	138.000	2-3	140.76 /_	-90.0	1.02
-	3	81.267 /_	120.0	1.02	138.000	3-1	140.76 /_	150.0	1.02
B ..	1	7.8864 /_	-33.3	0.98982	13.800	1-2	13.65 /_	-2.3	0.98915
-	2	7.9921 /_	-151.8	1.0031	13.800	2-3	13.843 /_	-121.8	1.0031
-	3	7.9921 /_	88.2	1.0031	13.800	3-1	13.85 /_	117.2	1.0036
C ..	1	7.8375 /_	-33.6	0.9837	13.800	1-2	13.585 /_	-2.5	0.98445
-	2	7.9743 /_	-152.0	1.0009	13.800	2-3	13.81 /_	-122.0	1.0007
-	3	7.9708 /_	88.0	1.0004	13.800	3-1	13.795 /_	116.9	0.99967
-	4	0.033702 /_	-0.5	0.0042299	13.800				
D ..	1	7.8184 /_	-33.7	0.9813	13.800	1-2	13.554 /_	-2.6	0.98218
-	2	7.9568 /_	-152.1	0.99867	13.800	2-3	13.779 /_	-122.1	0.99846
-	3	7.9533 /_	87.9	0.99822	13.800	3-1	13.764 /_	116.8	0.9974

Modo *SnapShot*

- A



apShot.dss | Equivalente_VLN_Node.Txt | Equivalente_Power_elem_kVA.txt | Equivalente_Losses.Txt | Equivalente_Curr_Elem.Txt

LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus	Node	VLN (kV)	Angle	pu	Base kV	Node-Node	VLL (kV)	Angle	pu
A ..	1	81.267 /_	0.0	1.02	138.000	1-2	140.76 /_	30.0	1.02
-	2	81.267 /_	-120.0	1.02	138.000	2-3	140.76 /_	-90.0	1.02
-	3	81.267 /_	120.0	1.02	138.000	3-1	140.76 /_	150.0	1.02
B ..	1	7.8864 /_	-33.3	0.98982	13.800	1-2	13.65 /_	-2.3	0.98915
-	2	7.9921 /_	-151.8	1.0031	13.800	2-3	13.843 /_	-121.8	1.0031
-	3	7.9921 /_	88.2	1.0031	13.800	3-1	13.85 /_	117.2	1.0036
C ..	1	7.8375 /_	-33.6	0.9837	13.800	1-2	13.585 /_	-2.5	0.98445
-	2	7.9743 /_	-152.0	1.0009	13.800	2-3	13.81 /_	-122.0	1.0007
-	3	7.9708 /_	88.0	1.0004	13.800	3-1	13.795 /_	116.9	0.99967
-	4	0.033702 /_	-0.5	0.0042299	13.800				
D ..	1	7.8184 /_	-33.7	0.9813	13.800	1-2	13.554 /_	-2.6	0.98218
-	2	7.9568 /_	-152.1	0.99867	13.800	2-3	13.779 /_	-122.1	0.99846
-	3	7.9533 /_	87.9	0.99822	13.800	3-1	13.764 /_	116.8	0.9974

Modo *SnapShot*

- Alguns resultados:

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

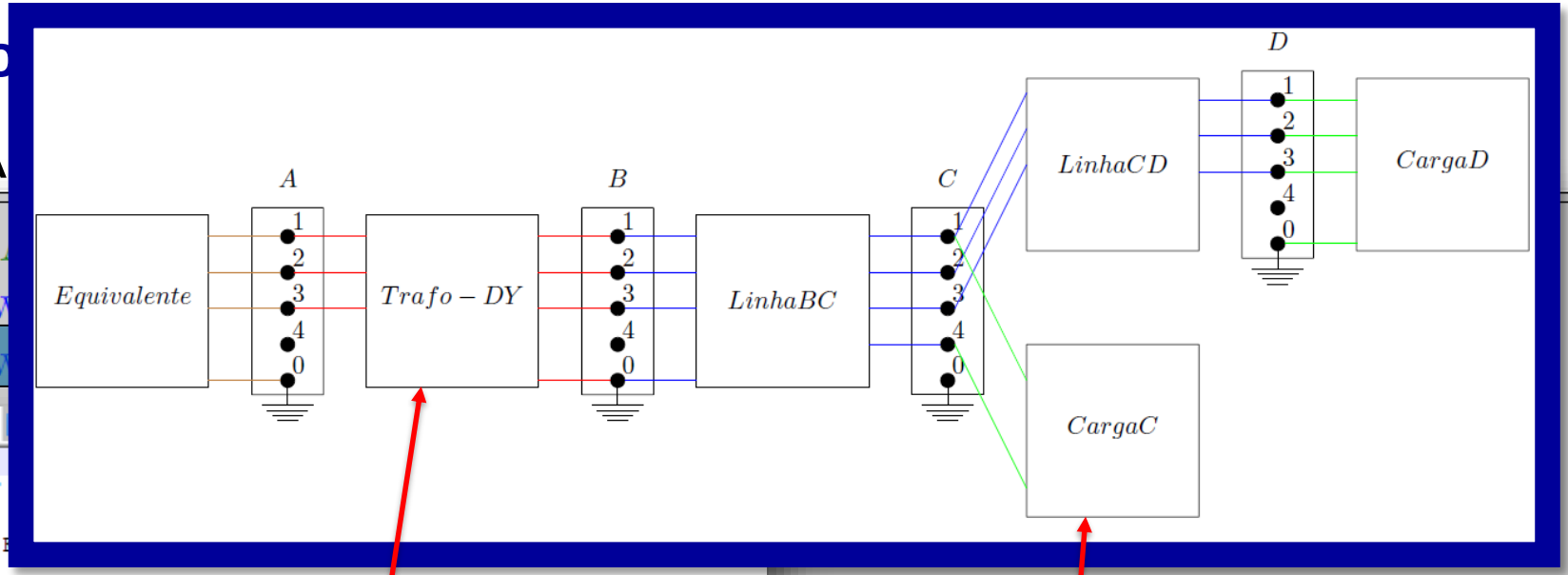
Shot.dss | Equivalente_VLN_Node.Txt | Equivalente_Power_elem_kVA.txt | Equivalente

```
CIRCUIT ELEMENT POWER FLOW

(Power Flow into element from indicated Bus)

Power Delivery Elements

  Bus Phase      kW      +j    kvar          kVA          PF

ELEMENT = "Vsource.SOURCE"
A         1       -842.6 +j    -620.7      1046.5        0.8052
A         2       -669.5 +j    -335.1       748.6        0.8942
A         3      -1003.3 +j    -327.9      1055.6        0.9505
   TERMINAL TOTAL -2515.4 +j   -1283.6      2824.0         0.8907
A         0          0.0 +j       0.0         0.0        1.0000
A         0          0.0 +j       0.0         0.0        1.0000
A         0          0.0 +j       0.0         0.0        1.0000
   TERMINAL TOTAL     0.0 +j       0.0         0.0         1.0000

ELEMENT = "Transformer.TRAFO"
A         1        842.6 +j     620.7      1046.5        0.8052
A         2        669.5 +j     335.1       748.6        0.8942
A         3       1003.3 +j     327.9      1055.6        0.9505
A         0          0.0 +j       0.0         0.0        1.0000
   TERMINAL TOTAL  2515.4 +j    1283.6      2824.0         0.8907
B         1      -1173.9 +j    -509.1      1279.6        0.9174
B         2       -668.3 +j    -288.0       727.7        0.9183
B         3       -668.6 +j    -288.2       728.0        0.9183
B         0          0.0 +j       0.0         0.0        1.0000
   TERMINAL TOTAL -2510.8 +j   -1085.3      2735.3         0.9179
```

```
Power Conversion Elements

  Bus Phase      kW    +j   kvar          kVA          PF

ELEMENT = "Load.CARGAC"
C         1      501.3 +j   214.9        545.4        0.9191
C         4       -1.3 +j    -2.0          2.3        0.5554
  TERMINAL TOTAL    500.0 +j    213.0        543.5        0.9200

ELEMENT = "Load.CARGAD"
D         1      666.7 +j   284.0        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    852.0       2173.9        0.9200


Total Circuit Losses =   15.4 +j  218.7
```

Mo

- A



Shot.dss

```
CIRCUIT

(Power

Power Delivery Elements

  Bus Phase      kW      +j    kvar          kVA          PF

ELEMENT = "Vsource.SOURCE"
A         1      -842.6 +j    -620.7       1046.5        0.8052
A         2      -669.5 +j    -335.1        748.6        0.8942
A         3     -1003.3 +j    -327.9       1055.6        0.9505
   TERMINAL TOTAL -2515.4 +j   -1283.6       2824.0        0.8907
A         0         0.0 +j       0.0          0.0        1.0000
A         0         0.0 +j       0.0          0.0        1.0000
A         0         0.0 +j       0.0          0.0        1.0000
   TERMINAL TOTAL     0.0 +j       0.0          0.0        1.0000

ELEMENT = "Transformer.TRAFO"
A         1       842.6 +j     620.7       1046.5        0.8052
A         2       669.5 +j     335.1        748.6        0.8942
A         3      1003.3 +j     327.9       1055.6        0.9505
A         0         0.0 +j       0.0          0.0        1.0000
   TERMINAL TOTAL  2515.4 +j    1283.6       2824.0        0.8907
B         1     -1173.9 +j    -509.1       1279.6        0.9174
B         2      -668.3 +j    -288.0        727.7        0.9183
B         3      -668.6 +j    -288.2        728.0        0.9183
B         0         0.0 +j       0.0          0.0        1.0000
   TERMINAL TOTAL -2510.8 +j   -1085.3       2735.3        0.9179
```

```
Power Conversion Elements

  Bus Phase      kW    +j   kvar          kVA          PF

ELEMENT = "Load.CARGAC"
C         1      501.3 +j   214.9        545.4        0.9191
C         4       -1.3 +j    -2.0          2.3        0.5554
  TERMINAL TOTAL    500.0 +j    213.0        543.5        0.9200

ELEMENT = "Load.CARGAD"
D         1      666.7 +j   284.0        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    852.0       2173.9        0.9200


Total Circuit Losses =   15.4 +j   218.7
```

Modo *SnapShot*

- Alguns resultados:

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

// Perfil de Tensao
Plot Profile

// Plot o Circuito
Plot circuit power max=2200 dots=n labels=n subs=y C1=Blue
```

Modo *SnapShot*

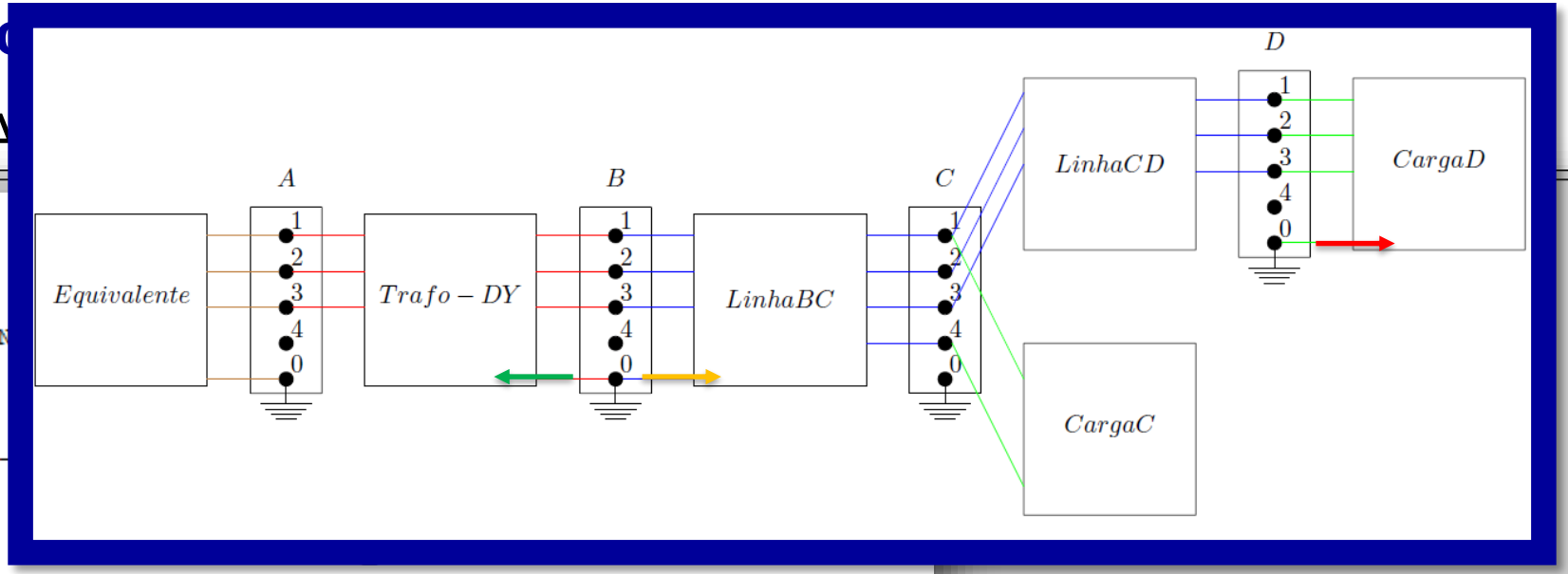
- Alguns resultados:

```
Power Delivery Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Vsource.SOURCE"
A         1             12.878 /_  143.6 =    -10.368 +j    7.6373
A         2              9.212 /_   33.4 =     7.6897 +j    5.0723
A         3             12.989 /_  -78.1 =     2.6786 +j    -12.71
------------
A         0             12.878 /_  -36.4 =     10.368 +j   -7.6373
A         0              9.212 /_ -146.6 =    -7.6897 +j   -5.0723
A         0             12.989 /_  101.9 =    -2.6786 +j     12.71

ELEMENT = "Transformer.TRAFO"
A         1             12.878 /_  -36.4 =     10.368 +j   -7.6373
A         2              9.212 /_ -146.6 =    -7.6897 +j   -5
A         3             12.989 /_  101.9 =    -2.6786 +j
A         0                  0 /_    0.0 =           0 +j
------------
B         1             162.25 /_  123.3 =    -88.999 +j    13
B         2             91.054 /_    4.8 =      90.73 +j    7
B         3             91.095 /_ -115.2 =    -38.738 +j   -82
B         0             71.259 /_  -58.7 =     37.008 +j   -60

ELEMENT = "Line.LINHABC"
B         1             162.25 /_  -56.7 =     88.999 +j   -13
B         2             91.054 /_ -175.2 =    -90.73 +j    -7
B         3             91.095 /_   64.8 =     38.738 +j    82
B         0             69.593 /_  123.2 =    -38.147 +j    58.206
------------
C         1             162.27 /_  123.3 =    -88.988 +j    135.69
C         2             91.064 /_    4.8 =     90.742 +j    7.6533
C         3             91.104 /_ -115.2 =    -38.763 +j   -82.446
C         4             69.592 /_  -56.8 =     38.147 +j   -58.205
```

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1             69.593 /_  -56.8 =     38.149 +j   -58.205
C         4             69.593 /_  123.2 =    -38.149 +j    58.205

ELEMENT = "Load.CARGAD"
D         1             92.682 /_  -56.7 =     50.831 +j     -77.5
D         2             91.071 /_ -175.2 =    -90.751 +j   -7.6353
D         3             91.112 /_   64.8 =     38.784 +j    82.445
D         0               2.92 /_   67.1 =     1.1362 +j    2.6898
```

Mo

- A




```
Power

  Bus

ELEMEN
A
A
A
------
A
A
A

ELEMENT = "Transformer.TRAFO"
A         1              12.878 /_  -36.4 =     10.368 +j    -7.6373
A         2               9.212 /_ -146.6 =    -7.6897 +j    -5
A         3              12.989 /_  101.9 =    -2.6786 +j
A         0                   0 /_    0.0 =           0 +j
------------
B         1             162.25 /_  123.3 =    -88.999 +j     13
B         2             91.054 /_    4.8 =     90.73 +j      7.
B         3             91.095 /_ -115.2 =    -38.738 +j    -82
B         0             71.259 /_  -58.7 =     37.008 +j    -60

ELEMENT = "Line.LINHABC"
B         1             162.25 /_  -56.7 =     88.999 +j    -13
B         2             91.054 /_ -175.2 =    -90.73 +j     -7.
B         3             91.095 /_   64.8 =     38.738 +j     82
B         0             69.593 /_  123.2 =    -38.147 +j     58.206
------------
C         1             162.27 /_  123.3 =    -88.988 +j     135.69
C         2             91.064 /_    4.8 =     90.742 +j     7.6533
C         3             91.104 /_ -115.2 =    -38.763 +j    -82.446
C         4             69.592 /_  -56.8 =     38.147 +j    -58.205
```

```
Power Conversion Elements

  Bus Phase     Magnitude, A      Angle        (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1             69.593 /_  -56.8 =     38.149 +j    -58.205
C         4             69.593 /_  123.2 =    -38.149 +j     58.205

ELEMENT = "Load.CARGAD"
D         1             92.682 /_  -56.7 =     50.831 +j      -77.5
D         2             91.071 /_ -175.2 =    -90.751 +j    -7.6353
D         3             91.112 /_   64.8 =     38.784 +j     82.445
D         0               2.92 /_   67.1 =     1.1362 +j     2.6898
```

Modo *SnapShot*

- Alguns resultados:

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

// Perfil de T
Plot Profile

// Plot o Circ
Plot circuit p
```

=y C1=Blue

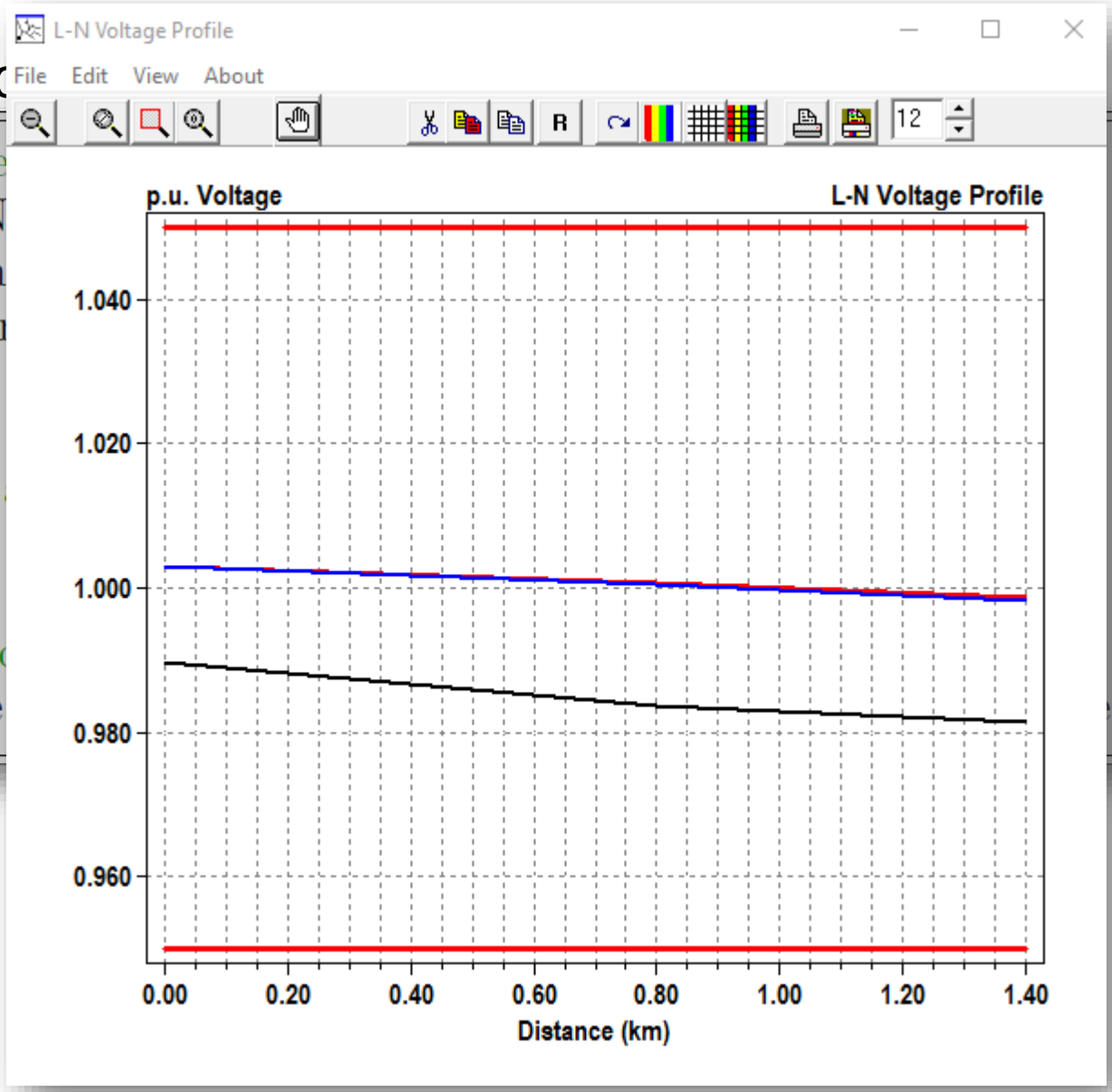
Shot.dss | Equivalente_VLN_Node.Txt | Equivalente_Losses.Txt | Equivalente_Curr_Ele

```
LOSSES REPORT

Power Delivery Element Loss Report

Element                    kW Losses     % of Power    kvar Losses

"Transformer.TRAFO"          4.60321,      0.18      198.325
"Line.LINHABC"               7.94985,      0.32      14.9121
"Line.LINHACD"               2.87117,      0.14      5.41784

LINE LOSSES=                          10.8 kW
TRANSFORMER LOSSES=                    4.6 kW

TOTAL LOSSES=                         15.4 kW

TOTAL LOAD POWER =                  2500.0 kW
Percent Losses for Circuit =        0.62 %
```

Modo *SnapShot*

- Alguns resultado

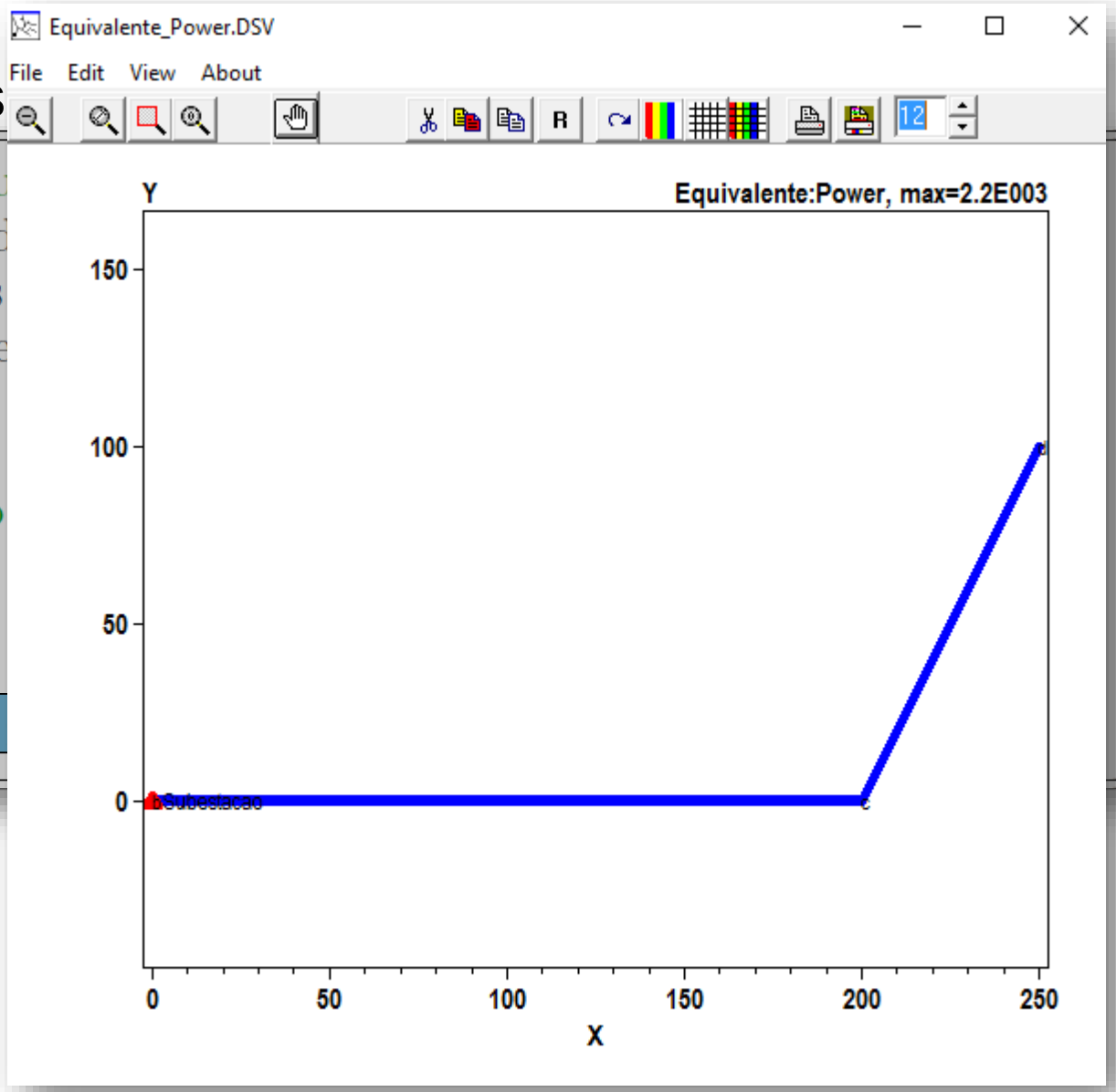
```
// Arquivos de Re
Show Voltage LN N
Show Power Elemen
Show Currents Ele
Show Losses

// Perfil de Tens
Plot Profile

// Plot o Circuit
Plot circuit powe
```



Modo *SnapShot*

- Alguns resultados

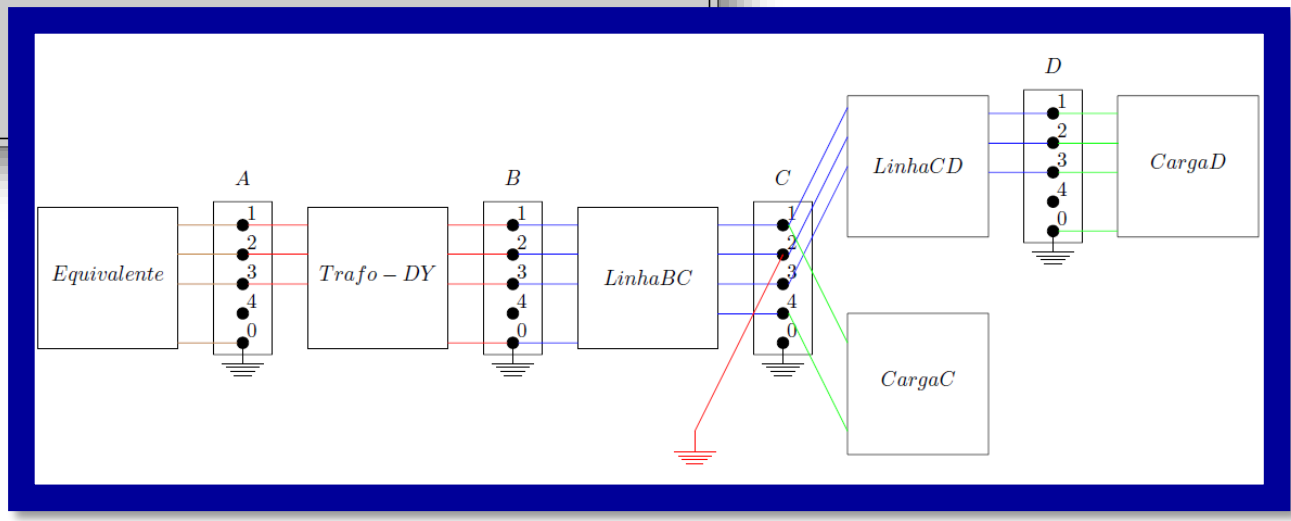
```
// Arquivos de Resu
Show Voltage LN Nod
Show Power Elements
Show Currents Eleme
Show Losses

// Perfil de Tensao
Plot Profile

// Plot o Circuito
Plot circuit power
```



Elemento *Fault* no Modo *SnapShot*

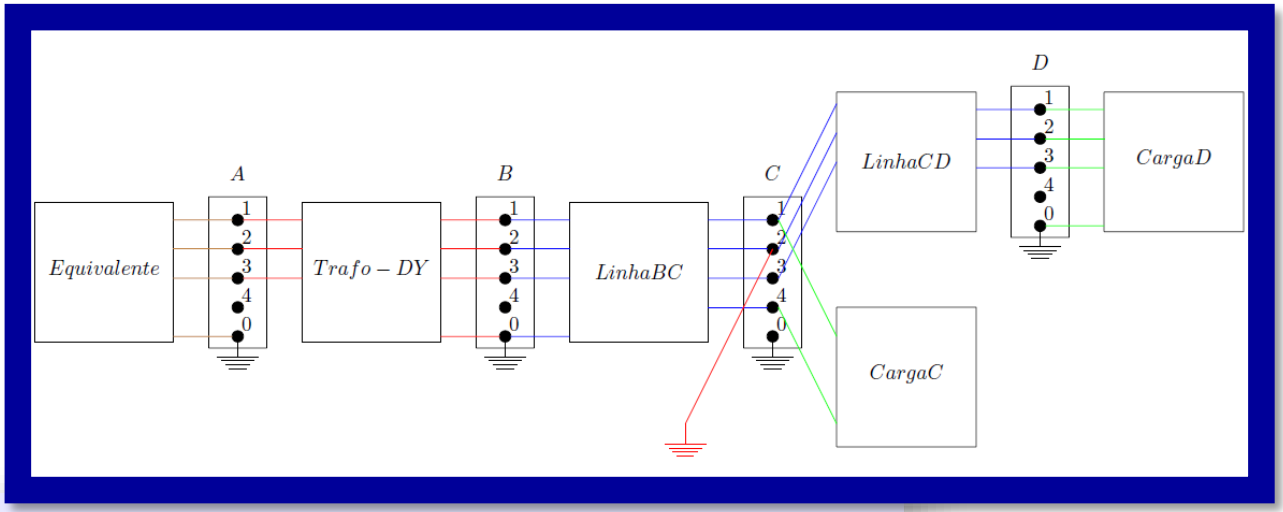
- Curto-circuitos podem ser aplicados através do elemento *Fault*
- Comandos necessários para a simulação:

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

// Dados da Falta monofasica na Barra C
New Fault.1Fase bus1=C.2 phases=1 r=0.0001

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



Elemento *Fault* no

- Alguns resultados:



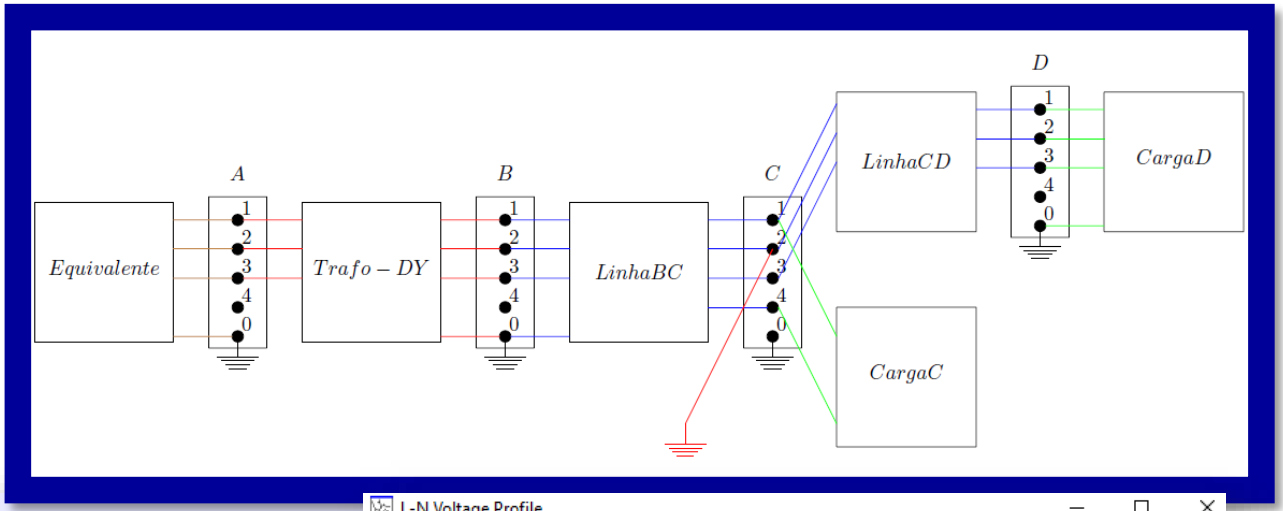
LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus	Node	VLN (kV)	Angle	pu	Base kV	Node-Node	VLL (kV)	Angle	pu
A ..	1	81.256 /_	0.0	1.0199	138.000	1-2	140.74 /_	30.0	1.0198
-	2	81.259 /_	-120.0	1.0199	138.000	2-3	140.76 /_	-90.0	1.02
-	3	81.267 /_	120.0	1.02	138.000	3-1	140.75 /_	150.0	1.0199
B ..	1	7.9188 /_	-33.2	0.99389	13.800	1-2	8.9558 /_	-25.7	0.64897
-	2	1.5122 /_	-162.7	0.18979	13.800	2-3	8.5894 /_	-101.3	0.62242
-	3	7.9768 /_	88.3	1.0012	13.800	3-1	13.872 /_	117.4	1.0052
C ..	1	8.3534 /_	-28.3	1.0484	13.800	1-2	8.3536 /_	-28.3	0.60533
-	2	0.00020966 /_	124.6	2.6314E-005	13.800	2-3	8.3488 /_	-96.7	0.60499
-	3	8.349 /_	83.3	1.0479	13.800	3-1	13.815 /_	117.5	1.0011
-	4	0.83678 /_	24.3	0.10503	13.800				
D ..	1	8.3488 /_	-28.6	1.0479	13.800	1-2	8.3365 /_	-28.4	0.6041
-	2	0.028513 /_	-93.0	0.0035787	13.800	2-3	8.3316 /_	-96.8	0.60374
-	3	8.3031 /_	83.2	1.0421	13.800	3-1	13.787 /_	117.4	0.99903

```
ELEMENT = "Fault.1FASE"
C        2           2096.6 /_  124.6 =    -1189.6 +j    1726.4
------------
C        0           2096.6 /_  -55.4 =     1189.6 +j   -1726.4
```

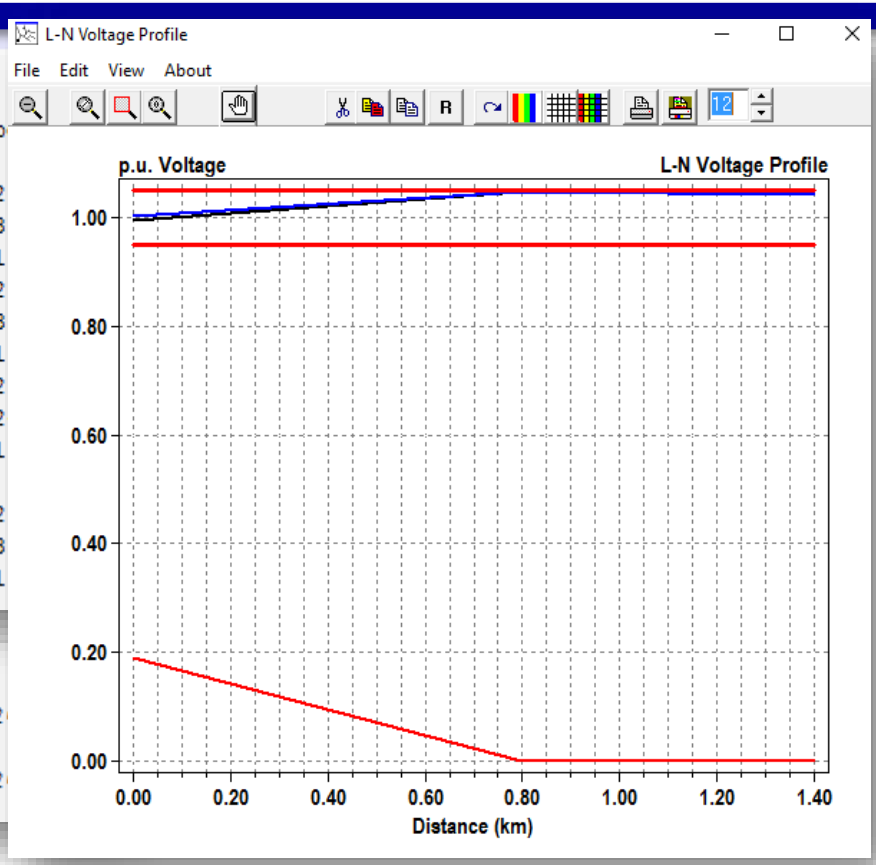
Elemento *Fault* no

- Alguns resultados:




```
LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus   Node     VLN (kV)    Angle       pu      Base kV     Node-No

A .. 1        81.256 /_     0.0     1.0199    138.000         1-2
   - 2        81.259 /_ -120.0      1.0199    138.000         2-3
   - 3        81.267 /_  120.0        1.02    138.000         3-1
B .. 1         7.9188 /_  -33.2     0.99389     13.800         1-2
   - 2         1.5122 /_ -162.7     0.18979     13.800         2-3
   - 3         7.9768 /_   88.3      1.0012     13.800         3-1
C .. 1         8.3534 /_  -28.3      1.0484     13.800         1-2
   - 2    0.00020966 /_  124.6 2.6314E-005      13.800           2
   - 3         8.349 /_   83.3      1.0479     13.800         3-1
   - 4       0.83678 /_   24.3     0.10503     13.800
D .. 1         8.3488 /_  -28.6      1.0479     13.800         1-2
   - 2      0.028513 /_  -93.0  0.0035787     13.800         2-3
   - 3         8.3031 /_   83.2      1.0421     13.800         3-1
```

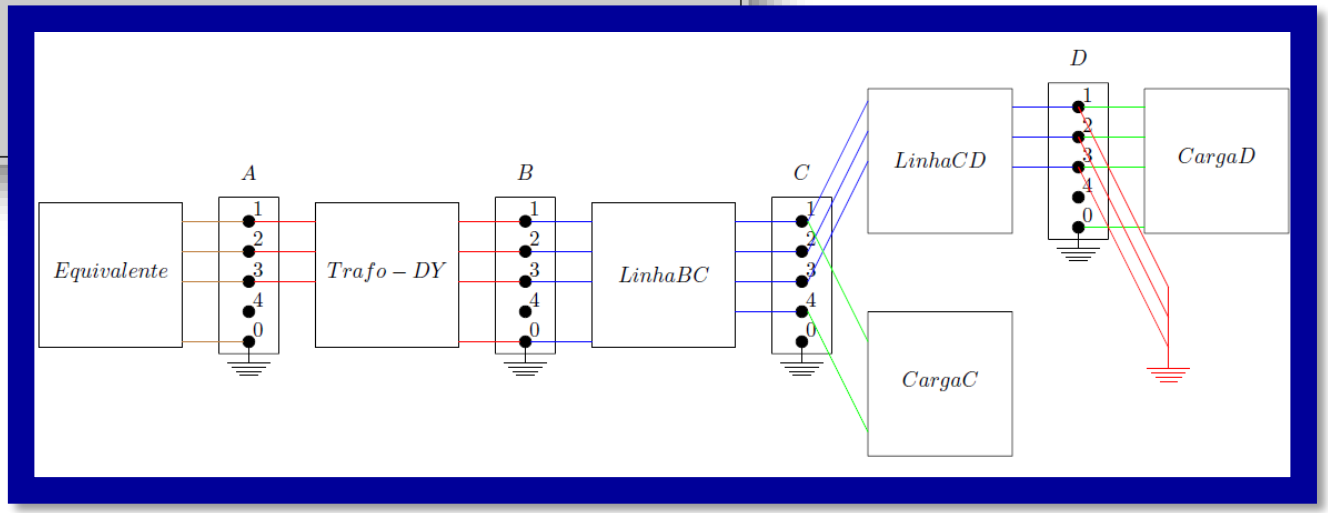
```
ELEMENT = "Fault.1FASE"
C         2            2096.6 /_  124.6 =    -1189.6 +j     172
------------
C         0            2096.6 /_  -55.4 =     1189.6 +j    -172
```



Elemento *Fault* no Modo *SnapShot*

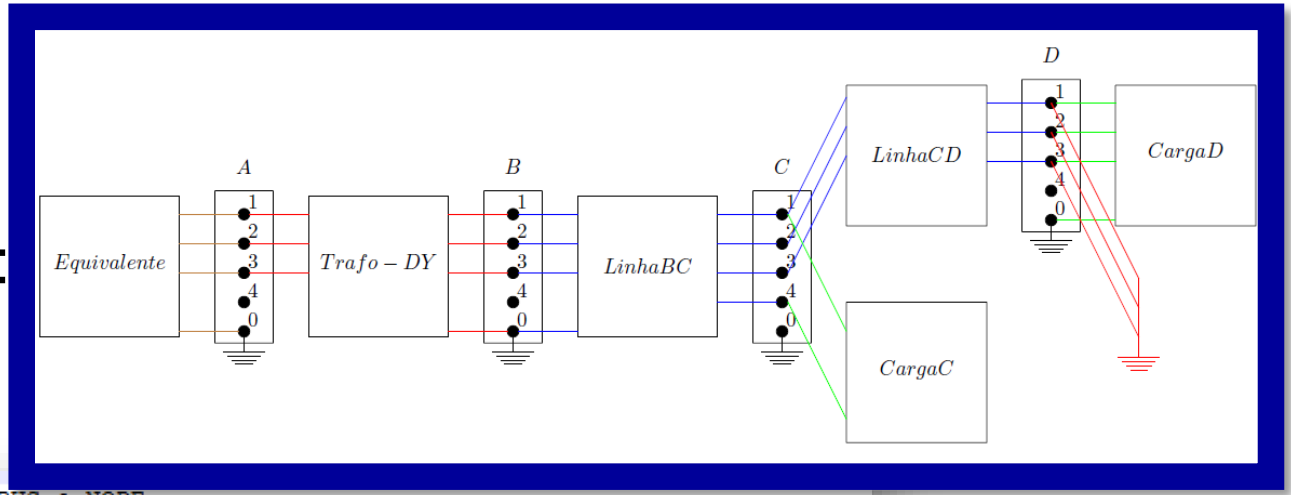
- Curto-circuitos podem ser aplicados através do elemento *Fault*
- Comandos para a simulação:

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

// Dados da Falta Trifasica na Barra D
New Fault.3Fases bus1=D phases=3 r=0.0001

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



Elemento *Fault* no

- Alguns resultados:

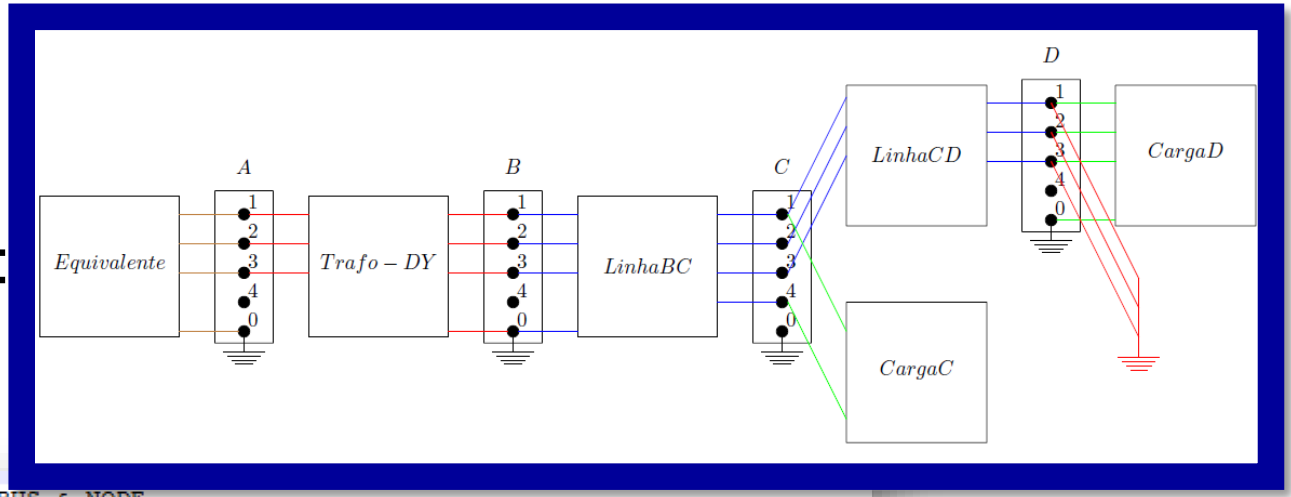



```
LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus  Node     VLN (kV)    Angle       pu      Base kV    Node-Node    VLL (kV)   Angle       pu

A .. 1        81.247 /_     0.0    1.0197    138.000         1-2      140.72 /_    30.0     1.0197
   - 2        81.247 /_ -120.0     1.0197    138.000         2-3      140.72 /_   -90.0     1.0197
   - 3        81.248 /_  120.0     1.0197    138.000         3-1      140.72 /_   150.0     1.0197
B .. 1        1.3608 /_  -53.8     0.1708     13.800         1-2        2.22 /_   -22.9    0.16087
   - 2        1.2641 /_ -169.3    0.15866     13.800         2-3      2.2394 /_ -137.8    0.16228
   - 3        1.3368 /_   71.9    0.16778     13.800         3-1      2.4004 /_   99.3    0.17394
C .. 1       0.56152 /_  -49.3   0.070477     13.800         1-2     0.98725 /_  -20.2    0.07154
   - 2       0.56708 /_ -171.3   0.071175     13.800         2-3     0.98031 /_ -141.0   0.071037
   - 3       0.56845 /_   69.3   0.071346     13.800         3-1     0.97156 /_   99.8   0.070403
   - 4      0.031911 /_   -3.8  0.0040052     13.800
D .. 1    0.00021696 /_ -113.8 2.723E-005      13.800       1-2 0.00037922 /_  -84.2 2.748E-005
   - 2    0.00021865 /_  125.2 2.7443E-005     13.800       2-3 0.00037656 /_  155.0 2.7287E-005
   - 3    0.00021621 /_    5.2 2.7137E-005     13.800       3-1 0.00037319 /_   35.8 2.7043E-005
```

```
ELEMENT = "Fault.3FASES"
D        1            2169.6 /_ -113.8 =    -874.86 +j   -1985.4
D        2            2186.5 /_  125.2 =   -1259.5 +j    1787.3
D        3            2162.1 /_    5.2 =    2153.3 +j    195.89
------------
D        0            2169.6 /_   66.2 =    874.86 +j    1985.4
D        0            2186.5 /_  -54.8 =    1259.5 +j   -1787.3
D        0            2162.1 /_ -174.8 =   -2153.3 +j   -195.89
```

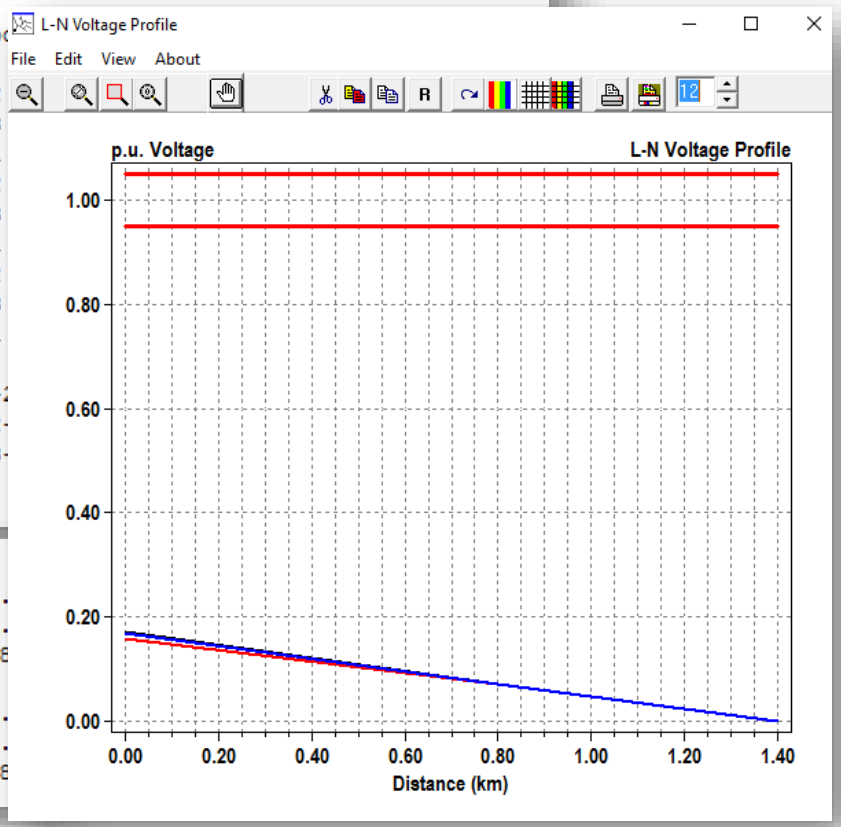
Elemento *Fault* no

- Alguns resultados:




```
LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus   Node     VLN (kV)    Angle       pu      Base kV     Node-Noc

A .. 1        81.247 /_     0.0     1.0197    138.000         1-2
   - 2        81.247 /_ -120.0     1.0197    138.000         2-3
   - 3        81.248 /_  120.0     1.0197    138.000         3-1
B .. 1         1.3608 /_  -53.8     0.1708     13.800         1-2
   - 2         1.2641 /_ -169.3    0.15866     13.800         2-3
   - 3         1.3368 /_   71.9    0.16778     13.800         3-1
C .. 1       0.56152 /_  -49.3   0.070477     13.800         1-2
   - 2       0.56708 /_ -171.3   0.071175     13.800         2-3
   - 3       0.56845 /_   69.3   0.071346     13.800         3-1
   - 4      0.031911 /_   -3.8 0.0040052     13.800
D .. 1    0.00021696 /_ -113.8 2.723E-005     13.800         1-
   - 2    0.00021865 /_  125.2 2.7443E-005    13.800         2-
   - 3    0.00021621 /_    5.2 2.7137E-005    13.800         3-
```

```
ELEMENT = "Fault.3FASES"
D         1            2169.6 /_ -113.8 =     -874.86 +j    -1985.
D         2            2186.5 /_  125.2 =    -1259.5 +j     1787.
D         3            2162.1 /_    5.2 =     2153.3 +j     195.8
------------
D         0            2169.6 /_   66.2 =     874.86 +j     1985.
D         0            2186.5 /_  -54.8 =     1259.5 +j    -1787.
D         0            2162.1 /_ -174.8 =    -2153.3 +j    -195.8
```



ESCOLA POLITÉCNICA DA USP

Modo *FaultStudy*

- Calcula as correntes de falta em todas as barras do sistema
- Comandos para a simulação:

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

// FaultStudy Mode
Set mode=FaultStudy
Solve

// Coordenadas
BusCoords Coordenadas.csv

// Arquivos de Resultados
Export SeqZ
Show fault
Export FaultStudy
```

Modo *FaultStudy*

- Calcula as correntes de falta em todas as barras do sistema
- Comandos para a simulação:

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

//
Set
Solv

// Coordenadas
BusCoords Coordenadas.csv

// Arquivos de Resultados
Export SeqZ
Show fault
Export FaultStudy
```

tStudy.dss | Equivalente_FaultStudy.Txt | Equivalente_EXP_SEQZ.CSV | Equivalente_EXP_FAULTS.CSV

Bus	NumNodes	R1	X1	R0	X0	Z1	Z0	"X1/R1"	"X0/R0"
"A"	3	0.023095	0.0923759	0.0258629	0.0775887	0.0952192	0.0817857	4	3
"B"	3	0.217139	3.10346	0.214576	3.1014	3.11105	3.10881	14.29	14.45
"C"	4	0.365238	2.63768	0.567647	3.75008	2.66285	3.7928	7.222	6.606
"D"	3	0.513422	3.6057	0.925307	5.51569	3.64207	5.59277	7.023	5.961

Modo *FaultStu*

- Calcula as co
- Comandos pa

```
// Definindo T
Set voltagebas
Calcvoltagebas

// I
Set
Solv

// Coordenadas
BusCoords Coor

// Arquivos de
Export SeqZ
Show fault
Export FaultStu
```

tStudy.dss | Equivale

Bus,	NumNodes,	
"A",	3,	0.023
"B",	3,	0.217
"C",	4,	0.365
"D",	3,	0.513

tStudy.dss | Equivalente_FaultStudy.Txt | Equivalente_EXP_SEQZ.CSV | Equivalente_EXP_FAULTS.CSV

FAULT STUDY REPORT

ALL-Node Fault Currents

Bus	Node 1	X/R	Node 2	X/R	Node 3	X/R	...	(Amps)	
"A",	853475,	4.0,	853475,	4.0,	853475,	4.0			
"B",	2561,	11.7,	2560,	16.1,	2560,	16.1			
"C",	2325,	6.9,	2343,	10.2,	2313,	9.9,		37,	3.5
"D",	2172,	5.8,	2189,	7.8,	2164,	7.8			

ONE-Node to ground Faults

			pu Node Voltages (L-N Volts if no base)			
Bus	Node	Amps	Node 1	Node 2	Node 3	...
"A"	1	896144	0.000	0.974	1.018	
"A"	2	896146	1.018	0.000	0.974	
"A"	3	896147	0.974	1.018	0.000	
"B"	1	2562	0.000	1.004	1.003	
"B"	2	2561	0.992	0.000	1.004	
"B"	3	2561	0.992	1.003	0.000	
"C"	1	2094	0.000	1.052	1.057	0.096
"C"	2	2099	1.048	0.000	1.047	0.105
"C"	3	2098	1.030	1.061	0.000	0.098
"C"	4	38	0.985	1.003	1.001	0.000
"D"	1	1840	0.000	1.078	1.087	
"D"	2	1848	1.077	0.000	1.074	
"D"	3	1848	1.058	1.090	0.000	

Adjacent Node-Node Faults

				pu Node Voltages (L-N Volts if no base)			
Bus	Node-Node		Amps	Node 1	Node 2	Node 3	...
"A"	1	2	739035	0.510	0.510	1.020	
"A"	2	3	739038	1.020	0.510	0.510	
"B"	1	2	2203	0.499	0.499	1.004	

Modo *FaultStu*

- Calcula as co
- Comandos pa

```
// Definindo T
Set voltagebas
Calcvoltagebas

// I
Set
Solv

// Coordenadas
BusCoords Coor

// Arquivos de
Export SeqZ
Show fault
Export FaultStu
```

tStudy.dss | Equivalente_FaultStudy.Txt | Equivalente_EXP_SEQZ.CSV | Equivalente_EXP_FAULTS.CSV

```
FAULT STUDY REPORT

ALL-Node Fault Currents

Bus        Node 1  X/R        Node 2  X/R        Node 3  X/R    ...   (Amps)

"A",      853475,   4.0,     853475,   4.0,     853475,   4.0
"B",        2561,  11.7,       2560,  16.1,       2560,  16.1
"C",        2325,   6.9,       2343,  10.2,       2313,   9.9,          37,    3.5
"D",        2172,   5.8,       2189,   7.8,       2164,   7.8


ONE-Node to ground Faults

                                                  pu Node Voltages (L-N Volts if no base)
Bus    Node  Amps          Node 1     Node 2     Node 3     ...

"A"       1       896144          0.000      0.974      1.018
"A"       2       896146          1.018      0.000      0.974
"A"       3       896147          0.974      1.018      0.000
"B"       1
"B"       2
"B"       3
"C"       1
"C"       2
"C"       3
"C"       4
"D"       1
"D"       2
"D"       3          1848         1.058      1.090      0.000

Adjacent Node-Node Faults

                                                    pu Node Voltages (L-N Volts if no base)
Bus          Node-Node      Amps          Node 1     Node 2     Node 3     ...

"A"       1   2       739035          0.510      0.510      1.020
"A"       2   3       739038          1.020      0.510      0.510
"B"       1   2         2203          0.499      0.499      1.004
```

tStudy.dss | Equivalente

```
Bus,  NumNodes,
"A", 3,    0.023
"B", 3,    0.217
"C", 4,    0.365
"D", 3,    0.513
```

Study.dss | Equivalente_EXP_FAULTS.CSV | Equivalente_FaultStudy.Txt

```
Bus,  3-Phase,  1-Phase,  L-L
A          ,     853475,     895885,     739038
B          ,       2561,       2562,       2217
C          ,       2343,       2099,       2067
D          ,       2189,       1848,       1886
```

Comparação entre *FaultStudy* e *Fault* (*SnapShot*)

FaultStudy

ONE-Node to ground Faults

Bus	Node	Amps	pu Node Voltages (L-N V Node 1	Node 2	Node 3	...
"A"	1	896144	0.000	0.974	1.018	
"A"	2	896146	1.018	0.000	0.974	
"A"	3	896147	0.974	1.018	0.000	
"B"	1	2562	0.000	1.004	1.003	
"B"	2	2561	0.992	0.000	1.004	
"B"	3	2561	0.992	1.003	0.000	
"C"	1	2094	0.000	1.052	1.057	
"C"	2	2099	1.048	0.000	1.047	
"C"	3	2098	1.030	1.061	0.000	
"C"	4	38	0.985	1.003	1.001	
"D"	1	1840	0.000	1.078	1.087	
"D"	2	1848	1.077	0.000	1.074	
"D"	3	1848	1.058	1.090	0.000	

Fault (SnapShot)

```
ELEMENT = "Fault.1FASE"
C        2           2096.6 /_  124.6 =    -1189.6 +j    1726.4
------------
C        0           2096.6 /_  -55.4 =     1189.6 +j   -1726.4
```

Comparação entre *FaultStudy* e *Fault* (*SnapShot*)

FaultStudy

ONE-Node to ground Faults

Bus	Node	Amps	pu Node Voltages (L-N V Node 1	Node 2	Node 3	...
"A"	1	896144	0.000	0.974	1.018	
"A"	2	896146	1.018	0.000	0.974	
"A"	3	896147	0.974	1.018	0.000	
"B"	1	2562	0.000	1.004	1.003	
"B"	2	2561	0.992	0.000	1.004	
"B"	3	2561	0.992	1.003	0.000	
"C"	1	2094	0.000	1.052	1.057	
"C"	2	2099	1.048	0.000	1.047	
"C"	3	2098	1.030	1.061	0.000	
"C"	4	38	0.985	1.003	1.001	
"D"	1	1840	0.000	1.078	1.087	
"D"	2	1848	1.077	0.000	1.074	
"D"	3	1848	1.058	1.090	0.000	

ltStudy.dss | Equivalente_FaultStudy.Txt | Equivalente_EXP_SEQZ.CSV | Equivalente_E

FAULT STUDY REPORT

ALL-Node Fault Currents

Bus	Node 1	X/R	Node 2	X/R	Node 3	X/R
"A",	853475,	4.0,	853475,	4.0,	853475,	4.0
"B",	2561,	11.7,	2560,	16.1,	2560,	16.1
"C",	2325,	6.9,	2343,	10.2,	2313,	9.9,
"D",	2172,	5.8,	2189,	7.8,	2164,	7.8

Fault (SnapShot)

```
ELEMENT = "Fault.1FASE"
C        2          2096.6 /_  124.6 =    -1189.6 +j    1726.4
------------
C        0          2096.6 /_  -55.4 =     1189.6 +j   -1726.4
```

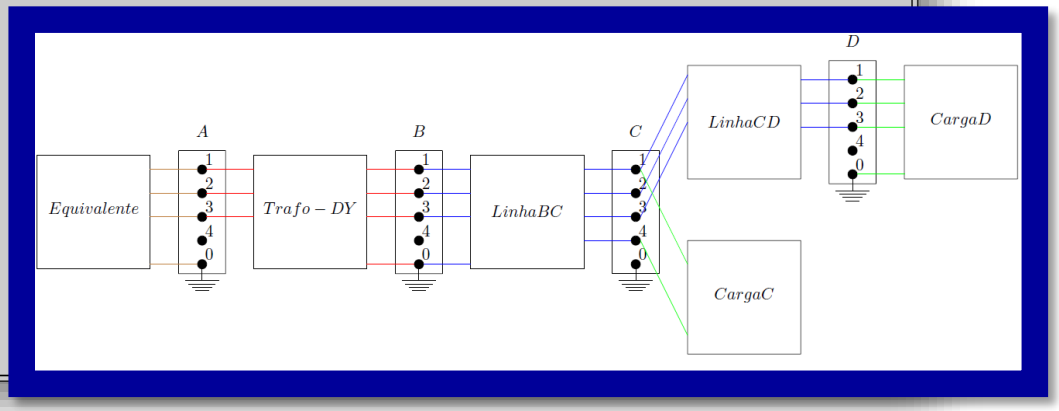
```
ELEMENT = "Fault.3FASES"
D        1          2169.6 /_ -113.8 =    -874.86 +j   -1985.4
D        2          2186.5 /_  125.2 =    -1259.5 +j    1787.3
D        3          2162.1 /_    5.2 =     2153.3 +j    195.89
------------
D        0          2169.6 /_   66.2 =     874.86 +j    1985.4
D        0          2186.5 /_  -54.8 =     1259.5 +j   -1787.3
D        0          2162.1 /_ -174.8 =    -2153.3 +j   -195.89
```

Modo *Harmonic*

- Realiza o fluxo de potência para as harmônicas selecionadas
- Comandos para a simulação:

```
// Dados dos Espectros Harmonicos das Cargas
New Spectrum.spCargaC NumHarm=3 harmonic=(1 3 5) %mag=(100 5 1) angle=(0 180 90)
New Spectrum.spCargaD NumHarm=2 harmonic=(1 5) %mag=(100 2) angle=(0 30)

// 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 spectrum=spCargaC
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1 spectrum=spCargaD
```

```
// Monitores na Sub (deve ser conectado em um elemento e nao em uma barra)
New Monitor.PotenciaSub element=Transformer.Trafo terminal=1 mode=1 ppolar=no
New Monitor.TensaoSub element=Transformer.Trafo terminal=1 mode=0

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

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



Modo *Harmonic*

- Alguns resultados:

```
// Arquivos dos Monitores
Show Monitor PotenciaSub
Show Monitor TensaoSub

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

valente_Mon_tensaosub.csv | Equivalente_VLN_Node.Txt | Equivalente_Curr_Elem.Txt | Equivalente_Mon_potenciasub.csv

```
Freq, Harmonic, P1 (kW), Q1 (kvar), P2 (kW), Q2 (kvar), P3 (kW), Q3 (kvar), P4 (kW), Q4 (kvar)
60, 1.00000, 842.611, 620.651, 669.451, 335.087, 1003.34, 327.903, 0, 0
180, 3.00000, -7.85529E-007, -9.42635E-006, -1.28291E-012, -1.5395E-011, -7.8446E-007, -9.41352E-006, 0, 0
300, 5.00000, -7.89661E-007, -1.57932E-005, -6.72664E-007, -1.34533E-005, -8.44831E-007, -1.68966E-005, 0, 0
```

Modo *Harmonic*

- Alguns resultados:

```
// Arquivos dos Monitores
Show Monitor PotenciaSub
Show Monitor TensaoSub

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

ivalente_Mon_tensaosub.csv | Equivalente_VLN_Node.Txt | Equivalente_Curr_Elem.Txt | Equivalente_Mon_potenciasub.csv

Freq	Harmonic	V1	VAngle1	V2	VAngle2	V3	VAngle3	V4	VAngle4	I1	IAngle1	I2	IAngle2	I3	IAngle3	I4	IAngle4
60	1.00000	81266.9	-0.000550908	81267.3	-120	81267.2	119.999	0	0	12.8775	-36.3752	9.21197	-146.59	12.9888	101.901	0	0
180	3.00000	0.0512881	-92.6181	6.55442E-005	145.186	0.0512532	87.3199	0	0	0.184429	2.14555	0.000235693	-120.05	0.184304	-177.916	0	0
300	5.00000	0.0855154	-10.1924	0.0789266	104.871	0.0884523	-136.264	0	0	0.184913	82.6701	0.170666	-162.266	0.191264	-43.4013	0	0

180,	3.00000,	-7.85529E-007,	-9.42635E-006,	-1.28291E-012,	-1.5395E-011,	-7.8446E-007,	-9.41352E-006,	0,	0
300,	5.00000,	-7.89661E-007,	-1.57932E-005,	-6.72664E-007,	-1.34533E-005,	-8.44831E-007,	-1.68966E-005,	0,	0

Modo *Harmonic*

- Alguns resultados:

```
// Arquivos dos Monitores
Show Monitor PotenciaSub
Show Monitor TensaoSub

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

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1          0.69593 /_  166.2 =   -0.67586 +j    0.16592
C         4          0.69593 /_  -13.8 =    0.67586 +j   -0.16592

ELEMENT = "Load.CARGAD"
D         1           1.8536 /_  106.3 =    -0.5203 +j    1.7791
D         2           1.8214 /_ -126.0 =    -1.0694 +j   -1.4744
D         3           1.8222 /_   -6.0 =     1.8124 +j   -0.18938
D         0          0.25073 /_ -152.6 =   -0.22264 +j   -0.11531
```

```
LINE-GROUND and LINE-LINE VOLTAGES BY BUS & NODE

Bus  Node    VLN (kV)   Angle      pu      Base kV    Node-Node   VLL (kV)  Angle      pu

A .. 1   8.5515E-005 /_  -10.2 1.0733E-006   138.000        1-2 0.00013878 /_  -41.2 1.0057E-006
   - 2   7.8927E-005 /_  104.9 9.9061E-007   138.000        2-3  0.0001442 /_   72.4 1.0449E-006
   - 3   8.8452E-005 /_ -136.3 1.1102E-006   138.000        3-1 0.00015506 /_ -162.7 1.1236E-006
B .. 1     0.032462 /_   20.9 0.0040744    13.800         1-2   0.050844 /_   -7.7 0.0036844
   - 2     0.027185 /_  137.5  0.003412    13.800         2-3   0.046927 /_  107.4 0.0034005
   - 3     0.027109 /_ -102.9 0.0034025    13.800         3-1    0.05259 /_ -133.7 0.0038109
C .. 1     0.035694 /_   20.3   0.00448    13.800         1-2   0.055367 /_   -7.9 0.0040121
   - 2     0.029267 /_  136.9 0.0036734    13.800         2-3   0.051644 /_  106.2 0.0037423
   - 3       0.0304 /_ -103.2 0.0038155    13.800         3-1   0.058287 /_ -133.9 0.0042237
   - 4    0.0014156 /_ -106.9 0.00017767    13.800
D .. 1     0.037689 /_   18.8 0.0047304    13.800         1-2   0.058977 /_   -8.8 0.0042737
   - 2     0.030929 /_  137.0 0.0038819    13.800         2-3   0.055127 /_  106.0 0.0039947
   - 3     0.032747 /_ -103.1 0.0041101    13.800         3-1   0.061623 /_ -134.4 0.0044654
```

```
 IAngle3, I4, IAngle4
197, -146.59, 12.9888, 101.901, 0, 0
555, 0.000235693, -120.05, 0.184304, -177.916, 0, 0
01, 0.170666, -162.266, 0.191264, -43.4013, 0, 0
```

```
, -7.8446E-007, -9.41352E-006, 0, 0
5, -8.44831E-007, -1.68966E-005, 0, 0
```

Modo *Harmonic*

- Resultados para uma harmônica:

```
// Harmonics Mode
Set mode=SnapShot
Solve
Set harmonics=[3]
Set mode=Harmonic
Solve
```

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1           3.4796 /_    9.7 =     3.4297 +j   0.58772
C         4           3.4796 /_ -170.3 =    -3.4297 +j  -0.58772

ELEMENT = "Load.CARGAD"
D         1                0 /_    0.0 =           0 +j          0
D         2                0 /_    0.0 =           0 +j          0
D         3                0 /_    0.0 =           0 +j          0
D         0                0 /_    0.0 =           0 +j          0
```

Modo *Harmonic*

- Fonte de harmônica:

```
// Dados dos Espectros Harmonicos das Cargas
New Spectrum.spCargaC NumHarm=3 harmonic=(1 3 5) %mag=(100 5 1) angle=(0 180 90)
New Spectrum.spCargaD NumHarm=2 harmonic=(1 5) %mag=(100 2) angle=(0 30)

// 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 spectrum=spCargaC
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1 spectrum=spCargaD
```

- Fundamental

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1            69.593 /_  -56.8 =     38.149 +j    -58.205
C         4            69.593 /_  123.2 =    -38.149 +j     58.205

ELEMENT = "Load.CARGAD"
D         1            92.682 /_  -56.7 =     50.831 +j      -77.5
D         2            91.071 /_ -175.2 =    -90.751 +j    -7.6353
D         3            91.112 /_   64.8 =     38.784 +j     82.445
D         0              2.92 /_   67.1 =     1.1362 +j     2.6898
```

- 3º Harmônica

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1            3.4796 /_    9.7 =     3.4297 +j    0.58772
C         4            3.4796 /_ -170.3 =    -3.4297 +j   -0.58772

ELEMENT = "Load.CARGAD"
D         1                 0 /_    0.0 =           0 +j          0
D         2                 0 /_    0.0 =           0 +j          0
D         3                 0 /_    0.0 =           0 +j          0
D         0                 0 /_    0.0 =           0 +j          0
```

Modo *Harmonic*

- Fonte de harmônica:

```
// Dados dos Espectros Harmonicos das Cargas
New Spectrum.spCargaC NumHarm=3 harmonic=(1 3 5) %mag=(100 5 1) angle=(0 180 90)
New Spectrum.spCargaD NumHarm=2 harmonic=(1 5) %mag=(100 2) angle=(0 30)

// 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 spectrum=spCargaC
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1 spectrum=spCargaD
```

- Fundamental

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1           69.593 /_  -56.8 =     38.149 +j    -58.205
C         4           69.593 /_  123.2 =    -38.149 +j     58.205

ELEMENT = "Load.CARGAD"
D         1           92.682 /_  -56.7 =     50.831 +j     -77.5
D         2           91.071 /_ -175.2 =    -90.751 +j    -7.6353
D         3           91.112 /_   64.8 =     38.784 +j
D         0             2.92 /_   67.1 =     1.1362 +j
```

- 3º Harmônica

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1           3.4796 /_   9.7 =     3.4297 +j    0.58772
C         4           3.4796 /_ -170.3 =    -3.4297 +j   -0.58772

ELEMENT = "Load.CARGAD"
D         1                0 /_   0.0 =           0 +j          0
D         2                0 /_   0.0 =           0 +j          0
D         3                0 /_   0.0 =           0 +j          0
                           0 /_   0.0 =           0 +j          0
```

$$I_h = \frac{\%mag}{100} \times I_1$$

Modo *Harmonic*

- Fonte de harmônica:

```
// Dados dos Espectros Harmonicos das Cargas
New Spectrum.spCargaC NumHarm=3 harmonic=(1 3 5) %mag=(100 5 1) angle=(0 180 90)
New Spectrum.spCargaD NumHarm=2 harmonic=(1 5) %mag=(100 2) angle=(0 30)

// 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 spectrum=spCargaC
New Load.CargaD phases=3 bus1=D conn=wye kv=13.8 kw=2000 pf=0.92 model=1 spectrum=spCargaD
```

- Fundamental

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1            69.593 /_   -56.8 =     38.149 +j    -58.205
C         4            69.593 /_   123.2 =    -38.149 +j     58.205

ELEMENT = "Load.CARGAD"
D         1            92.682 /_  -56.7 =     50.831 +j     -77.5
D         2            91.071 /_ -175.2 =    -90.751 +j    -7.6353
D         3            91.112 /_   64.8 =     38.784 +j     82.445
D         0              2.92 /_   67.1 =     1.1362 +j     2.6898
```

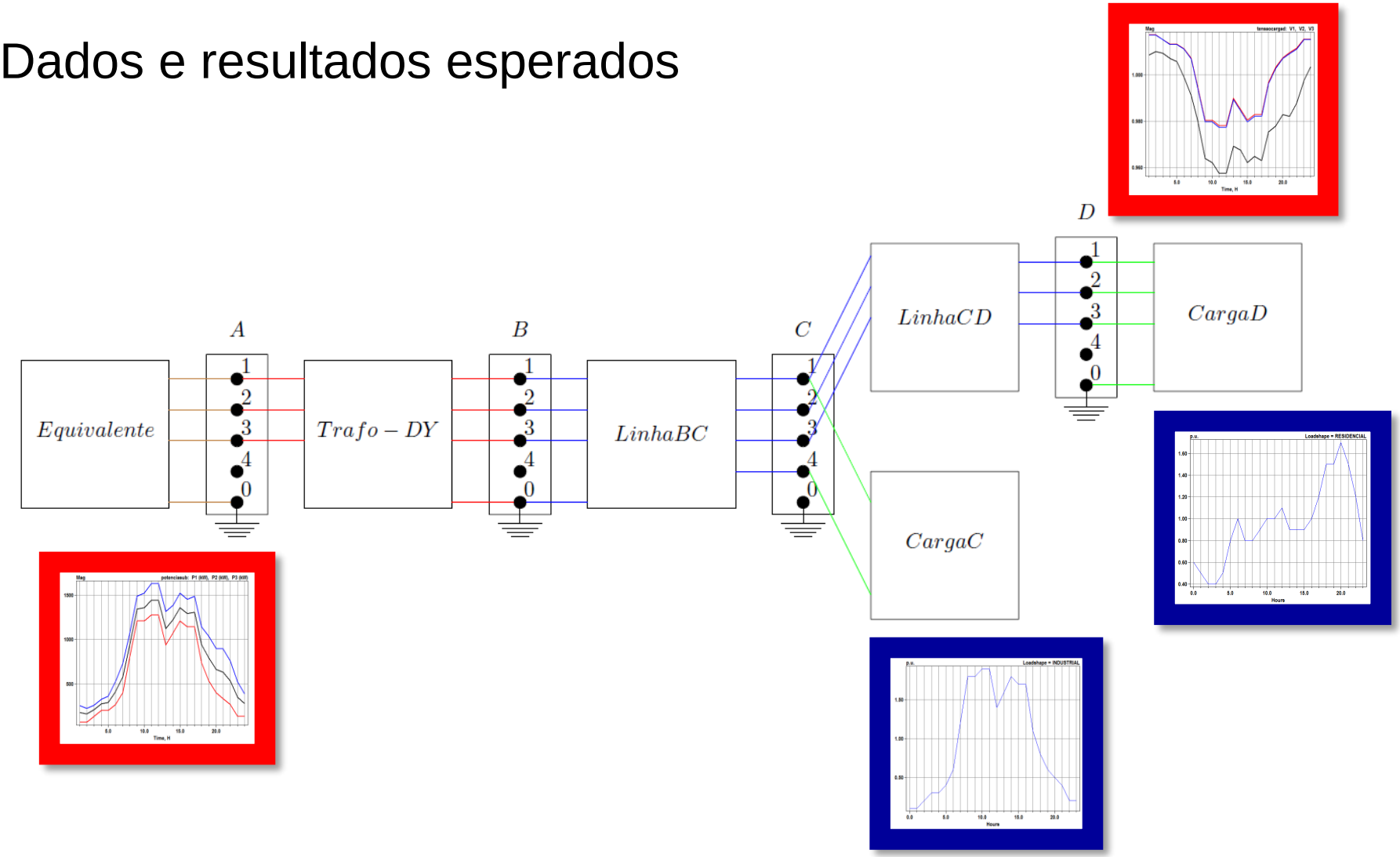
- 3º Harmônica

```
Power Conversion Elements

  Bus Phase    Magnitude, A     Angle       (Real)    +j   (Imag)

ELEMENT = "Load.CARGAC"
C         1            3.4796 /_    9.7 =     3.4297 +j    0.58772
C         4            3.4796 /_ -170.3 =    -3.4297 +j   -0.58772

ELEMENT = "Load.CARGAD"
D         1                 0 /_    0.0 =           0 +j          0
D         2                 0 /_    0.0 =           0 +j          0
D         3                 0 /_    0.0 =           0 +j          0
D         0                 0 /_    0.0 =           0 +j          0
```

$$\alpha_h = h \times \alpha_1 + angle_h$$

Modo *QSTS(Daily)*

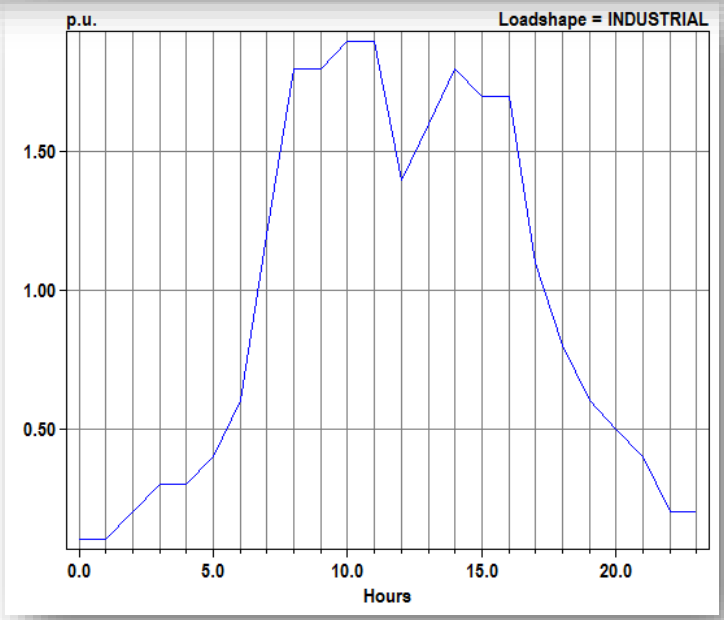
- Dados e resultados esperados

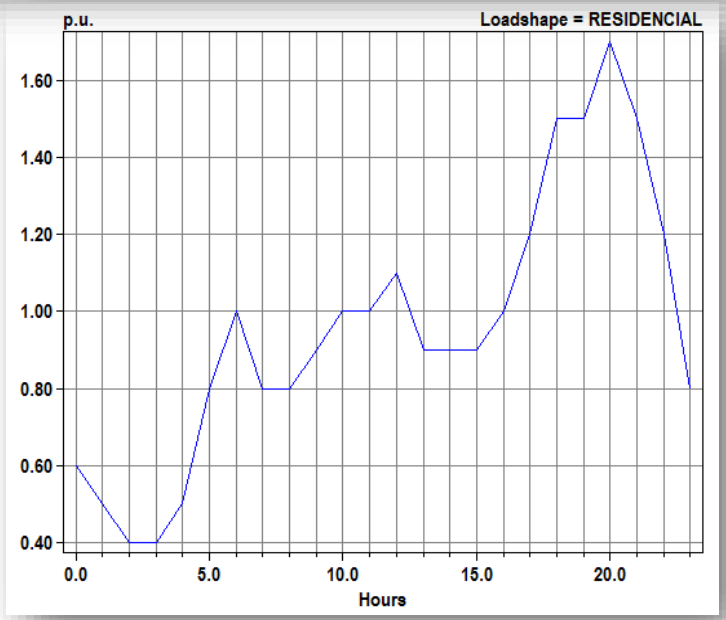


Modo *QSTS(Daily)*

- Comandos para a simulação:

```
// 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 conn=wye 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
```

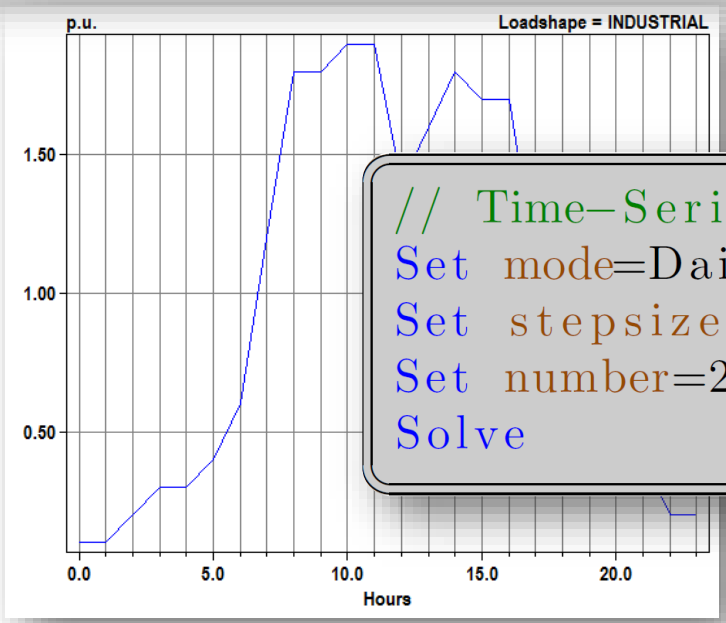


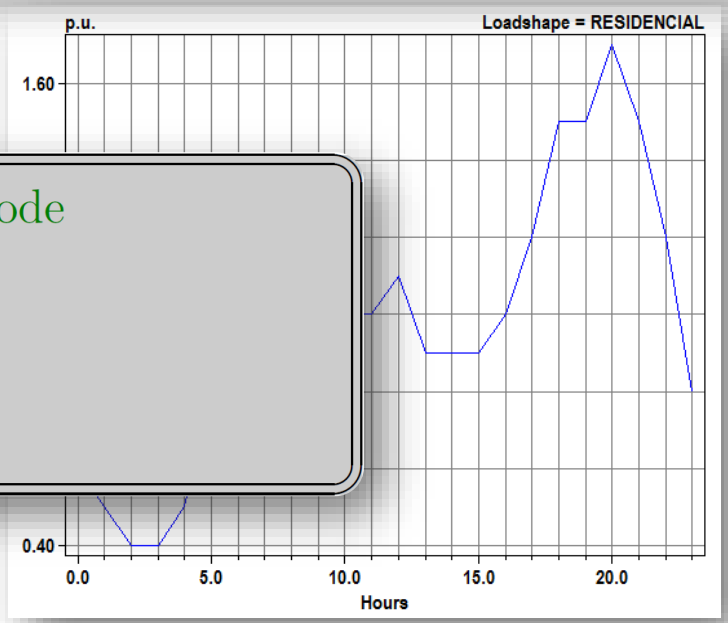


Modo *QSTS(Daily)*

- Comandos para a simulação:

```
// 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 conn=wye 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
```






```
// Time-Series Mode
Set mode=Daily
Set stepsize=1h
Set number=24
Solve
```

Modo *QSTS(Daily)*

- Elementos de Suporte de Medição:

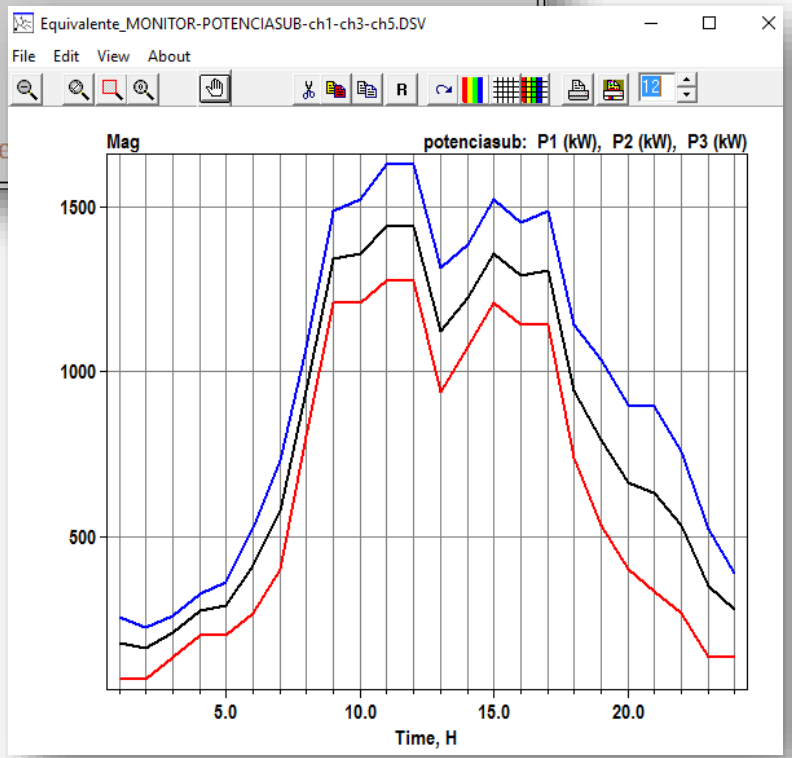
```
// Medidor
New EnergyMeter.MedidorSub element=Transformer.Trafo terminal=1
```

```
// Monitores
// Monitores na Sub (deve ser conectado em um elemento e nao em uma barra)
New Monitor.PotenciaSub element=Transformer.Trafo terminal=1 mode=1 ppolar=no
New Monitor.TensaoSub element=Transformer.Trafo terminal=1 mode=0
// Monitores na CargaD
New Monitor.PotenciaCargaD element=Load.CargaD terminal=1 mode=1 ppolar=no
New Monitor.TensaoCargaD element=Load.CargaD terminal=1 mode=0
```

Modo *QSTS(Daily)*

- Comandos necessários para obter alguns resultados:

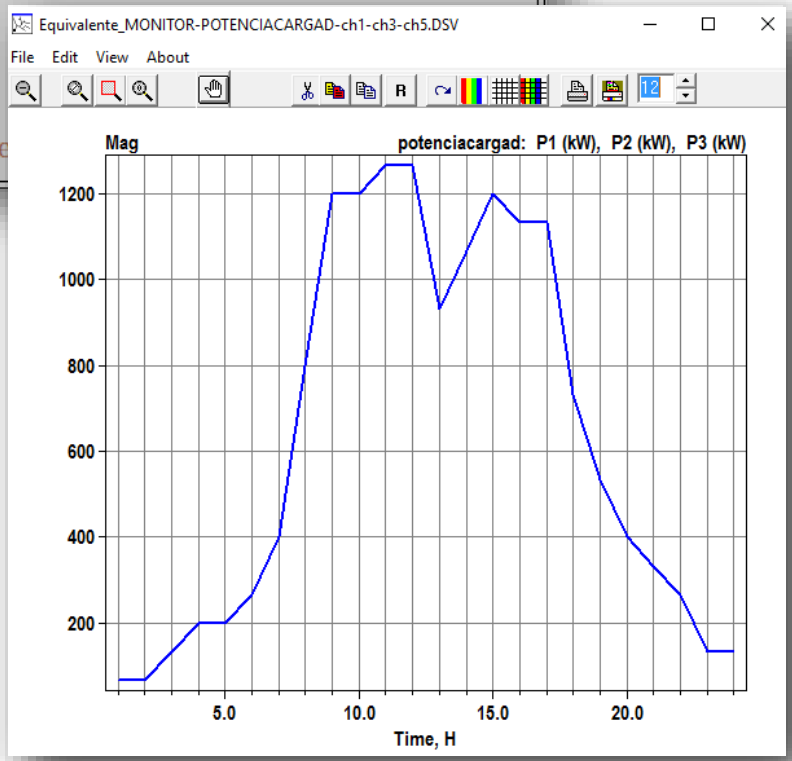
```
// Resultados dos Monitores
// Monitor de Potencia da Sub
Export monitors potenciasub
Plot monitor object= potenciasub channels=(1 3 5 )
// Monitor de Tensao da Sub
Export monitors tensaosub
Plot monitor object= tensaosub channels=(1 3 5 ) bases=[79674.3 79674.3 79674.3]
// Monitor de Potencia da CargaD
Export monitors potenciacargad
Plot monitor object= potenciacargad channels=(1 3 5 )
// Monitor de Tensao da CargaD
Export monitors tensaocargad
Plot monitor object= tensaocargad channels=(1 3 5 ) base
```



Modo *QSTS(Daily)*

- Comandos necessários para obter alguns resultados:

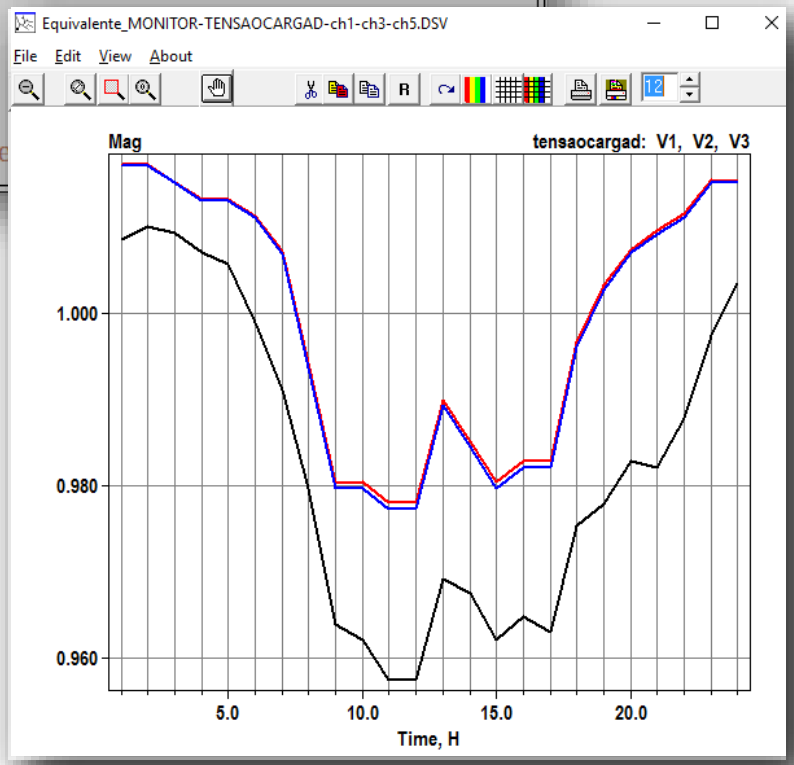
```
// Resultados dos Monitores
// Monitor de Potencia da Sub
Export monitors potenciasub
Plot monitor object= potenciasub channels=(1 3 5 )
// Monitor de Tensao da Sub
Export monitors tensaosub
Plot monitor object= tensaosub channels=(1 3 5 ) bases=[79674.3 79674.3 79674.3]
// Monitor de Potencia da CargaD
Export monitors potenciacargad
Plot monitor object= potenciacargad channels=(1 3 5 )
// Monitor de Tensao da CargaD
Export monitors tensaocargad
Plot monitor object= tensaocargad channels=(1 3 5 ) base
```



Modo *QSTS(Daily)*

- Comandos necessários para obter alguns resultados:

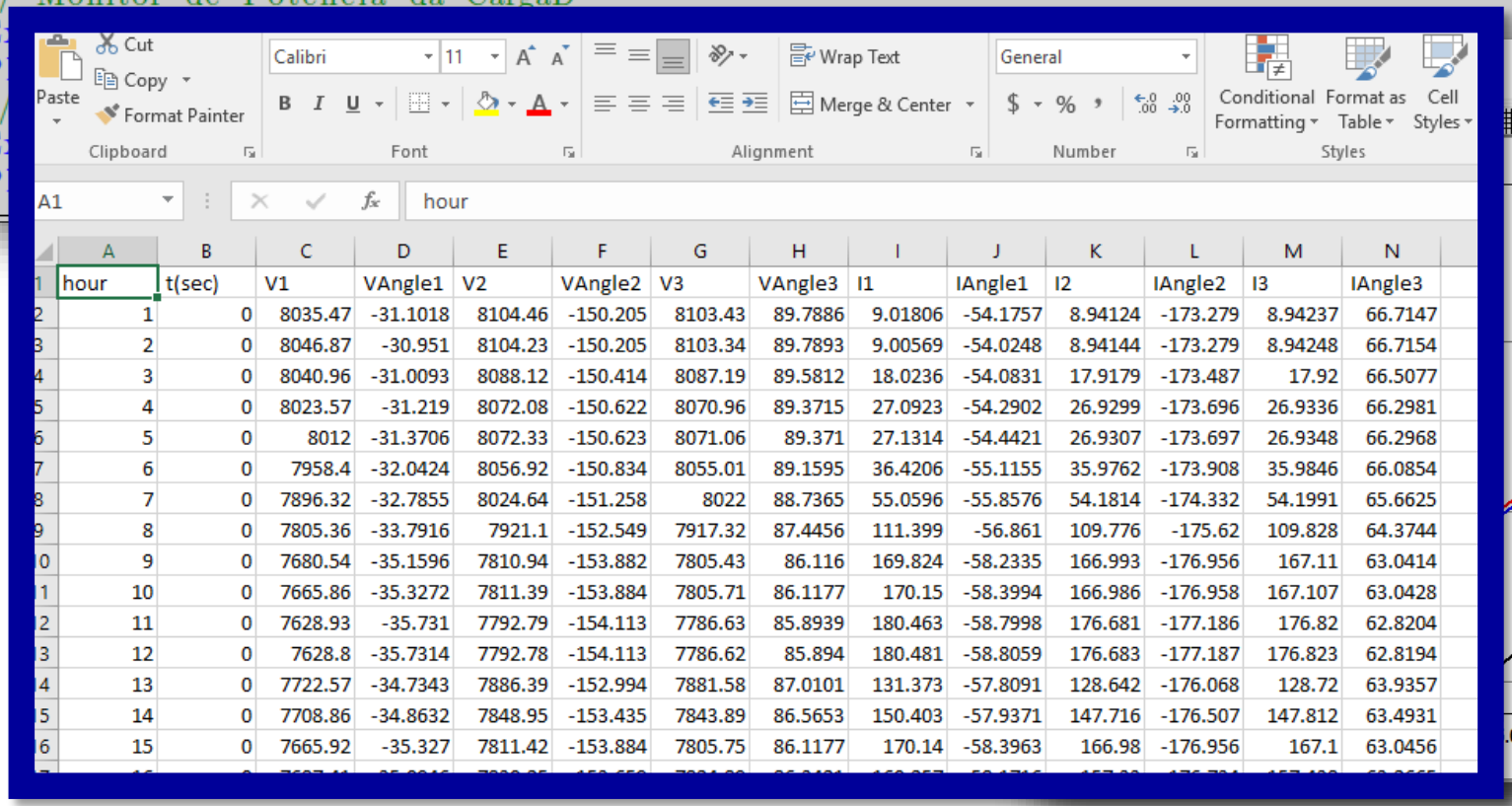
```
// Resultados dos Monitores
// Monitor de Potencia da Sub
Export monitors potenciasub
Plot monitor object= potenciasub channels=(1 3 5 )
// Monitor de Tensao da Sub
Export monitors tensaosub
Plot monitor object= tensaosub channels=(1 3 5 ) bases=[79674.3 79674.3 79674.3]
// Monitor de Potencia da CargaD
Export monitors potenciacargad
Plot monitor object= potenciacargad channels=(1 3 5 )
// Monitor de Tensao da CargaD
Export monitors tensaocargad
Plot monitor object= tensaocargad channels=(1 3 5 ) base
```



Modo *QSTS(Daily)*

- Comandos necessários para obter alguns resultados:

```
// Resultados dos Monitores
// Monitor de Potencia da Sub
Export monitors potenciasub
Plot monitor object= potenciasub channels=(1 3 5 )
// Monitor de Tensao da Sub
Export monitors tensaosub
Plot monitor object= tensaosub channels=(1 3 5 ) bases=[79674.3 79674.3 79674.3]
// Monitor de Potencia da CargaD
```



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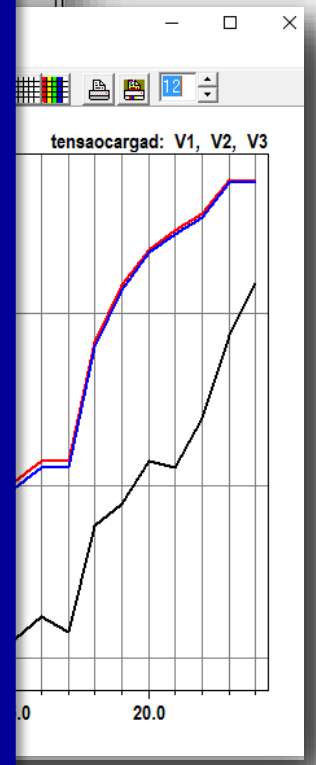
Merge & Center
Alignment
General
Number
Conditional Formatting
Format as Table
Cell Styles
Styles
A1
hour

	A	B	C	D	E	F	G	H	I	J	K	L	M	N
1	hour	t(sec)	V1	VAngle1	V2	VAngle2	V3	VAngle3	I1	IAngle1	I2	IAngle2	I3	IAngle3
2	1	0	8035.47	-31.1018	8104.46	-150.205	8103.43	89.7886	9.01806	-54.1757	8.94124	-173.279	8.94237	66.7147
3	2	0	8046.87	-30.951	8104.23	-150.205	8103.34	89.7893	9.00569	-54.0248	8.94144	-173.279	8.94248	66.7154
4	3	0	8040.96	-31.0093	8088.12	-150.414	8087.19	89.5812	18.0236	-54.0831	17.9179	-173.487	17.92	66.5077
5	4	0	8023.57	-31.219	8072.08	-150.622	8070.96	89.3715	27.0923	-54.2902	26.9299	-173.696	26.9336	66.2981
6	5	0	8012	-31.3706	8072.33	-150.623	8071.06	89.371	27.1314	-54.4421	26.9307	-173.697	26.9348	66.2968
7	6	0	7958.4	-32.0424	8056.92	-150.834	8055.01	89.1595	36.4206	-55.1155	35.9762	-173.908	35.9846	66.0854
8	7	0	7896.32	-32.7855	8024.64	-151.258	8022	88.7365	55.0596	-55.8576	54.1814	-174.332	54.1991	65.6625
9	8	0	7805.36	-33.7916	7921.1	-152.549	7917.32	87.4456	111.399	-56.861	109.776	-175.62	109.828	64.3744
10	9	0	7680.54	-35.1596	7810.94	-153.882	7805.43	86.116	169.824	-58.2335	166.993	-176.956	167.11	63.0414
11	10	0	7665.86	-35.3272	7811.39	-153.884	7805.71	86.1177	170.15	-58.3994	166.986	-176.958	167.107	63.0428
12	11	0	7628.93	-35.731	7792.79	-154.113	7786.63	85.8939	180.463	-58.7998	176.681	-177.186	176.82	62.8204
13	12	0	7628.8	-35.7314	7792.78	-154.113	7786.62	85.894	180.481	-58.8059	176.683	-177.187	176.823	62.8194
14	13	0	7722.57	-34.7343	7886.39	-152.994	7881.58	87.0101	131.373	-57.8091	128.642	-176.068	128.72	63.9357
15	14	0	7708.86	-34.8632	7848.95	-153.435	7843.89	86.5653	150.403	-57.9371	147.716	-176.507	147.812	63.4931
16	15	0	7665.92	-35.327	7811.42	-153.884	7805.75	86.1177	170.14	-58.3963	166.98	-176.956	167.1	63.0456



Modo *QSTS(Daily)*

- Comandos necessários para obter a [illegible]vés do medidor:

```
// Resultados do Medidor
Show meters
Export meters
```

TheveninEquivalente_VLN_Node.Txt | TheveninEquivalente_

```
ENERGY METER VALUES

Registers:
Reg 1 = kWh
Reg 2 = kvarh
Reg 3 = Max kW
Reg 4 = Max kVA
Reg 5 = Zone kWh
Reg 6 = Zone kvarh
Reg 7 = Zone Max kW
Reg 8 = Zone Max kVA
Reg 9 = Overload kWh Normal
Reg 10 = Overload kWh Emerg
Reg 11 = Load EEN
Reg 12 = Load UE
Reg 13 = Zone Losses kWh
Reg 14 = Zone Losses kvarh
Reg 15 = Zone Max kW Losses
Reg 16 = Zone Max kvar Losses
Reg 17 = Load Losses kWh
Reg 18 = Load Losses kvarh
Reg 19 = No Load Losses kWh
Reg 20 = No Load Losses kvarh
Reg 21 = Max kW Load Losses
Reg 22 = Max kW No Load Losses
Reg 23 = Line Losses
Reg 24 = Transformer Losses
Reg 25 = Line Mode Line Losses
Reg 26 = Zero Mode Line Losses
Reg 27 = 3-phase Line Losses
Reg 28 = 1- and 2-phase Line Losses
Reg 29 = Gen kWh
Reg 30 = Gen kvarh
Reg 31 = Gen Max kW
Reg 32 = Gen Max kVA
Reg 33 = 138 kV Losses
Reg 34 = 13.8 kV Losses
Reg 35 = Aux1
Reg 36 = Aux6
```

Modo *QSTS(Daily)*

- Comandos necessários para obter a vés do medidor:

```
// Resultados do Medidor
Show meters
Export meters
```

```
heveninEquivalente_VLN_Node.Txt   TheveninEquivalente_

ENERGY METER VALUES

Registers:
Reg 1 = kWh
Reg 2 = kvarh
Reg 3 = Max kW
Reg 4 = Max kVA
Reg 5 = Zone kWh
Reg 6 = Zone kvarh
Reg 7 = Zone Max kW
Reg 8 = Zone Max kVA
Reg 9 = Overload kWh Normal
Reg 10 = Overload kWh Emerg
Reg 11 = Load EEN
Reg 12 = Load UE
Reg 13 = Zone Losses kWh
Reg 14 = Zone Losses kvarh
Reg 15 = Zone Max kW Losses
Reg 16 = Zone Max kvar Losses
Reg 17 = Load Losses kWh
Reg 18 = Load Losses kvarh
```

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Year

	A	B	C	D	E	F	G	H	I	J	K	L
	Year	LDCurve	Hour	Meter	"kWh"	"kvarh"	"Max kW"	"Max kVA"	"Zone kWh"	"Zone kvarh"	"Zone Max kW"	"Zone Max kVA"	"Ove
	0		24	"MEDIDORSUB"	57102	30198	4344	4942	56650	24132	4300	4674	

```
Reg 29 = Gen kWh
Reg 30 = Gen kvarh
Reg 31 = Gen Max kW
Reg 32 = Gen Max kVA
Reg 33 = 138 kV Losses
Reg 34 = 13.8 kV Losses
Reg 35 = Aux1
Reg 36 = Aux6
```

Referências

- Dugan, Roger: Slides de Treinamentos. http://sourceforge.net/p/electricdss/code/HEAD/tree/trunk/Training/. [Online; acessado emn11/09/2017].

Comentários Adicionais

Esse material foi disponibilizado gratuitamente, porém, ao utilizá-lo, pedimos que as devidas referências sejam feitas.

Se você possui alguma dúvida ou encontrou algum erro nesse material, por favor, entre em contato conosco através do e-mail opendss.brasil@gmail.com.

Obrigado!
Dúvidas?