

OpenDSS Training Workshop

Basics and Scripting

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Instructor



Andres Ovalle

Andres Ovalle is an Engineer/Scientist III with the Power System Studies team at the Electric Power Research Institute (EPRI). His current research activities focus on modeling of power systems, system protection in distribution and transmission, and impacts geomagnetic disturbance related harmonics on power systems. Mr. Ovalle joined EPRI in 2018. Prior to joining EPRI, Mr. Ovalle was with the French National Railways Company (SNCF) and the Grenoble Electrical Engineering Laboratory (G2E-lab) for approximately 2 years where he worked as a postdoctoral research engineer in the use of energy storage for the support of electrified railways. Mr. Ovalle received the B.S.E.E. degree from the Universidad de Los Andes, Bogota, Colombia, in 2011, the M.E.E. degree from the Universidad de Los Andes in 2013, and the Ph.D. in Electrical Engineering from the Université de Grenoble Alpes, Grenoble, France, in 2016.

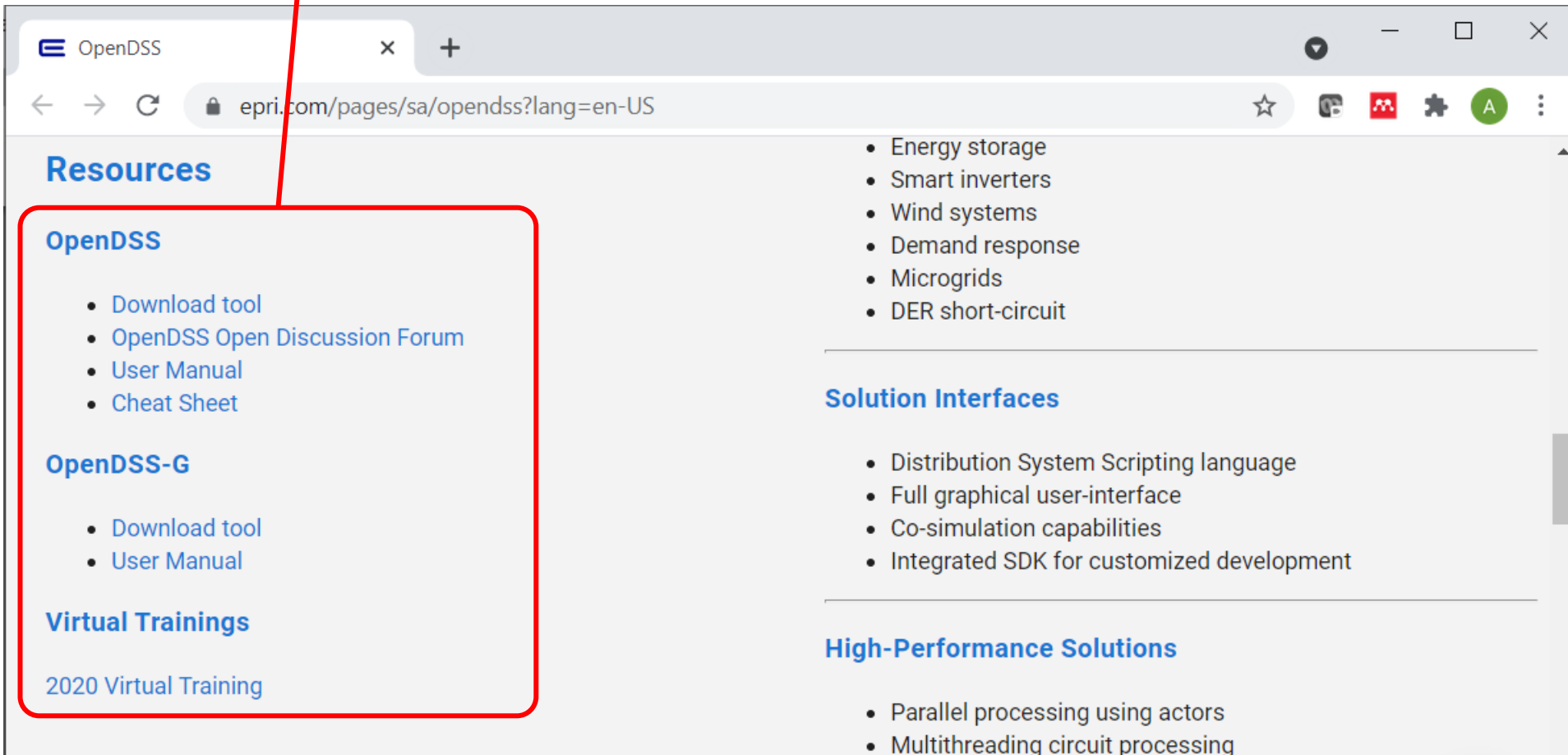


Installation and Startup

OpenDSS in EPRI.com

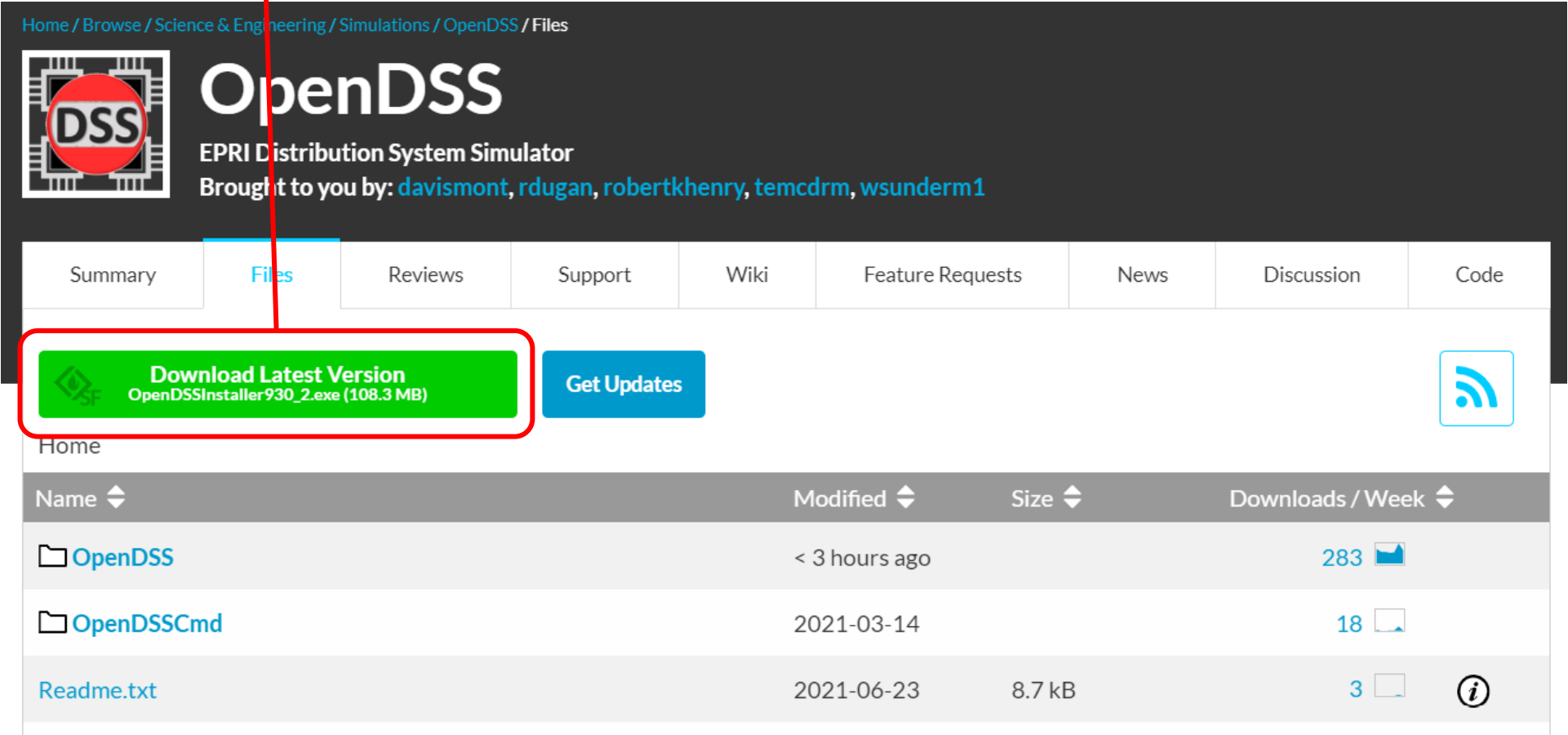
Plenty of resources to start with at EPRI.com

<https://www.epri.com/pages/sa/opendss?lang=en-US>



OpenDSS in SourceForge.net

You can get the latest installer of OpenDSS from <https://sourceforge.net/projects/electricdss/files/>




Home / Browse / Science & Engineering / Simulations / OpenDSS / Files


OpenDSS

EPRI Distribution System Simulator
Brought to you by: [davismont](#), [rdugan](#), [robertkhenry](#), [temcdm](#), [wsunderm1](#)







Summary **Files** Reviews Support Wiki Feature Requests News Discussion Code

 **Download Latest Version**
OpenDSSInstaller930_2.exe (108.3 MB)

[Get Updates](#)



Home

Name	Modified	Size	Downloads / Week
 OpenDSS	< 3 hours ago		283 
 OpenDSSCmd	2021-03-14		18 
Readme.txt	2021-06-23	8.7 kB	3  

OpenDSS in SourceForge.net

The *News* and forums in the *Discussion* tab are one of the best resources to get your questions answered

The screenshot shows the OpenDSS SourceForge project page. A red box highlights the 'Forums' section on the left sidebar, which includes links to 'Open Discussion (1800)', 'Help (1299)', 'Beginners (1046)', 'Experts (45)', and 'Help'. Another red box highlights the 'News' and 'Discussion' tabs in the top navigation bar. Two red arrows point from the text above to these tabs. The main content area displays a list of forum posts under the 'Open Discussion' tab, including topics like 'Flicker measurement using Monitors', 'distribution system (IEEE9 SYSTEM)', 'DD transformer RX', and 'Bug/inconsistency in Lines.R1 and Lines.X1 (vs. Lines.R0 and Lines.X0)'. A table at the bottom shows download statistics.

Size	Downloads / Week
	283
	18
8.7 kB	3

OpenDSS Files in Installation folder

Explorer - C:\Program Files\OpenDSS\

- OpenDSS
 - Doc
 - EPRITestCircuits
 - ckt24
 - ckt5
 - ckt7
 - epri_dpv
 - Examples
 - IEEE Test Cases
 - 123Bus
 - 13Bus
 - 34Bus
 - 37Bus
 - 4Bus-DY-Bal
 - 4Bus-GrdYD-Bal
 - 4Bus-OYOD-Bal
 - 4Bus-OYOD-UnBal
 - 4Bus-YD-Bal
 - 4Bus-YY-Bal
 - 4wire-Delta
 - 8500-Node
 - DG_Protection
 - IEEE 30 Bus
 - LineCodes
 - LVTestCase
 - LVTestCaseNorthAmerican
 - NEVTestCase
 - ShortCircuitCases
 - Training
 - x64
 - x86

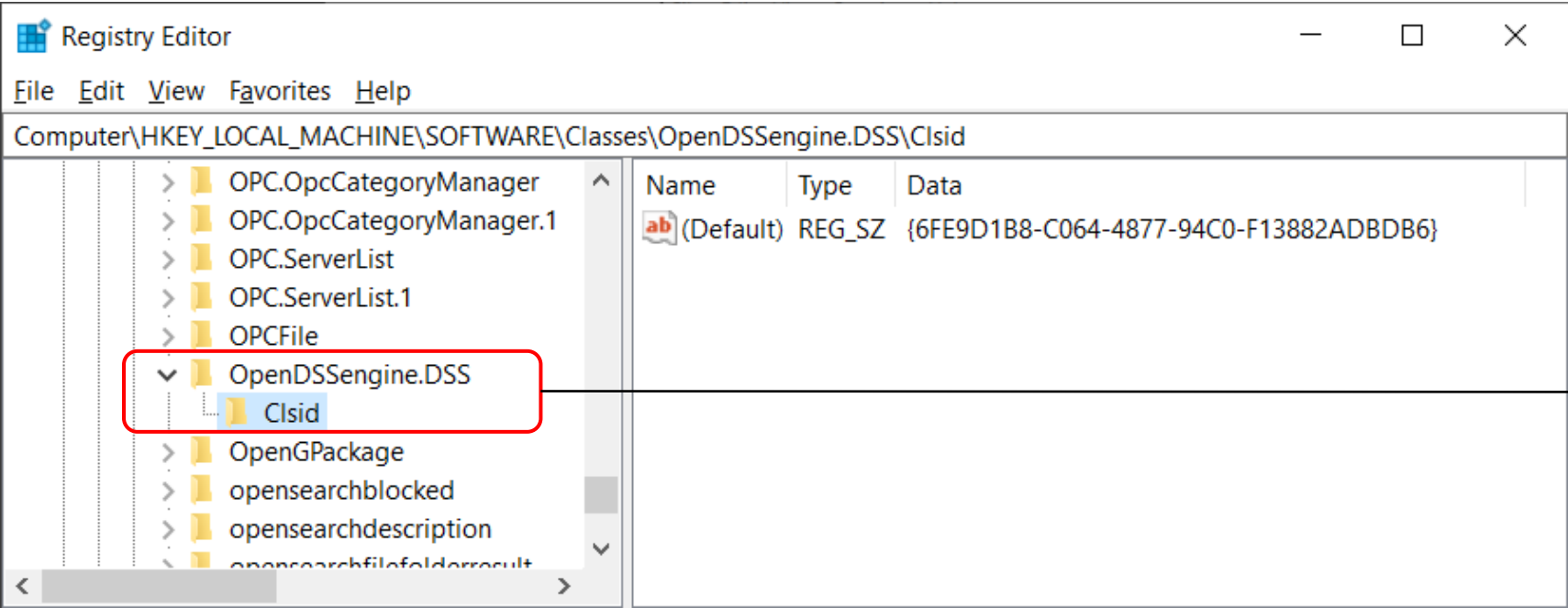
- Examples
 - C_Sharp
 - Celso_Example
 - civilar model
 - Excel
 - FreqScan
 - GICExample
 - HarmonicsTMode
 - InductionMachine
 - InverterModels
 - InverterTechNote
 - Loadshapes
 - Manual
 - Matlab
 - MemoryMappingLoadShapes
 - Microgrid
 - Parallel_Processing
 - Paulo_Example
 - Python
 - Scripts
 - Stevenson
 - StoCtrl_Current_PeakShave
 - StoCtrl_SeasonTarget
 - StorageControllerTechNote
 - StorageTechNote
 - SyntaxFiles
 - UPFC_Test
 - VB
 - VCCS
 - WampServer
- IEEE Test Cases

Main OpenDSS program files

- OpenDSSDirect.dll
- OpenDSSengine.dll
- OpenDSS.exe
- OpenDSS_COM.chm
- readme.txt
- License.txt
- DSSProgress.exe
- ComPorts.ini
- DSSView.exe
- IndMach012a.dll
- KLUSolve.dll
- kmetis.exe
- pmetis.exe
- OpenDSSDirect.h

COM Server Registration

The installer automatically registers the OpenDSS COM server in the Windows Registry Entry



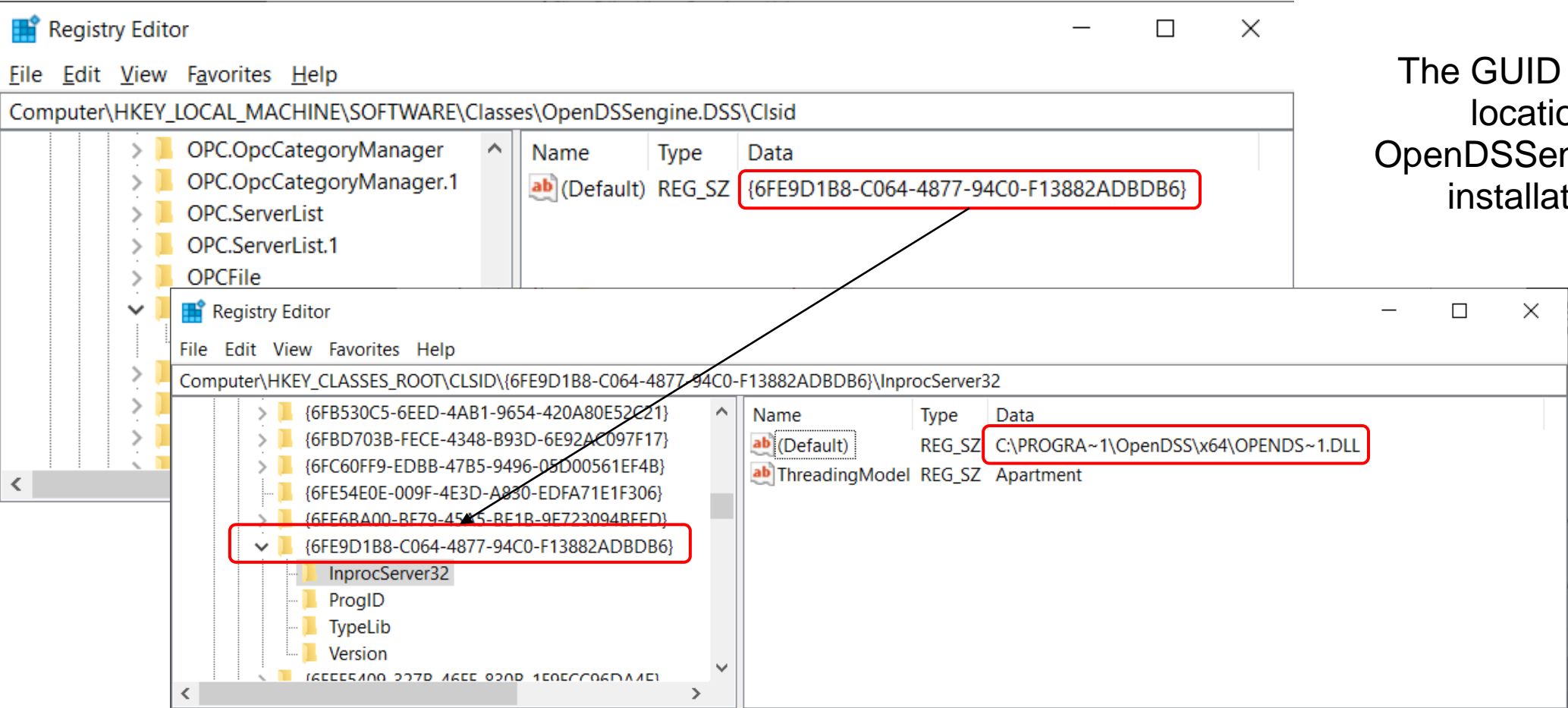
The COM Server shows up as OpenDSSEngine.DSS in the **Windows Registry**



The OpenDSS COM server is now available to any COM client/program on the computer

COM Server Registration

The installer automatically registers the OpenDSS COM server in the Windows Registry Entry



The GUID points to the location of the OpenDSSengine.dll in the installation folder



Getting the Source Code

OpenDSS in SourceForge.net

In the *Code* tab you can get the URL of the main repository or download a snapshot of the source code

<https://svn.code.sf.net/p/electricdss/code/trunk>

The screenshot shows the OpenDSS project page on SourceForge. The page header includes the breadcrumb "Home / Browse / Science & Engineering / Simulations / OpenDSS / Files" and the OpenDSS logo. Below the logo, it says "EPRI Distribution System Simulator" and "Brought to you by: davismont, rdugan, robertkhenry, temcdm, wsunderm1". The main content area has a "Tree [r3176] /" section with a "Download" button. Below this, there are tabs for "HTTPS" and "svn://". The "svn://" tab is selected, showing the URL "https://svn.code.sf.net/p/electricdss/code/trunk" in a red box. To the right, there is a "Code" tab also highlighted with a red box. Below the URL, there is a table with columns "File", "Date", "Author", and "Commit".

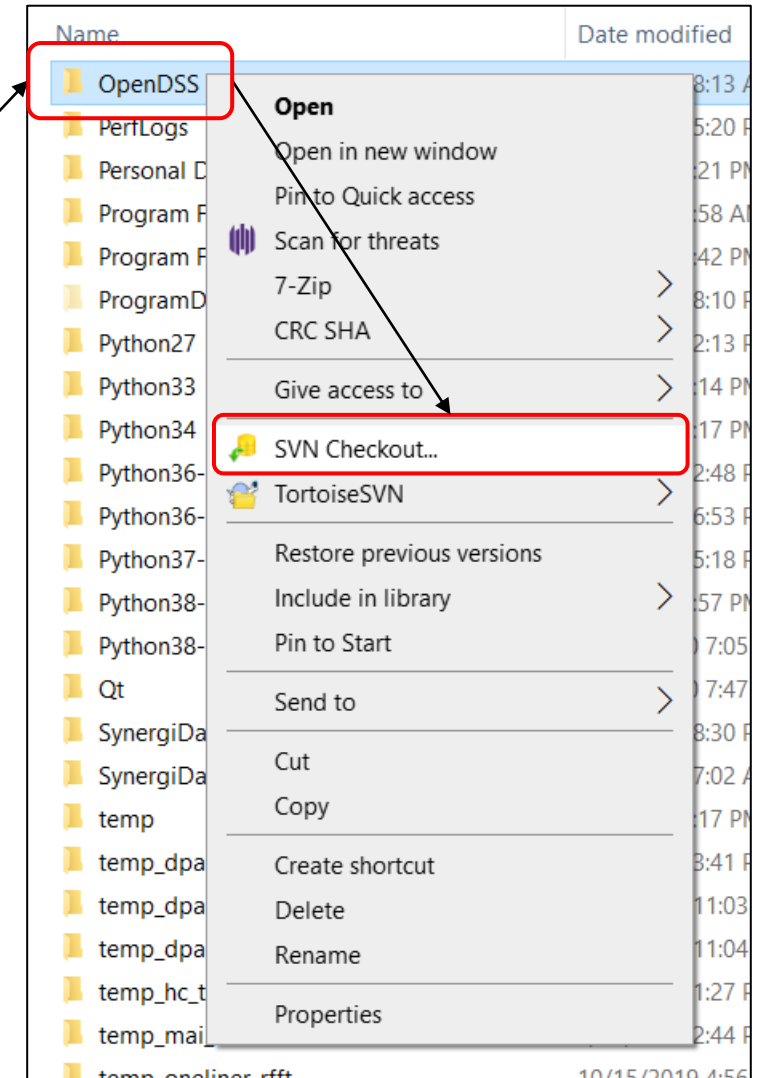
File	Date	Author	Commit
branches	2012-02-27	temcdm	[r666] for development branches
tags	2012-02-27	temcdm	[r667] for release snapshots

Accessing the Source Code Repository with TortoiseSVN

- Install a **TortoiseSVN** client from <https://tortoisesvn.net/downloads.html>
- Grab the OpenDSS files from SourceForge:

1. Create a clean directory such as **C: \OpenDSS**
2. Right-click on it and choose SVN Checkout... from the menu
3. The repository URL is <https://svn.code.sf.net/p/electricdss/code/trunk>

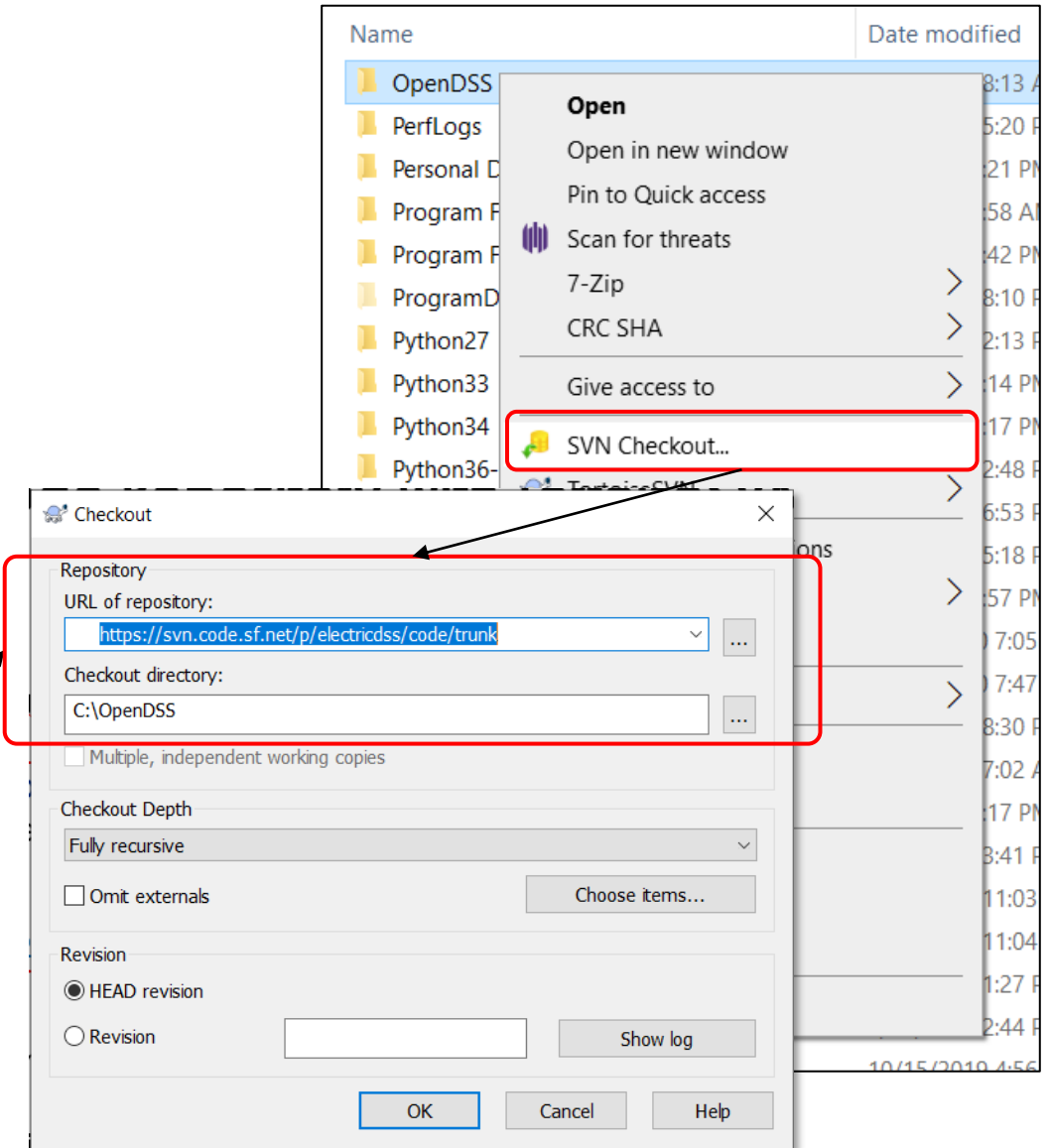
Thereafter, to update a folder or file, right-click on the folder or file and select **SVN Update**



Accessing the Source Code Repository with TortoiseSVN

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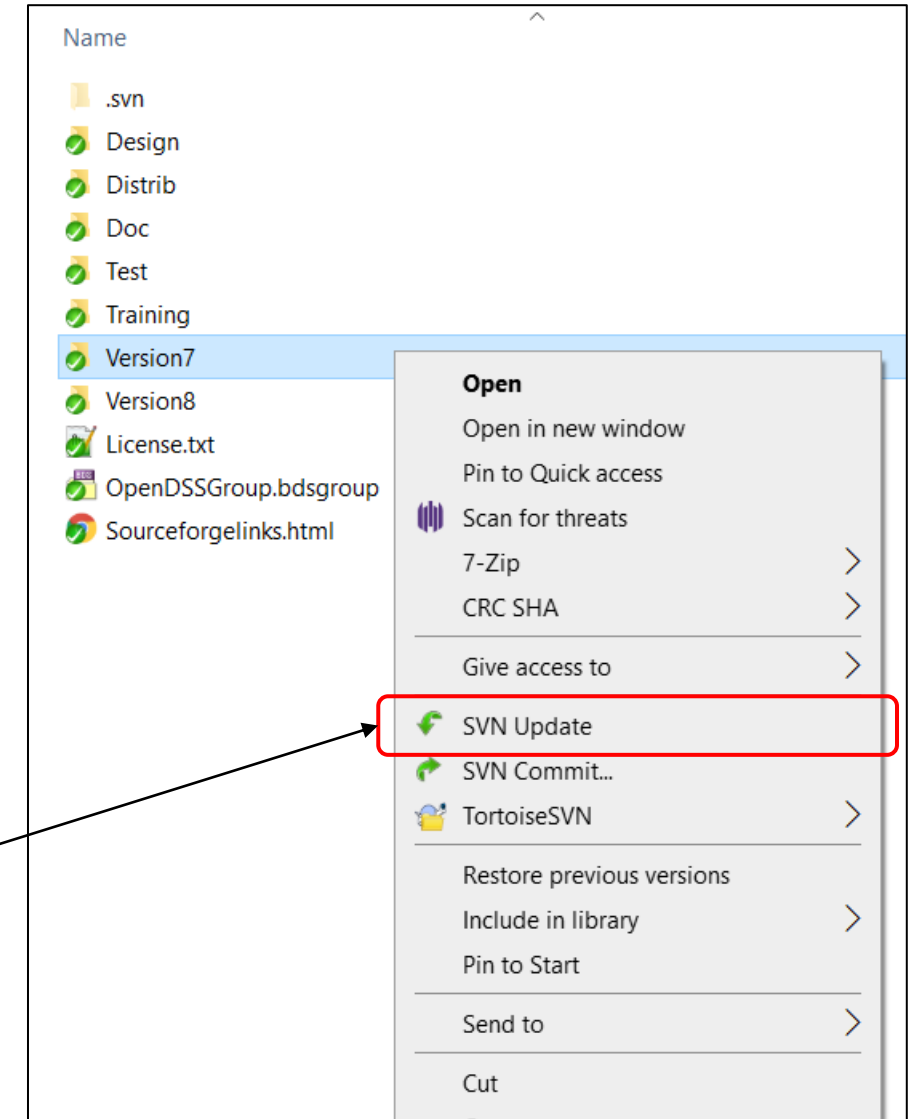
Thereafter, to update a folder or file, right-click on the folder or file and select **SVN Update**



Accessing the Source Code Repository with TortoiseSVN

- Install a **TortoiseSVN** client from <https://tortoisesvn.net/downloads.html>
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Thereafter, to update a folder or file, right-click on the folder or file and select **SVN Update**





Scripting Basics and Examples

OpenDSS interface

OpenDSS Data Directory: C:\temp\opendss_training\8500-Node\

File Edit Do Set Make Export Show Visualize Plot Reset Help

Source/Fault Vsource

C V P

Base Frequency = 60 Hz

C:\temp\opendss_training\8500-Node\Master-unbal.dss

Results for Actor ID # 1

CPU selected : -1

Status = SOLVED

Solution Mode = Snap

Number = 100

Load Mult = 1.000

Devices = 7280

Buses = 4876

Nodes = 8531

Control Mode =STATIC

Total Iterations = 62

Control Iterations = 5

Max Sol Iter = 16

- Circuit Summary -

Year = 0

Hour = 0

Max pu. voltage = 1.05

Min pu. voltage = 0.91152

Total Active Power: 12.0476 MW

Total Reactive Power: 1.45515 Mvar

Total Active Losses: 1.27448 MW, (10.58 %)

Total Reactive Losses: 2.82883 Mvar

Frequency = 60 Hz

Mode = Snap

Control Mode = STATIC

Load Model = PowerFlow

// Unbalanced Load Case

Clear

Set DefaultBaseFrequency=60

New Circuit.IEEE8500u

! Make the source stiff with small impedance

~ pu=1.05 r1=0 x1=0.001 r0=0 x0=0.001 |

Redirect LineCodes2.DSS

Redirect Triplex_Linecodes.dss

Redirect Lines.dss

Redirect Transformers.dss

//Redirect LoadXfmrs.dss ! Load Transformers

Redirect LoadXfmrCodes.dss ! Referencing XfmrCodes

Redirect Triplex_Lines.DSS

Redirect UnbalancedLoads.dss

Redirect Capacitors.dss

Redirect CapControls.DSS

Redirect Regulators.dss

! Let DSS estimate the voltage bases

Set voltagebases=[115, 12.47, 0.48, 0.208]

CalcVoltagebases ! This also establishes the bus list

! Load in bus coordintes now that bus list is established

Buscoords Buscoords.dss

/*

Set maxiter=50

Set maxcontroliter=30

Main example_lines.dss Master-unbal.dss Run_8500Node_Unbal.dss

MessagesOpenDSS - C:\temp\opendss_training\8500-Node\Master-unbal.dss

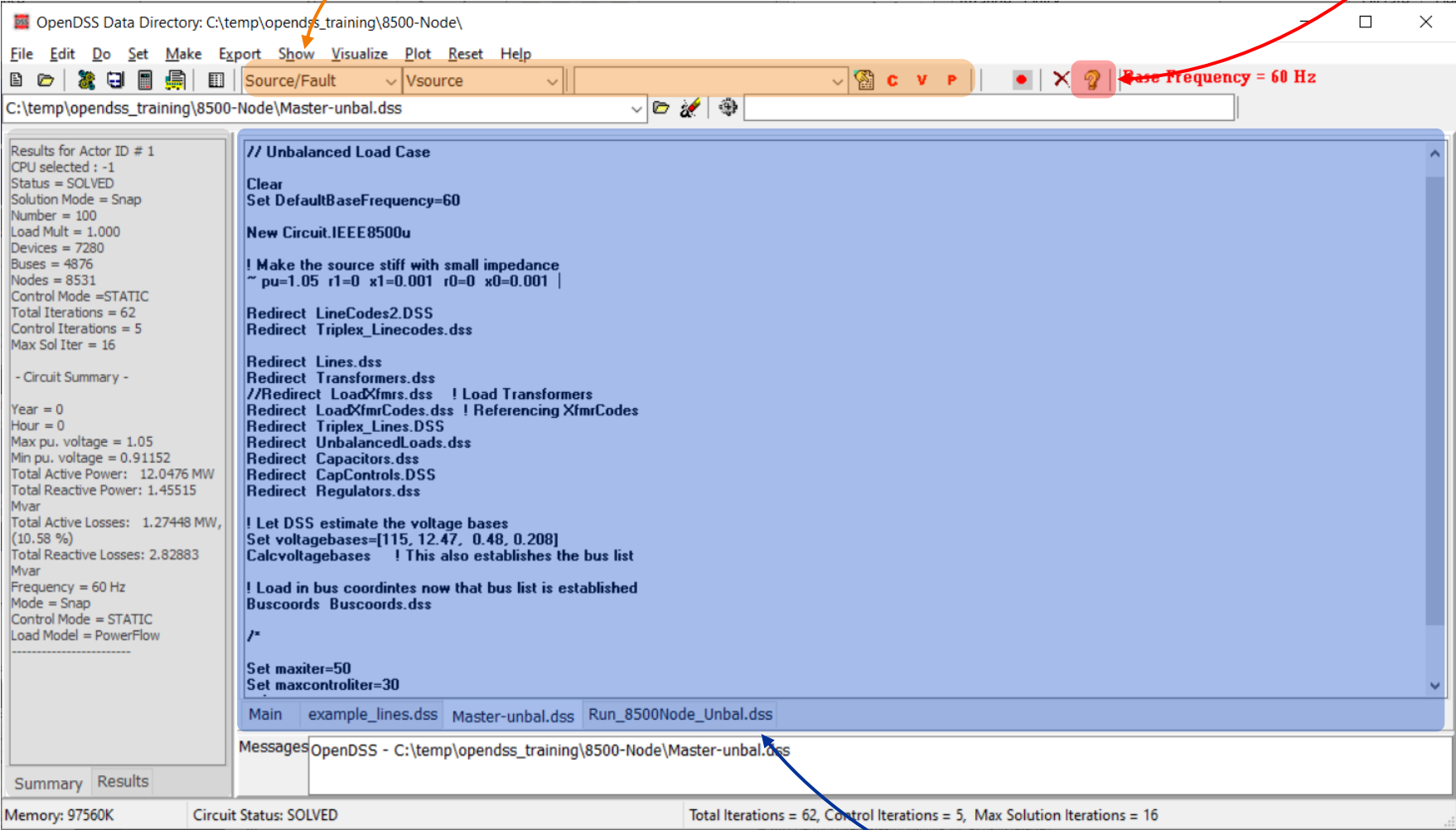
Summary Results

Memory: 97560K Circuit Status: SOLVED Total Iterations = 62, Control Iterations = 5, Max Solution Iterations = 16

OpenDSS interface

DSS Element toolbar

Command and Properties help



Solution / Results summaries

DSS script editor / navigator

OpenDSS interface

The image displays the OpenDSS software interface with three main components:

- OpenDSS Data Directory:** The top window shows the file path `C:\temp\opendss_training\8500-Node\`. The **Help** menu is open, highlighting the **COM interface** option. The status bar indicates **Base Frequency = 60 Hz**.
- OpenDSS_COM:** The bottom-left window shows the **Introduction** page of the **OpenDSS COM Interface**. It features a **DSS** logo and a detailed description of the Component Object Model (COM) interface, explaining its purpose for interacting with the simulator via DLLs.
- DSS Commands & Properties:** The bottom-right window displays a list of transformer properties. The **windings** property is selected, and its description is shown on the right: "Number of windings, this transformers. (Also is the number of terminals) Default is 2. This property triggers memory allocation for the Transformer and will cause other properties to revert to default values."

Summary of Commands and Scripting Characters

Scripting

Character	Description
~	Line continuation
[] () { } " ' `	Arrays, Matrices, Strings, Math Expressions
	Row delimiter in matrices
, space tab	Delimiter command parameters and array/matrix entries
.	Delimiter class-object, bus-node
=	Delimiter parameter tag and parameter value
! //	In line comments
/*...*/	Block comments

Commands
(common)

Command	Description
New	Create new DSS elements
Edit	Edit existing DSS elements
Set	Define solution modes and options
Solve	Perform current solution mode
Show	Write selected results to text files
Export	Export solution variables in CSV or XML format
Plot	Plots results with built-in plotting features

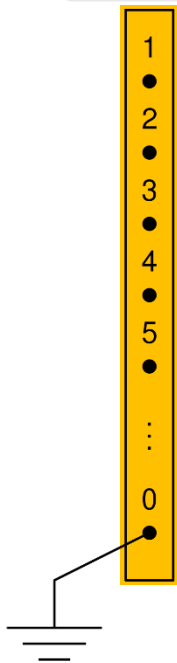
OpenDSS Buses and Nodes



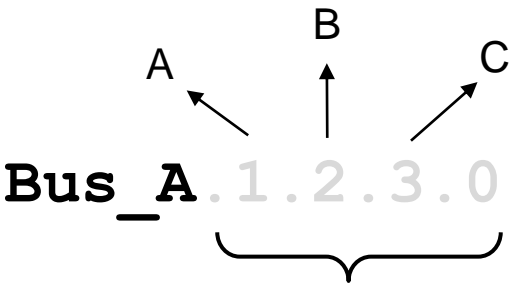
Buses are a collection of 1 or more nodes

Bus Name

Bus_A



- A bus can host several nodes
- Node 0 of the bus is always grounded (0 V)
- Conventionally nodes 1 2 and 3 are associated to phases A B and C (but it is not mandatory)

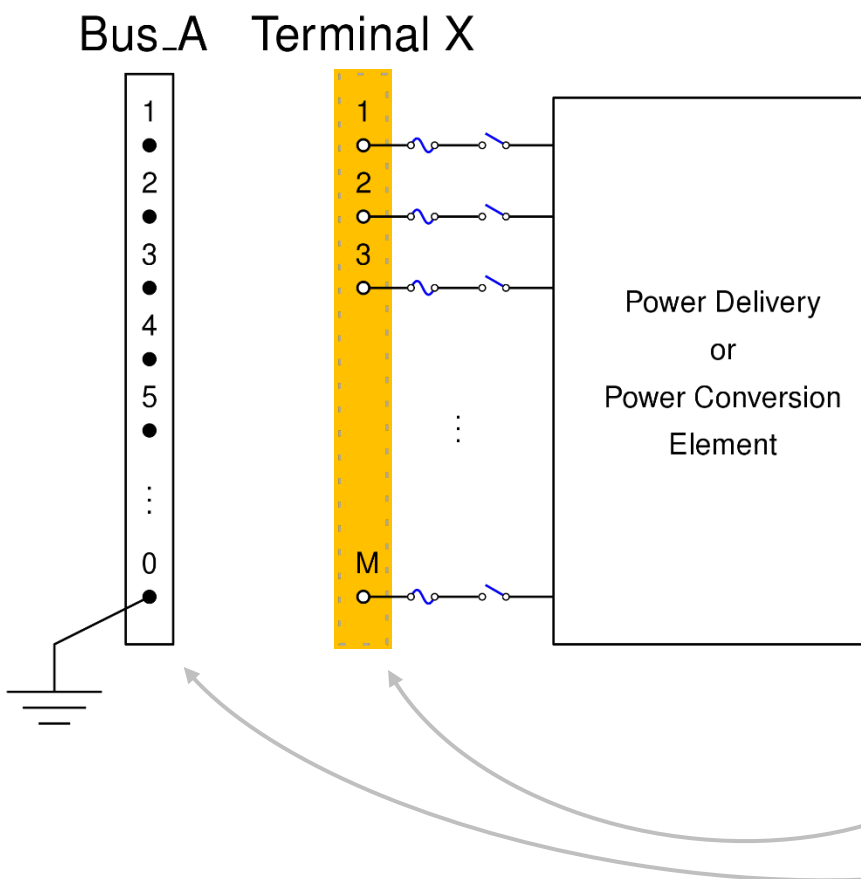


Assumed by default for 3-ph elements if not specified

OpenDSS Terminals



A Terminal can be associated to only one Bus.
A Bus can be associated to multiple terminals

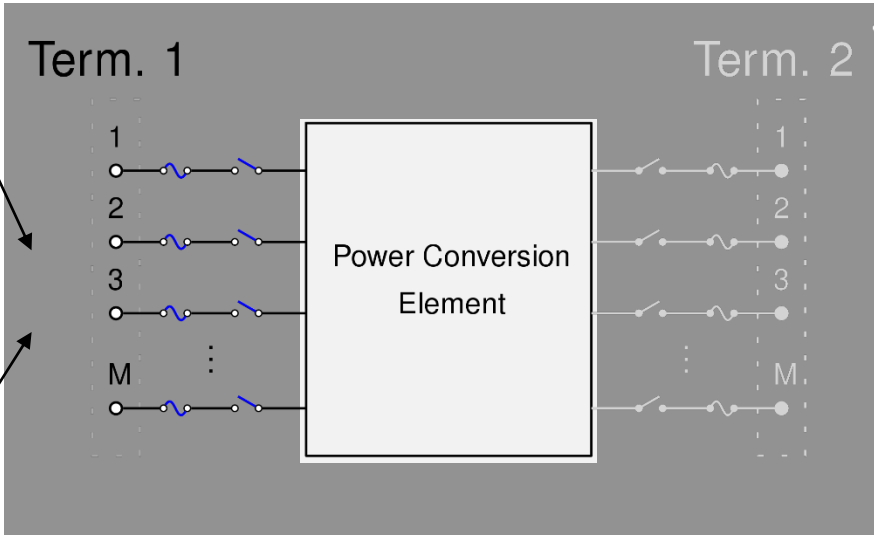
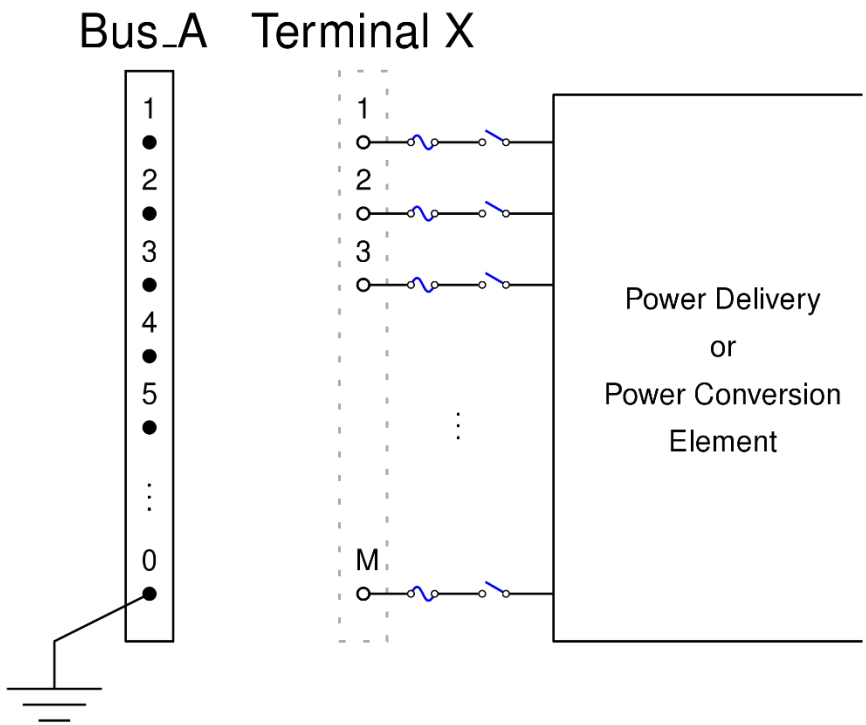


- Circuit Elements can have one or more terminals
- A Terminal is a collection of M conductors
- Circuit Elements have fuses in series with switches on each conductor of each of its terminals

Bus1=Bus_A.1.2.3.0

Power Delivery (PDE) & Power Conversion (PCE) Elements

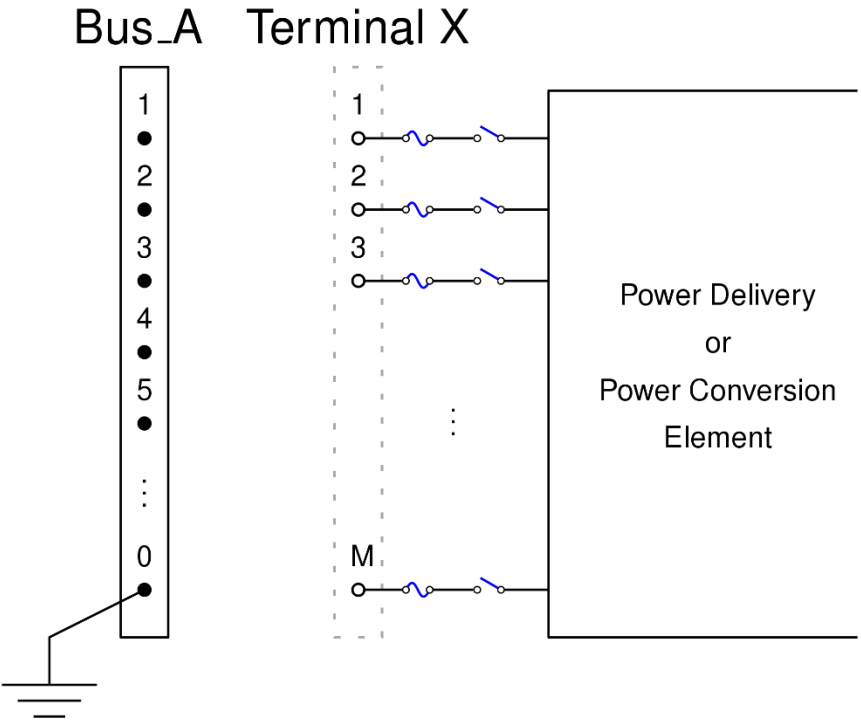
Load, Generator, Storage, ...



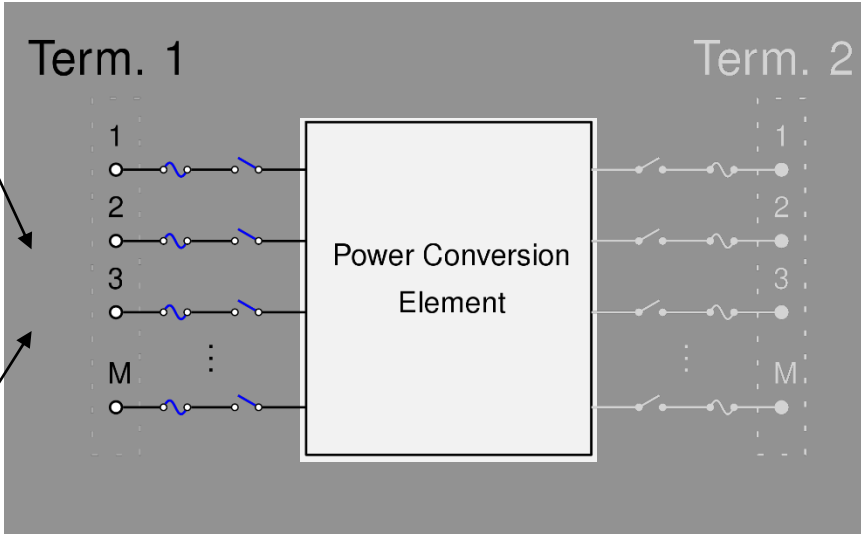
- Typically, one terminal but not always
- Connected in *shunt* with PDEs
- Function of V
- May be nonlinear

Power Delivery (PDE) & Power Conversion (PCE) Elements

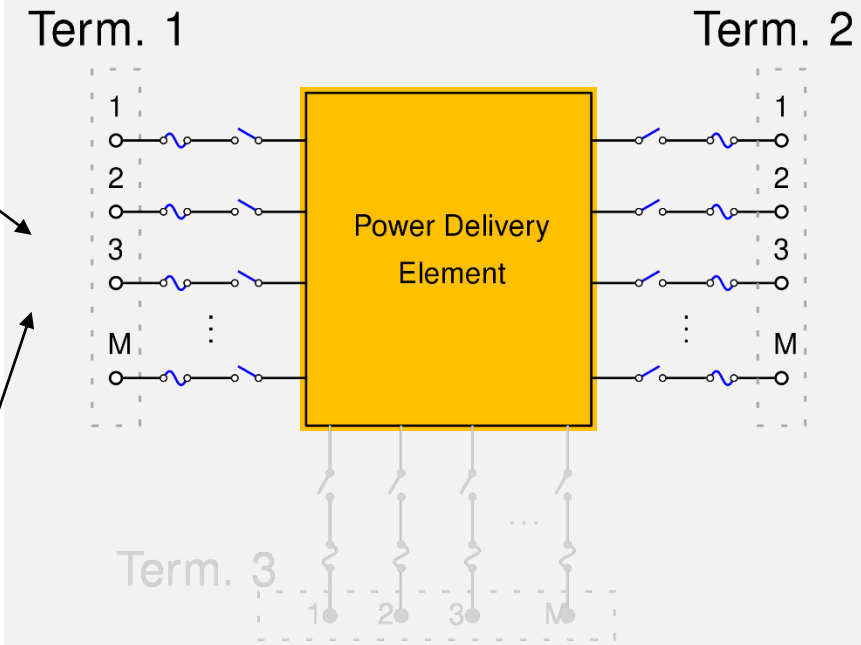
Load, Generator, Storage, ...



Transformers, Lines, Capacitors, Reactors,...



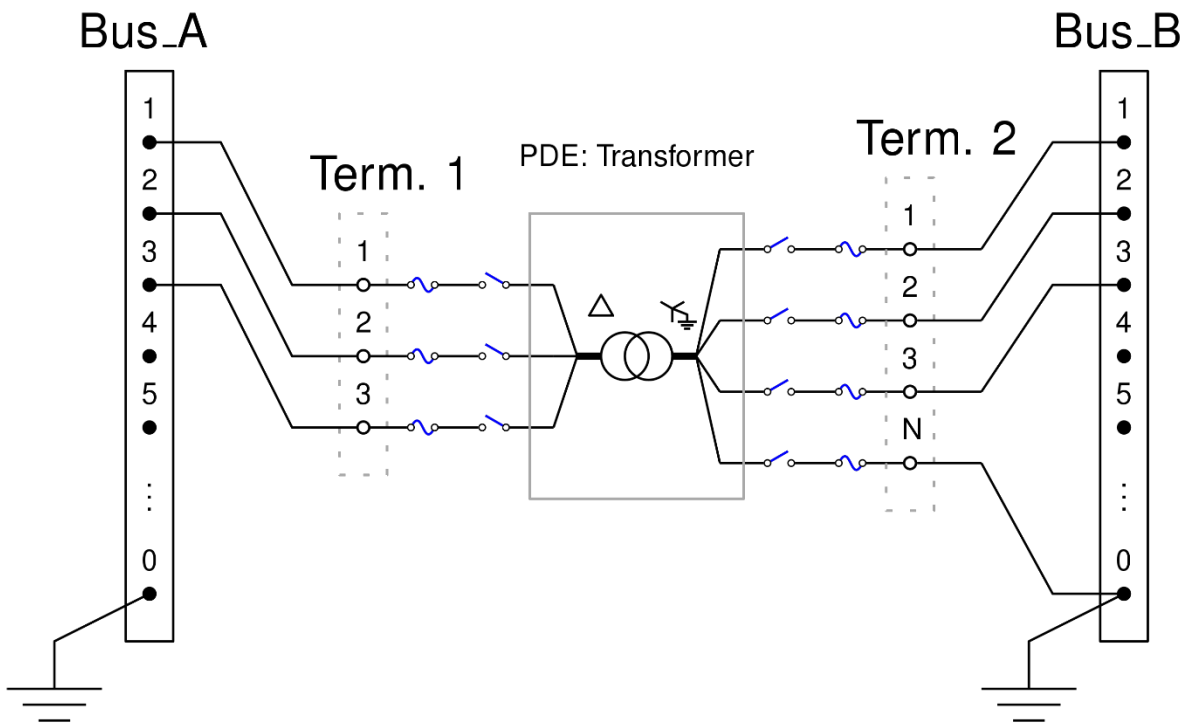
- Typically, one terminal but not always
- Connected in *shunt* with PDEs
- Function of V
- May be nonlinear



- Typically, two or more terminals
- Described by a Y_{prim} matrix

Example: Solidly Grounded Transformer

Part of the OpenDSS script that defines this transformer

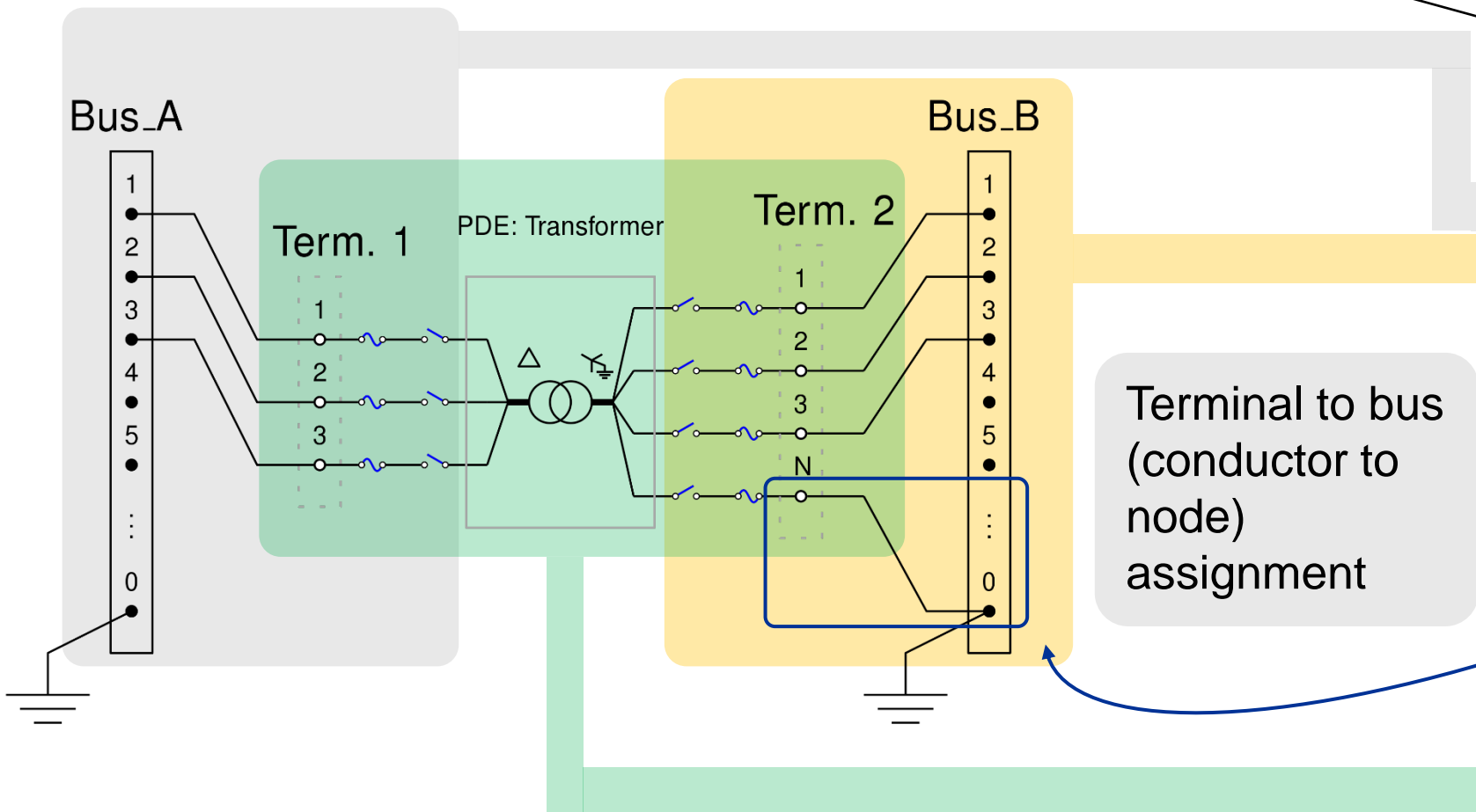


```
/*
My first DSS transformer
*/

! This is a Dy xfmr
New transformer.xfmr_name
~ phases=3 windings=2
~ Bus1=Bus_A.1.2.3
~ Bus2=Bus_B.1.2.3.0
~ conns=[delta, wye]
...
```


Example: Solidly Grounded Transformer

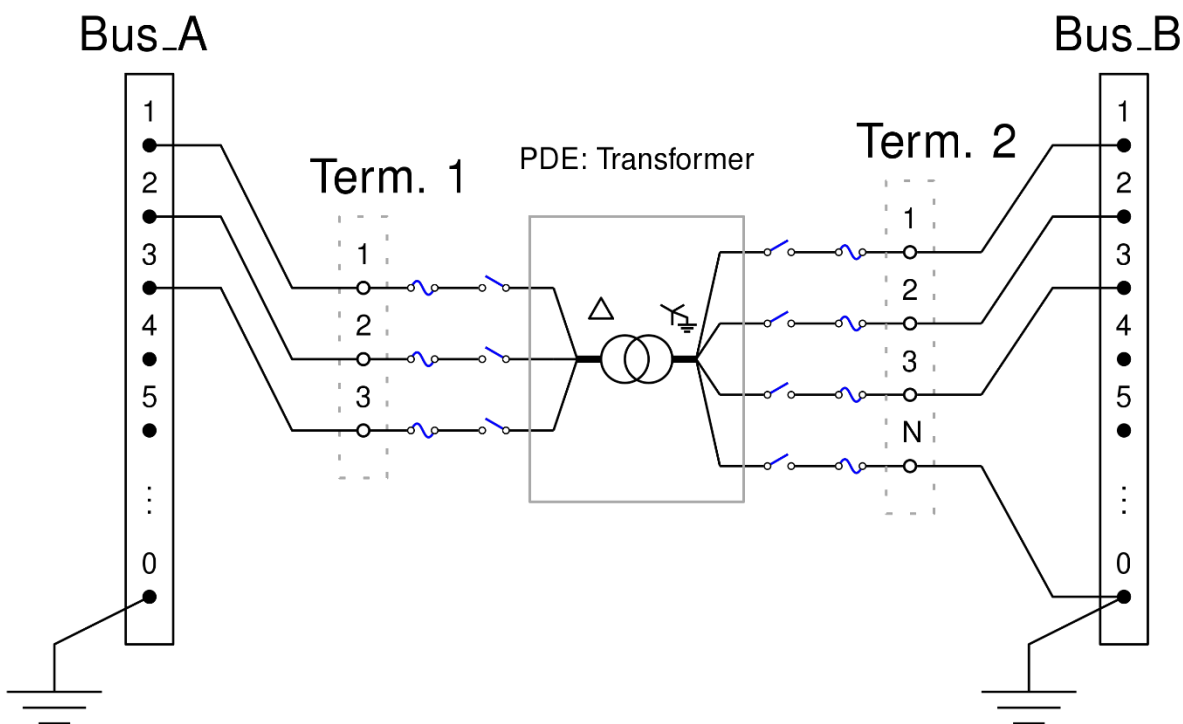
Circuit Element instantiation



```
/*  
My first DSS transformer  
*/  
  
! This is a Dy xfmr  
New transformer.xfmr_name  
~ phases=3 windings=2  
~ Bus1=Bus_A.1.2.3  
~ Bus2=Bus_B.1.2.3.0  
~ conns=[delta, wye]  
...
```

Example: Solidly Grounded Transformer

Use `/*...*/`, `//` or `!` for line or block comments

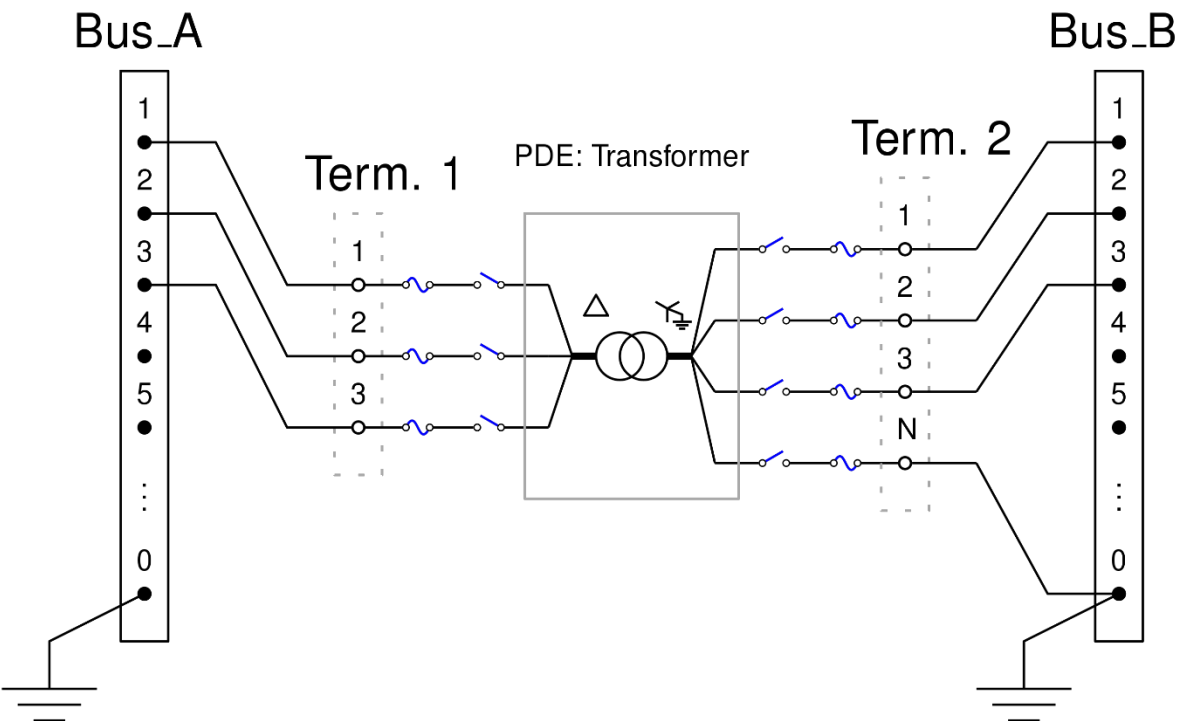


```
/*  
My first DSS transformer  
*/  
  
! This is a Dy xfmr  
New transformer.xfmr_name  
~ phases=3 windings=2  
~ Bus1=Bus_A.1.2.3  
~ Bus2=Bus_B.1.2.3.0  
~ conns=[delta, wye]  
...
```

Example: Solidly Grounded Transformer

Command syntax: **command** param_1, param_2 param_3

Comma, space or tab separated



Use = to separate keywords from values

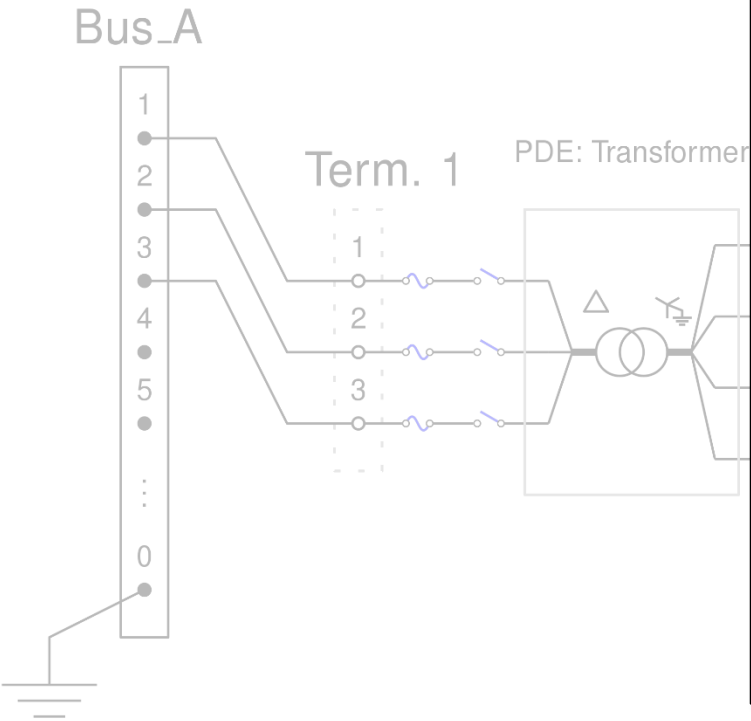
```
/*
My first DSS transformer
*/

! This is a Dy xfmr
New transformer.xfmr_name
~ phases=3 windings=2
~ Bus1=Bus_A.1.2.3
~ Bus2=Bus_B.1.2.3.0
~ conns=[delta, wye]
...
```

Example: Solidly Grounded Transformer

Command syntax: **command** param_1, param_2 param_3

Comma, space or tab separator



DSS Commands & Properties

Transformer

(1) phases

(2) windings

(3) wdg

(4) bus

(5) conn

(6) kV

(7) kVA

(8) tap

(9) %R

(10) Rneut

(11) Xneut

(12) buses

(13) conns

(14) kVs

(15) kVAs

(16) taps

(17) XHL

(18) XHT

(19) XLT

Number of windings, this transformers. (Also is the number of terminals) Default is 2. This property triggers memory allocation for the Transformer and will cause other properties to revert to default values.

Save All to File

Property Order:

Alphabetical

Numerical

```
/*
My first DSS transformer
*/
```

```
This is a Dy xfmr
new transformer.xfmr_name
  phases=3 windings=2
  bus1=Bus_A.1.2.3
  bus2=Bus_B.1.2.3.0
  conns=[delta, wye]
```

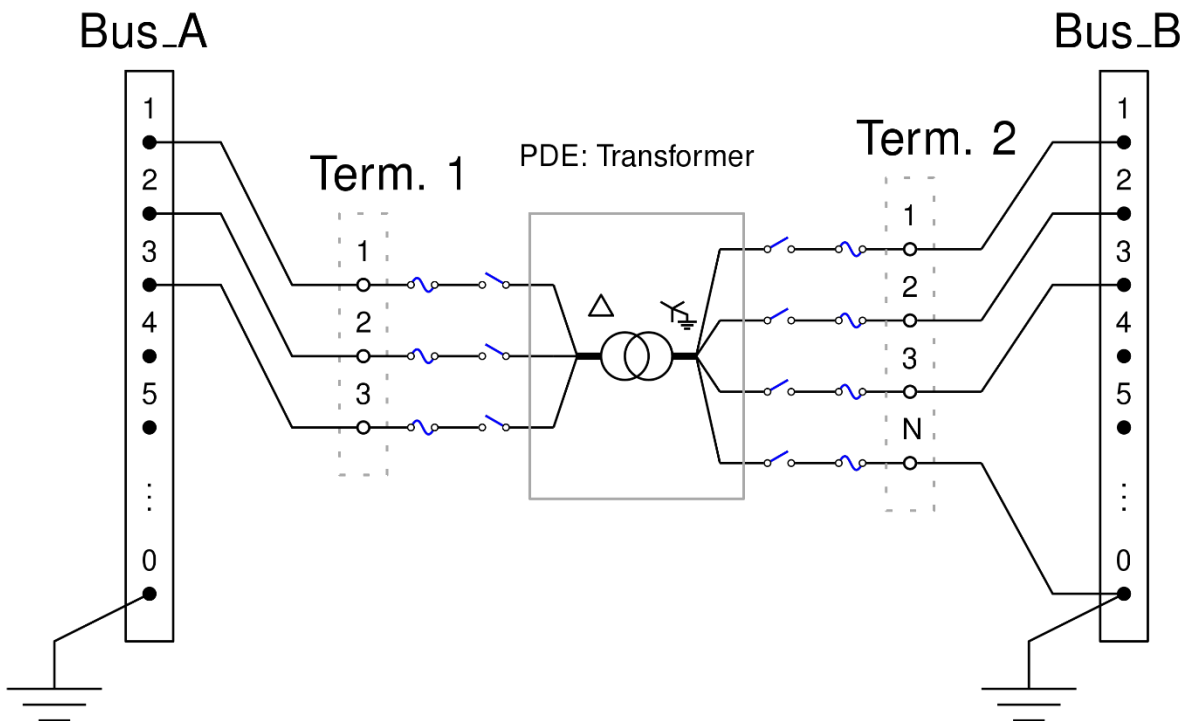


The parameter tag and equals sign in **keyword=value** are not needed if values are passed in numerical order. (See numerical order in OpenDSS command help)

Example: Solidly Grounded Transformer

Command syntax: **command** param_1, param_2 param_3

Comma, space or tab separated



Use ~ for line continuation

Use . for delimiting class, object, bus, node

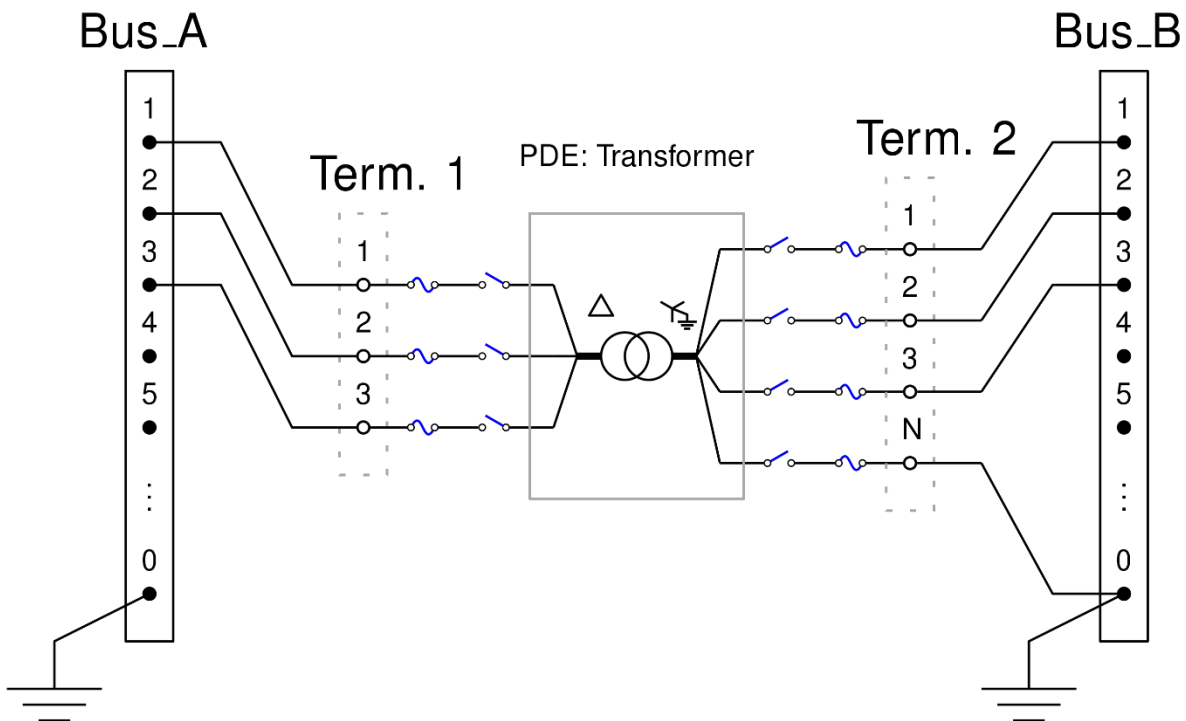
```
/*
My first DSS transformer
*/

! This is a Dy xfmr
New transformer.xfmr_name
~ phases=3 windings=2
~ Bus1=Bus_A.1.2.3
~ Bus2=Bus_B.1.2.3.0
~ coils=[delta, wye]
```

Example: Solidly Grounded Transformer

Command syntax: **command** param_1, param_2 param_3

Comma, space or tab separated

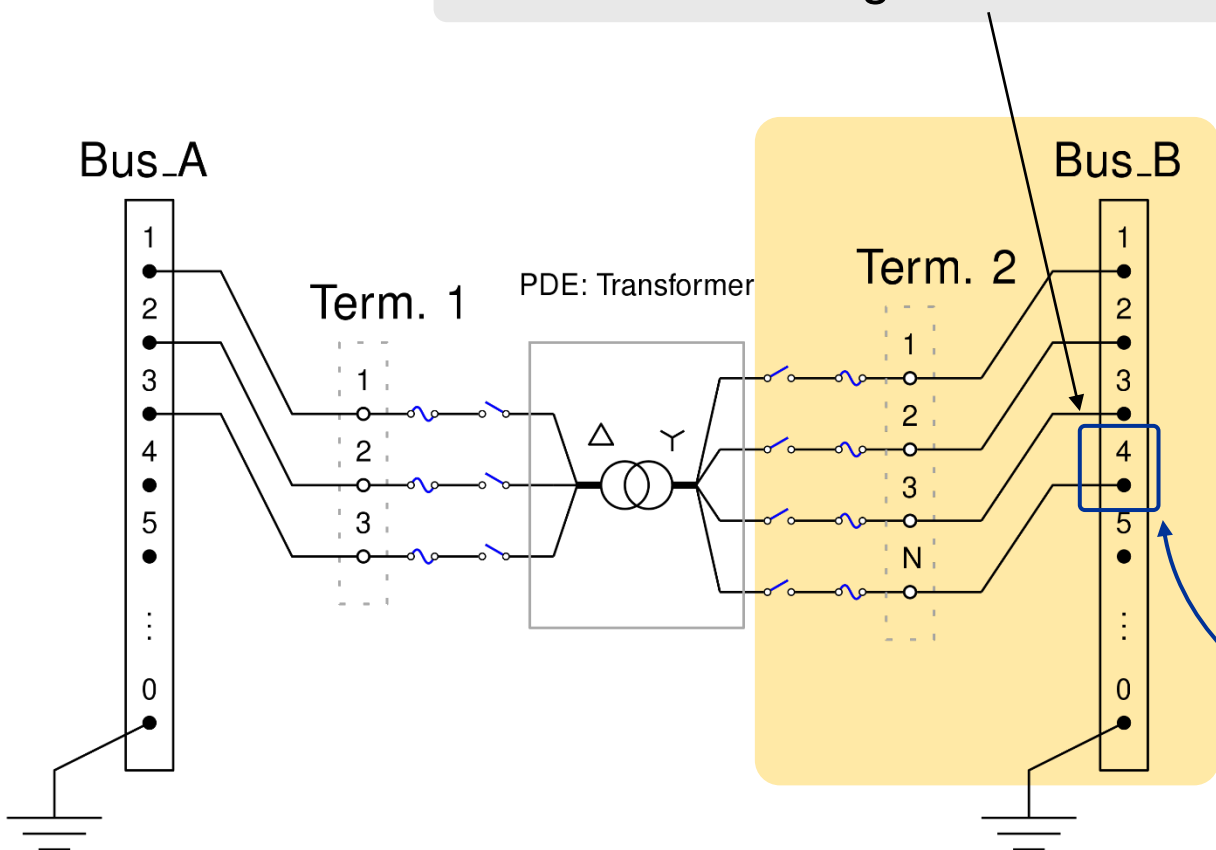


Use **[]** to create arrays. Comma or space to separate elements

```
/*  
My first DSS transformer  
*/  
  
! This is a Dy xfmr  
New transformer.xfmr_name  
~ phases=3 windings=2  
~ Bus1=Bus_A.1.2.3  
~ Bus2=Bus_B.1.2.3.0  
~ conns=[delta, wye]
```

Example: Ungrounded Transformer

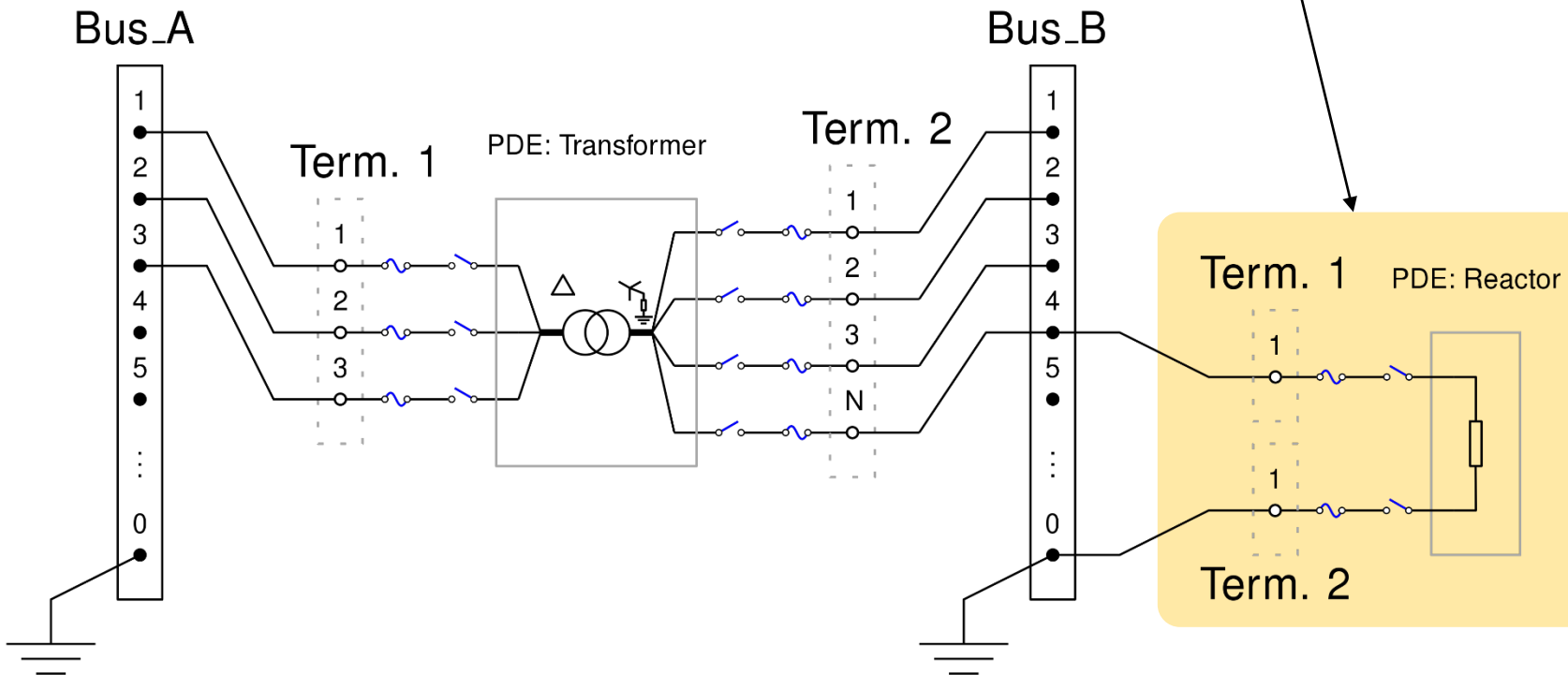
Connect neutral conductor to node 4 of the bus.
Neutral is floating now



```
/*  
My first DSS transformer  
*/  
  
! This is a Dy xfmr  
New transformer.xfmr_name  
~ phases=3 windings=2  
~ Bus1=Bus_A.1.2.3  
~ Bus2=Bus_B.1.2.3.4  
~ conns=[delta, wye]  
...
```

Example: Grounding Impedance

Connect both terminals of a reactor (another PDE) to *Bus_B* *None 4* and *Node 0*. The transformer is grounded again.



```

/*
My first DSS transformer
*/

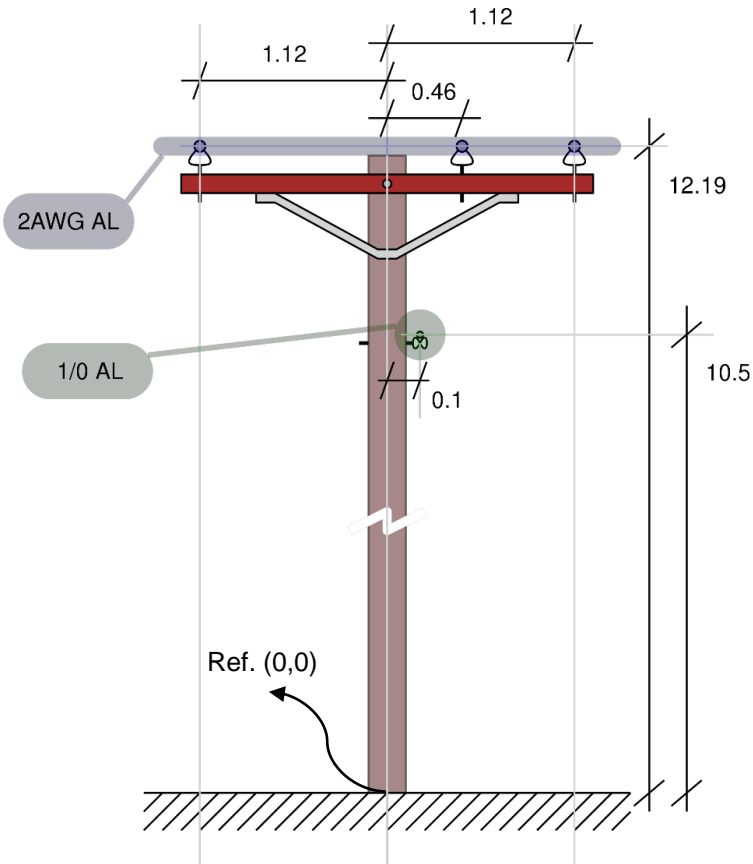
! This is a Dy xfmr
New transformer.xfmr_name
~ phases=3 windings=2
~ Bus1=Bus_A.1.2.3
~ Bus2=Bus_B.1.2.3.4
~ conns=[delta, wye]
...

New reactor.rg_name
~ phases=1
~ Bus1=Bus_B.4
~ Bus2=Bus_B.0
~ R=0.1 X=700.0
...

```


Example: Distribution Line Segment

If you know the per-length impedance matrices..



Use `[]` to create matrices.

Use `|` to separate rows.

! My first DSS line

New line.L1 bus1=A bus2=B phases=3

~ rmatrix=[0.9699 | 0.1200 0.9753 | 0.1181 0.1208 0.9714]

~ xmatrix=[0.7766 | 0.2905 0.7650 | 0.2682 0.3543 0.7733]

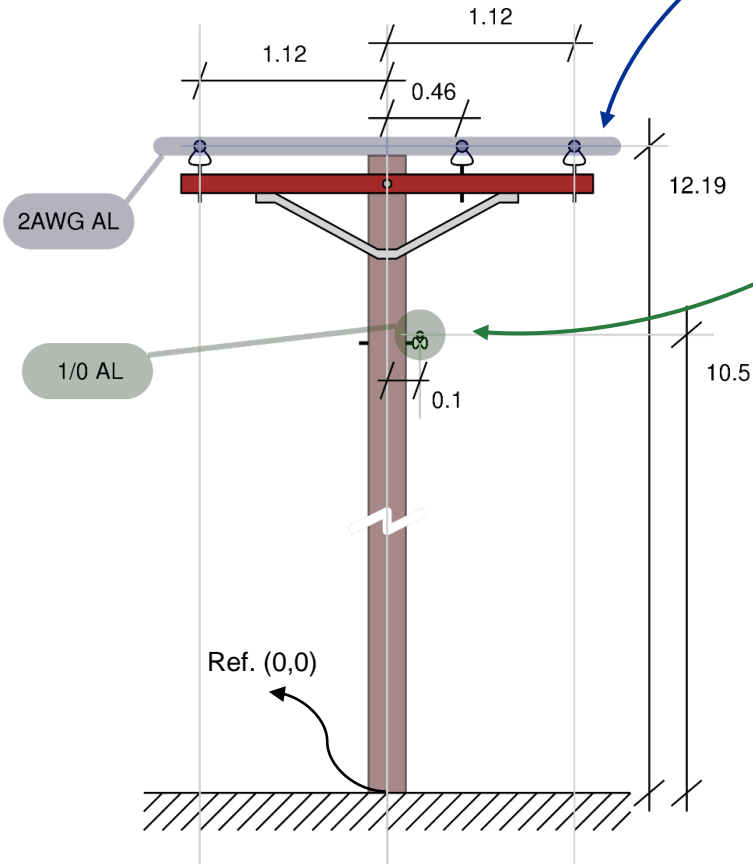
~ cmatrix=[7.4518 | -1.493 8.2716 | -1.029 -2.602 8.0307]

~ length=1 units=km

You can define all the matrix entries or just those of the lower triangle

Example: Distribution Line Segment

... or if you know the conductor and geometry details...



! Phase Conductor

```
New "wiredata.2AWG AL" Rac=0.86942 Runits=km GMRac=0.26924
~ GMRunits=cm diam=0.74168 radunits=cm
```

! Neutral Conductor

```
New wiredata.1/0AL Rac=0.54463 Runits=km GMRac=0.33833
~ GMRunits=cm diam=0.93472 radunits=cm
```

! Cross arm pole geometry details

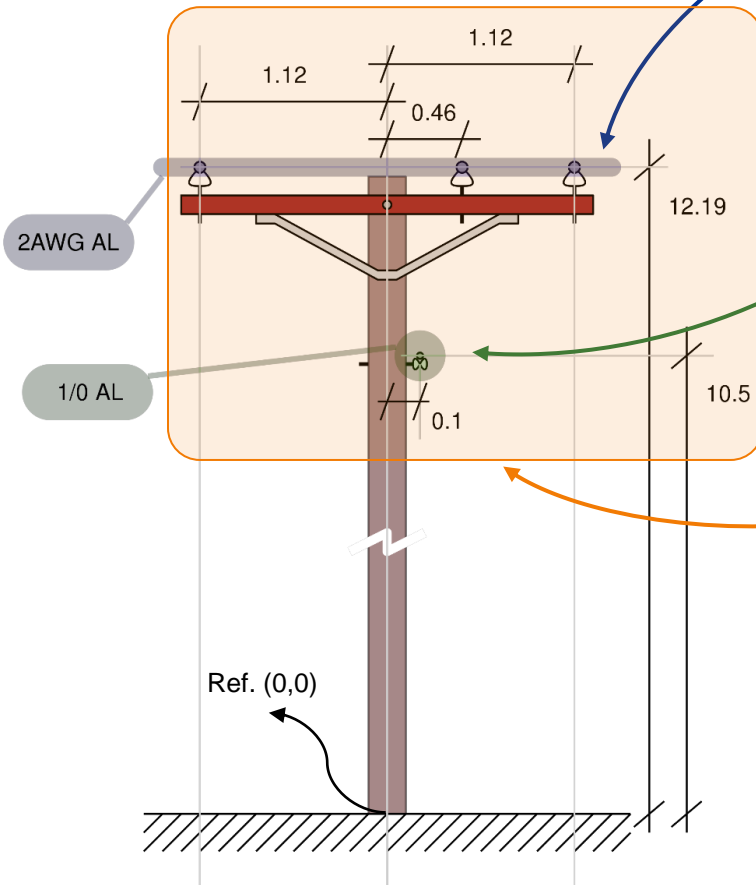
```
New linespacing.4KV_3PH_3CH nphases=3 nconds=4
~ x=[-1.1176 0.4572 1.1176 0.10160]
~ h=[12.1920 12.192 12.192 10.5664] units=m
```

! My second DSS line

```
New line.L2 bus1=A bus2=B phases=3 spacing=4KV_3PH_3CH
~ wires=["2AWG AL" "2AWG AL" "2AWG AL" 1/0AL] length=1
~ units=km
```

Example: Distribution Line Segment

... or if you know the conductor and geometry details...



! Phase Conductor

```
New "wiredata.2AWG AL" Rac=0.86942 Runits=km GMRac=0.26924
~ GMRunits=cm diam=0.74168 radunits=cm
```

! Neutral Conductor

```
New wiredata.1/0AL Rac=0.54463 Runits=km GMRac=0.33833
~ GMRunits=cm diam=0.93472 radunits=cm
```

! Cross arm pole geometry details

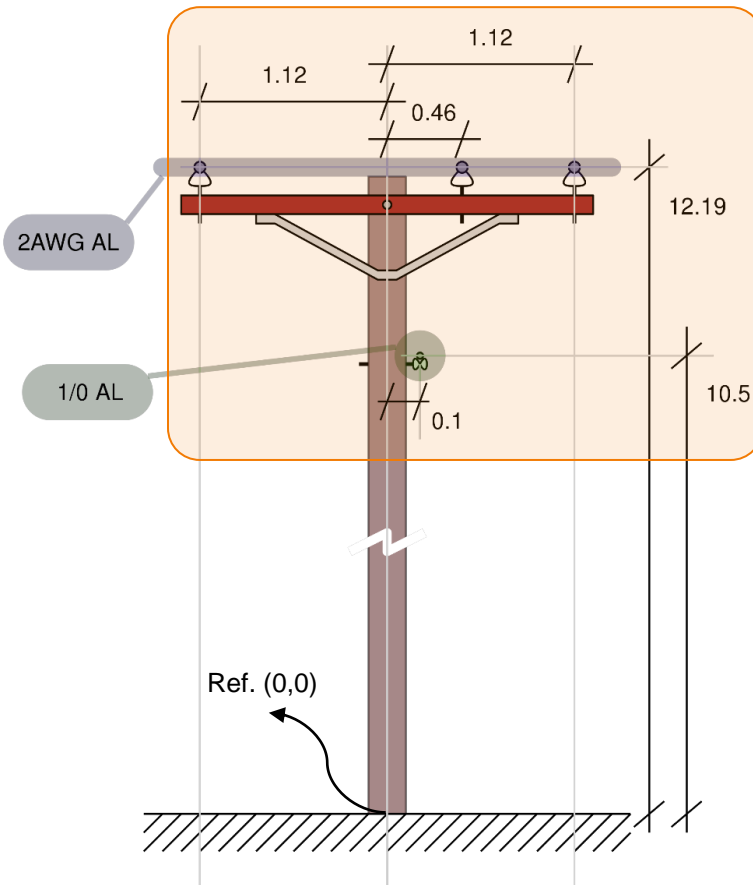
```
New linespacing.4KV_3PH_3CH nphases=3 nconds=4
~ x=[-1.1176 0.4572 1.1176 0.10160]
~ h=[12.1920 12.192 12.192 10.5664] units=m
```

! My second DSS line

```
New line.L2 bus1=A bus2=B phases=3 spacing=4KV_3PH_3CH
~ wires=["2AWG AL" "2AWG AL" "2AWG AL" 1/0AL] length=1
~ units=km
```

Example: Distribution Line Segment

... or if you know the conductor and geometry details...



! Phase Conductor

```
New "wiredata.2AWG AL" Rac=0.86942 Runits=km GMRac=0.26924
~ GMRunits=cm diam=0.74168 radunits=cm
```

! Neutral Conductor

```
New wiredata.1/0AL Rac=0.54463 Runits=km GMRac=0.33833
~ GMRunits=cm diam=0.93472 radunits=cm
```

! Cross arm pole geometry details

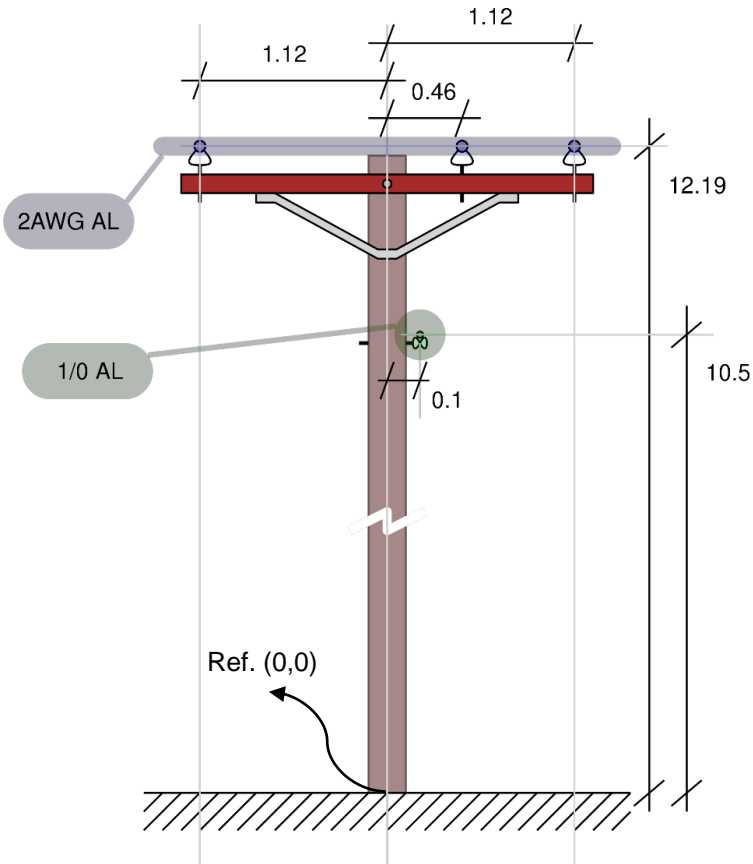
```
New linespacing.4KV_3PH_3CH nphases=3 nconds=4
~ x=[-1.1176 0.4572 1.1176 0.101601]
~ h=[12.1920 12.192 12.192 10.5664] units=m
```

! My second DSS line

```
New line.L2 bus1=A bus2=B phases=3 spacing=4KV_3PH_3CH
~ wires=["2AWG AL" "2AWG AL" "2AWG AL" 1/0AL] length=1
~ units=km
```

Example: Distribution Line Segment

... or if you know the conductor and geometry details...



Use `" "` if you want to have space characters in strings or names of DSS objects

! Phase Conductor

```
New "wiredata.2AWG AL" Rac=0.86942 Runits=km GMRac=0.26924
~ GMRunits=cm diam=0.74168 radunits=cm
```

! Neutral Conductor

```
New wiredata.1/0AL Rac=0.54463 Runits=km GMRac=0.33833
~ GMRunits=cm diam=0.93472 radunits=cm
```

! Cross arm pole geometry details

```
New linespacing.4KV_3PH_3CH nphases=3 nconds=4
~ x=[-1.1176 0.4572 1.1176 0.10160]
~ h=[12.1920 12.192 12.192 10.5664] units=m
```

! My second DSS line

```
New line.L2 bus1=A bus2=B phases=3 spacing=4KV_3PH_3CH
~ wires=["2AWG AL" "2AWG AL" "2AWG AL" 1/0AL] length=1
~ units=km
```

Example: Distribution Line Segment

File Edit Do Set Make Export Show Visualize Plot Reset Help

PDelements

Line

L2

Base Frequency = 60 Hz

hct\Test\FeederModels\AndresModels\Demo - with Relays\all_together\master_file.dss

Results for Actor ID # 1

CPU selected : -1

Status = SOLVED

Solution Mode = Snap

Number = 100

Load Mult = 1.000

Devices = 3

Buses = 3

Nodes = 9

Control Mode = STATIC

Total Iterations = 2

Control Iterations = 1

Max Sol Iter = 2

- Circuit Summary -

Year = 0

Hour = 0

Max pu. voltage = -0.001

Min pu. voltage = -1

Total Active Power: 2.21029E-014 MW

Total Reactive Power: 2.55557E-013 Mvar

Total Active Losses: 0 MW, (0 %)

Total Reactive Losses: 0 Mvar

Frequency = 60 Hz

Mode = Snap

Control Mode = STATIC

Load Model = PowerFlow

Clear

New circuit.dummy

! My first DSS line

New line.L1 bus1=A bus2=B phases=3

~ rmatrix=[0.9699 | 0.1200 0.9753 | 0.1181 0.1208 0.9714]

~ xmatrix=[0.7766 | 0.2905 0.7650 | 0.2682 0.3543 0.7733]

~ cmatrix=[7.4518 | -1.493 8.2716 | -1.029 -2.602 8.0307]

~ length=1 units=km

! Phase Conductor

New "wiredata.2AWG AL" Rac=0.86942 Runits=km GMRac=0.26924

~ GMRunits=cm diam=0.74168 radunits=cm

! Neutral Conductor

New wiredata.1/0AL Rac=0.54463 Runits=km GMRac=0.33833

~ GMRunits=cm diam=0.93472 radunits=cm

! Cross arm pole geometry details

New linespacing.4KV_3PH_3CH nphases=3 nconds=4

~ x=[-1.1176 0.4572 1.1176 0.10160]

~ h=[12.1920 12.192 12.192 10.5664] units=m

! My second DSS line

New line.L2 bus1=A bus2=B phases=3 spacing=4KV_3PH_3CH

~ wires=["2AWG AL" "2AWG AL" "2AWG AL" 1/0AL] length=1

~ units=km

solve

Main example_lines.dss

MessagesOpenDSS - C:\temp\opendss_training\example_lines.dss

Summary Results

Memory: 74372K

Circuit Status: SOLVED

Total Iterations = 2, Control Iterations

LINE.L1

Close Update

Property	Value
bus1	a
bus2	b
linecode	
length	1
phases	3
r1	----
x1	----
r0	----
x0	----
C1	----
C0	----
rmatrix	[0.9699 0.12 0.9753 0.1181 0.1208 0.9714]
xmatrix	[0.7766 0.2905 0.765 0.2682 0.3543 0.7733]
cmatrix	[7.4518 -1.493 8.2716 -1.029 -2.602 8.0307]
Switch	False
Rg	0.01805
Xg	0.155081
rho	100
geometry	
units	km
spacing	
wires	
EarthModel	Deri
cncables	
tscables	
B1	----
B0	----
Seasons	1
Ratings	[400.]
LineType	oh
normamps	400
emergamps	600
faultrate	0.1
pctperm	20
repair	3
basefreq	60

LINE.L2

Close Update

Property	Value
bus1	a
bus2	b
linecode	
length	1
phases	3
r1	----
x1	----
r0	----
x0	----
C1	----
C0	----
rmatrix	[0.9698716 0.1200147 0.9752889 0.1181342 0
xmatrix	[0.7766281 0.2905244 0.7650403 0.2681627 0
cmatrix	[7.451762 -1.4928 8.271604 -1.029494 -2.6017
Switch	False
Rg	0.01805
Xg	0.155081
rho	100
geometry	
units	km
spacing	4KV_3PH_3CH
wires	""2AWG AL" "2AWG AL" "2AWG AL" 1/0AL"
EarthModel	Deri
cncables	
tscables	
B1	----
B0	----
Seasons	1
Ratings	[400.]
LineType	oh
normamps	-1
emergamps	-1
faultrate	0.1
pctperm	20
repair	3
basefreq	60

Recap: Commands and Scripting Characters

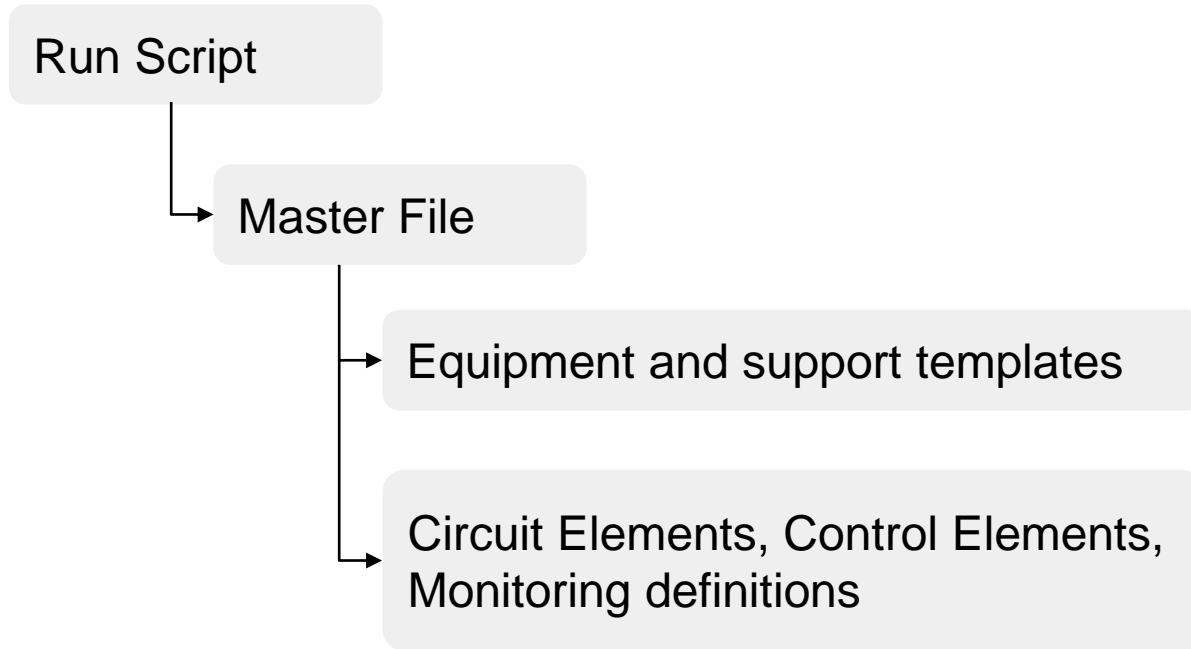
Scripting

Character	Description
~	Line continuation
[] () { } " ' `	Arrays, Matrices, Strings, Math Expressions
	Row delimiter in matrices
, space tab	Delimiter command parameters and array/matrix entries
.	Delimiter class-object, bus-node
=	Delimiter parameter tag and parameter value
! //	In line comments
/*...*/	Block comments

Commands
(common)

Command	Description
New	Create new DSS elements
Edit	Edit existing DSS elements
Set	Define solution modes and options
Solve	Perform current solution mode
Show	Write selected results to text files
Export	Export solution variables in CSV or XML format
Plot	Plots results with built-in plotting features

Large Circuits – Script structure



This structure is not required but it helps to explore and organize your model. A single script can host an entire model.

```
// Master file for 8500-Node IEEE Test Feeder Case
// Unbalanced Load Case
```

```
Clear
```

```
Set DefaultBaseFrequency=60
```

```
! Definition of main source (mandatory!)
```

```
New Circuit.IEEE8500
```

```
~ pu=1.05  r1=0  x1=0.001  r0=0  x0=0.001
```

```
! Templates
```

```
Redirect LineCodes2.dss
```

```
Redirect Triplex_Linecodes.dss
```

```
Redirect LoadXfmrCodes.dss
```

```
! Circuit Elements, Controls, Monitors
```

```
Redirect Lines.dss
```

```
Redirect Transformers.dss
```

```
Redirect Triplex_Lines.dss
```

```
Redirect UnbalancedLoads.dss
```

```
Redirect Capacitors.dss
```

```
Redirect CapControls.dss
```

```
Redirect Regulators.dss
```

```
! Let DSS estimate the voltage bases
```

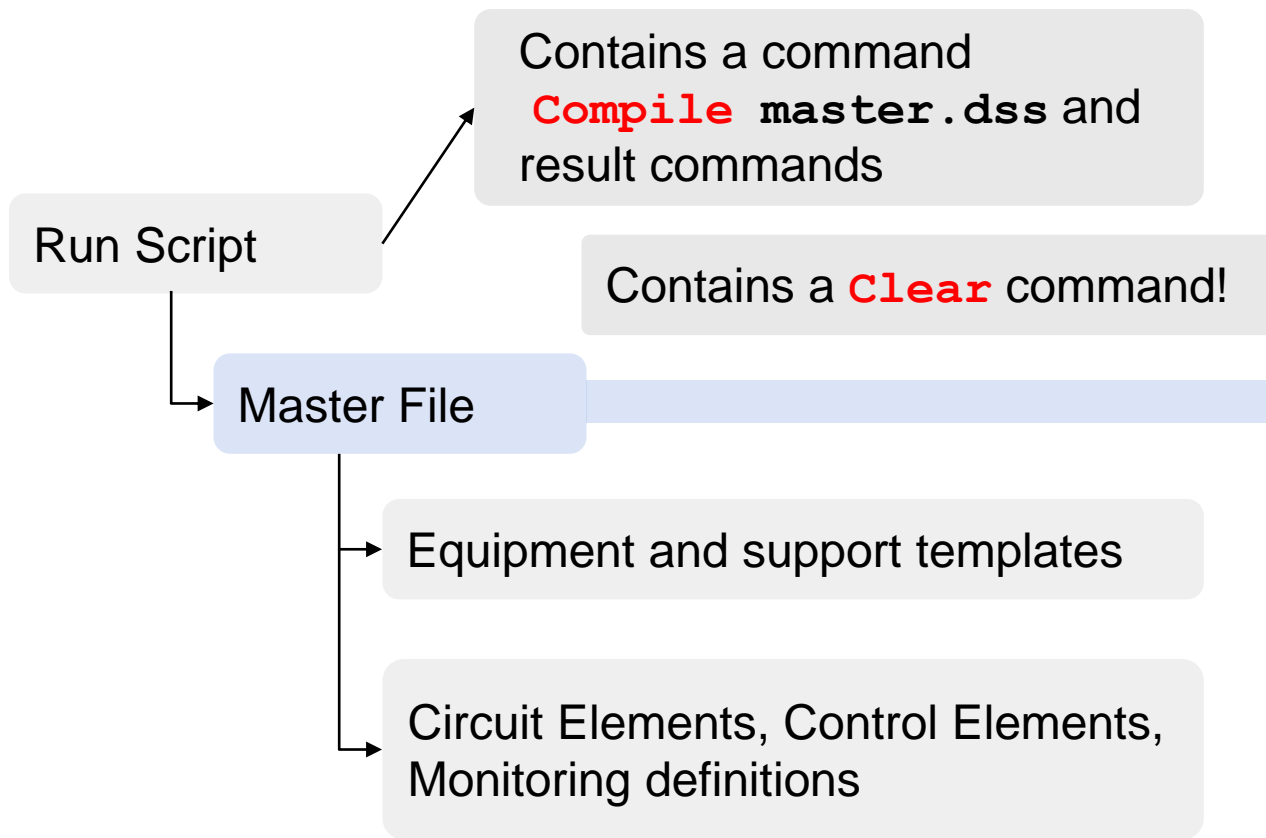
```
Set voltagebases=[115, 12.47, 0.48, 0.208]
```

```
Calc voltagebases ! This also establishes the bus list
```

```
! Load in bus coordinates now that bus list is established
```

```
Buscoords Buscoords.dss
```


Large Circuits – Script structure



```
// Master file for 8500-Node IEEE Test Feeder Case
// Unbalanced Load Case
```

```
Clear
```

```
Set DefaultBaseFrequency=60
```

```
! Definition of main source (mandatory!)
```

```
New Circuit.IEEE8500
```

```
~ pu=1.05 r1=0 x1=0.001 r0=0 x0=0.001
```

```
! Templates
```

```
Redirect LineCodes2.dss
```

```
Redirect Triplex_Linecodes.dss
```

```
Redirect LoadXfmrCodes.dss
```

```
! Circuit Elements, Controls, Monitors
```

```
Redirect Lines.dss
```

```
Redirect Transformers.dss
```

```
Redirect Triplex_Lines.dss
```

```
Redirect UnbalancedLoads.dss
```

```
Redirect Capacitors.dss
```

```
Redirect CapControls.dss
```

```
Redirect Regulators.dss
```

```
! Let DSS estimate the voltage bases
```

```
Set voltagebases=[115, 12.47, 0.48, 0.208]
```

```
Calc voltagebases ! This also establishes the bus list
```

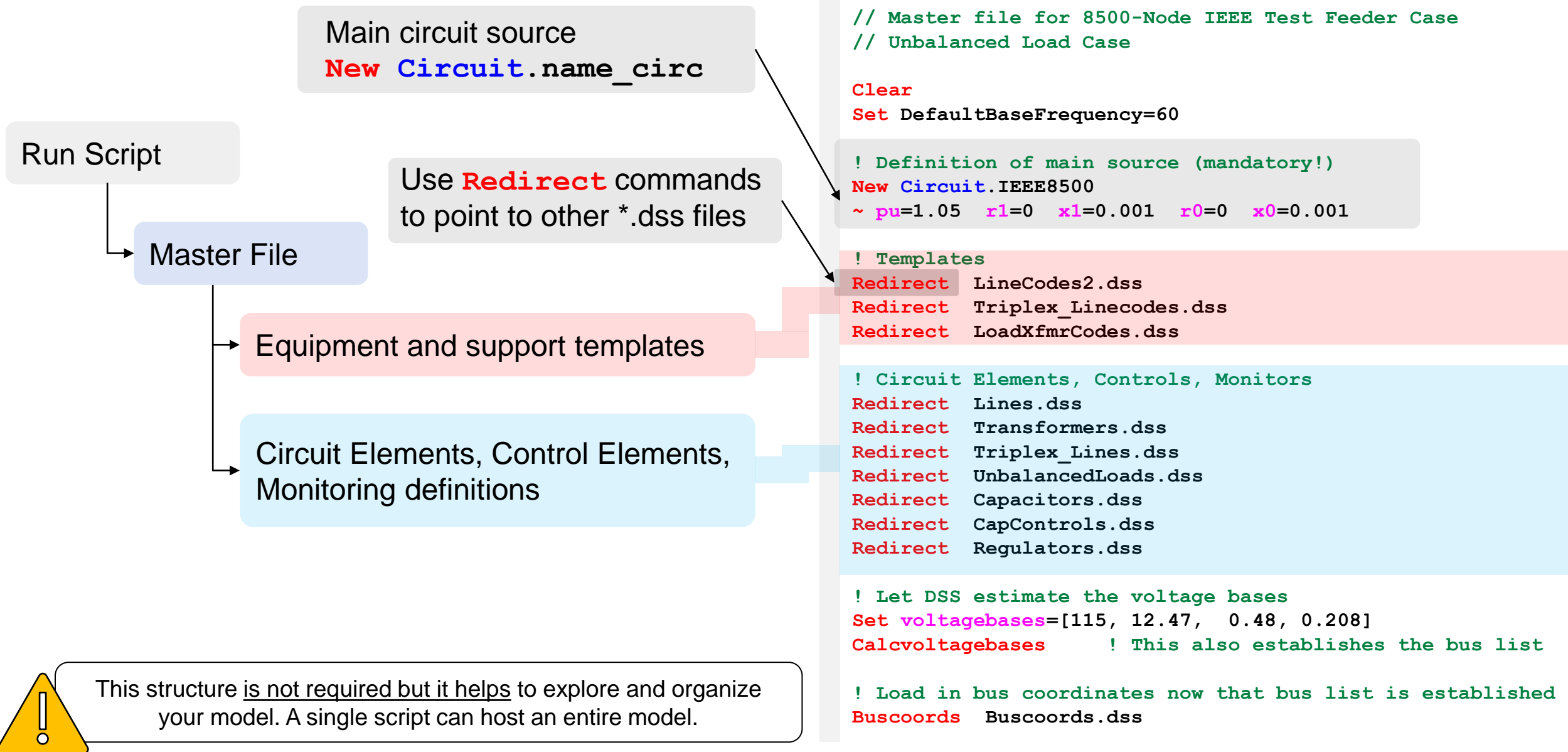
```
! Load in bus coordinates now that bus list is established
```

```
Buscoords Buscoords.dss
```



This structure is not required but it helps to explore and organize your model. A single script can host an entire model.

Large Circuits – Script structure



Large Circuits – Script structure

Main circuit source

```
New Linecode.1ph-x4_acsr4_acsr ...
New Linecode.1ph-xx4_acsr4_acsr ...
New Linecode.1ph-x2_acsr4_acsr ...
New Linecode.1ph-x4_acsr4_wpal ...
New Linecode.3ph_h-4_acsr4_acsr4_acsr4_acsr ...
...
LineCodes2.dss
```

Equipment and support templates

```
New Line.HVMV_Sub_connector ...
New Line.LN5502549-1 ...
New Line.LN6259988-1 ...
New Line.LN6077796-1 ...
New Line.LN5835135-2 ...
New Line.LN5896826-1 ...
New Line.LN5714038-1 ...
...
Lines.dss
```

```
// Master file for 8500-Node IEEE Test Feeder Case
// Unbalanced Load Case
```

```
Clear
Set DefaultBaseFrequency=60
```

```
! Definition of main source (mandatory!)
New Circuit.IEEE8500
~ pu=1.05 r1=0 x1=0.001 r0=0 x0=0.001
```

```
! Templates
```

```
Redirect LineCodes2.dss
Redirect Triplex_Linecodes.dss
Redirect LoadXfmrCodes.dss
```

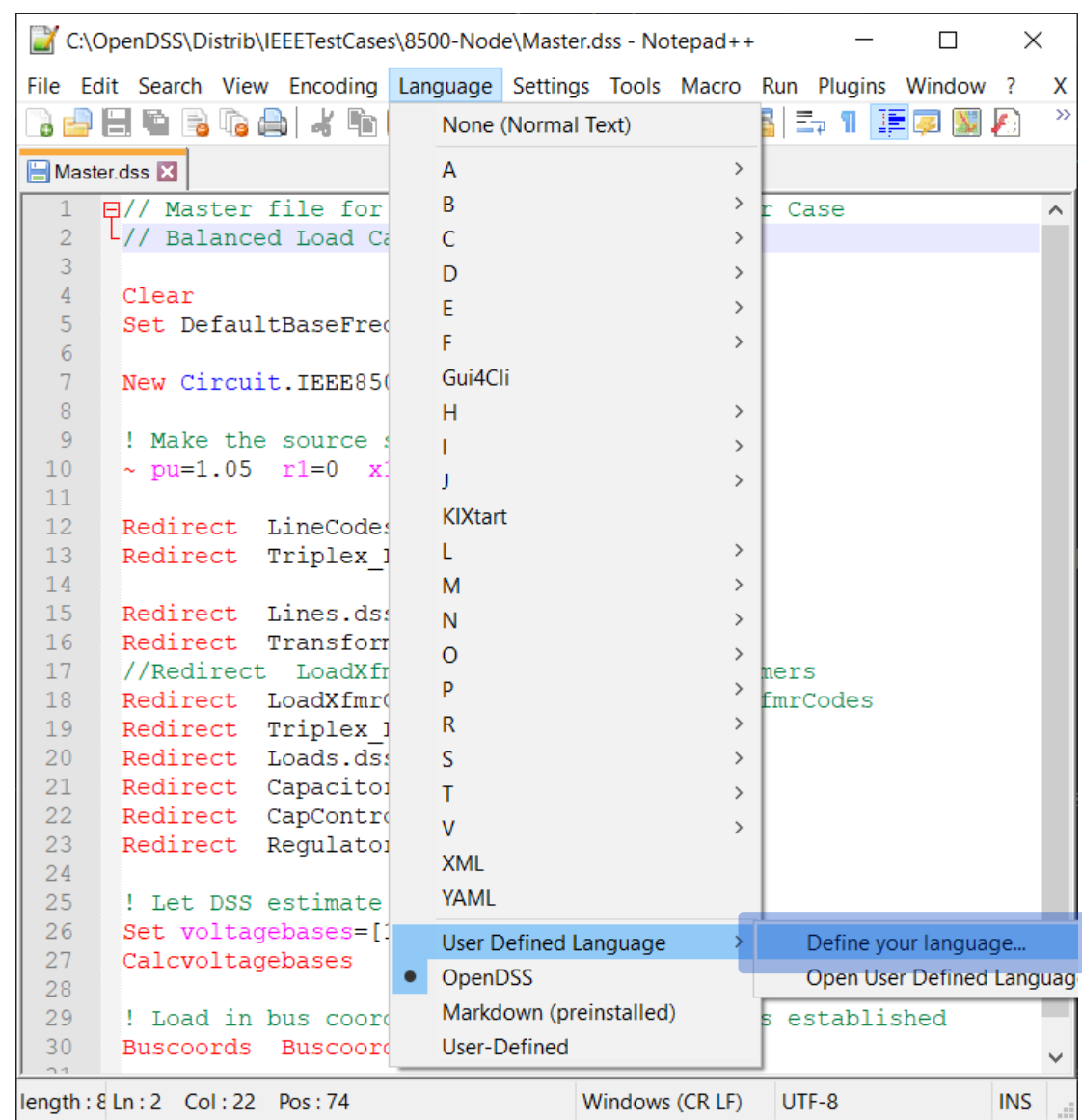
```
! Circuit Elements, Controls, Monitors
```

```
Redirect Lines.dss
Redirect Transformers.dss
Redirect Triplex_Lines.dss
Redirect UnbalancedLoads.dss
Redirect Capacitors.dss
Redirect CapControls.dss
Redirect Regulators.dss
```

```
! Let DSS estimate the voltage bases
Set voltagebases=[115, 12.47, 0.48, 0.208]
Calc voltagebases ! This also establishes the bus list
```

```
! Load in bus coordinates now that bus list is established
Buscoords Buscoords.dss
```

DSS Scripts in Text editor



```
1 // Master file for
2 // Balanced Load Ca
3
4 Clear
5 Set DefaultBaseFrec
6
7 New Circuit.IEEE850
8
9 ! Make the source s
10 ~ pu=1.05 rl=0 xl
11
12 Redirect LineCodes
13 Redirect Triplex_1
14
15 Redirect Lines.dss
16 Redirect Transform
17 //Redirect LoadXfr
18 Redirect LoadXfmrC
19 Redirect Triplex_1
20 Redirect Loads.dss
21 Redirect Capacitor
22 Redirect CapContro
23 Redirect Regulator
24
25 ! Let DSS estimate
26 Set voltagebases=[
27 Calcvoltagebases
28
29 ! Load in bus coord
30 Buscoords Buscoord
```

Use a text editor like **Notepad++** or **EditPlus** to better visualize your OpenDSS scripts

Import the syntax file from this folder
OpenDSS/Examples/SyntaxFiles

A restart of the text editor might be required



Demo

8500-node case – Some useful plotting commands

! Highlight a bus in the circuit plot

```
AddBusMarker Bus=12973156 code=15 color=Purple  
~ size=4
```

! Highlight circuit elements

```
Set markCapacitors=yes CapMarkersize=3  
Set markRegulators=yes RegMarkersize=5
```

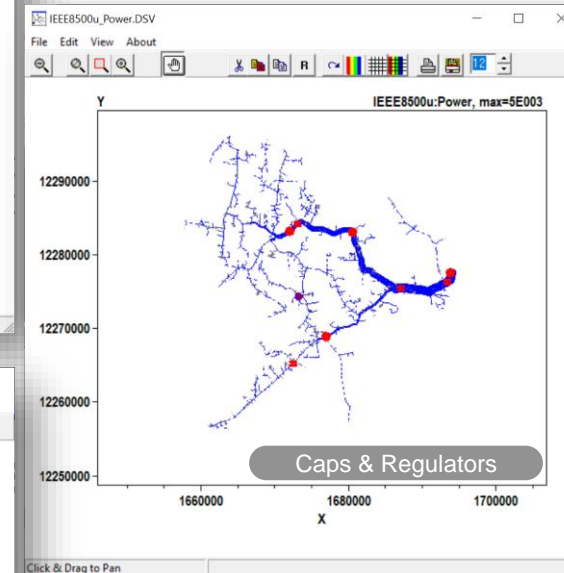
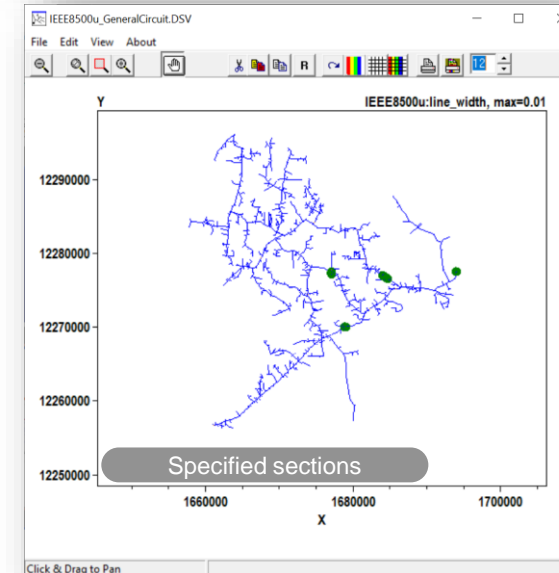
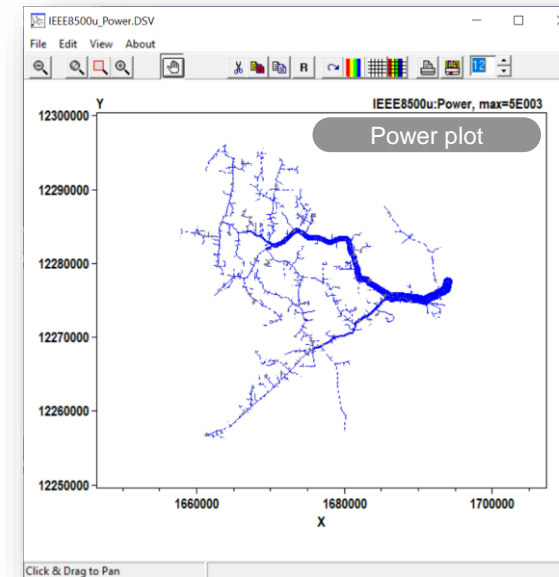
Interpolate

! Plot circuit. Line width based on power

```
Plot Circuit Power Max=5000 dots=n labels=n  
~ C1=Blue lph=3 ! $00FF0000
```

```
/* Plot circuit. Highlight circuit sections of  
interest (quantity refers to the column (0 is  
column 1) of the CSV defining the line width) */
```

```
Plot Circuit quantity=1 max=0.01  
~ object=lines_to_highlight.csv
```



	A	B
1	element_name	line_width
2	Line.ln5815900-1	0.05
3	LINE.LN6318761-1	0.05
4	LINE.LN6440069-1	0.05
5	LINE.LN5714045-1	0.05

8500-node case – Some useful plotting commands

! Additional energy meters to split the feeders

```
New Energymeter.m2 element=LINE.LN6381853-1 terminal=1
```

```
New Energymeter.m3 element=LINE.LN5799561-1 terminal=1
```

```
/* Command to export the PD elements in the zone of  
energy meter m3 to a CSV file */
```

```
Edit energymeter.m3 action=zonedump  
solve
```

! Plot energy meter zones

```
plot zones Power max=5000 labels=n subs=y C1=$00FF0000
```

```
/* Plot heatmap of voltage p.u. quantities (quantity  
refers to the column (0 is column 1) of the CSV  
defining the marker size) */
```

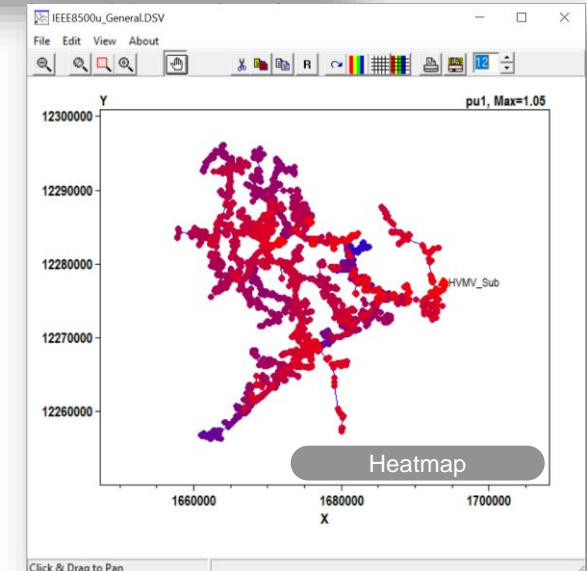
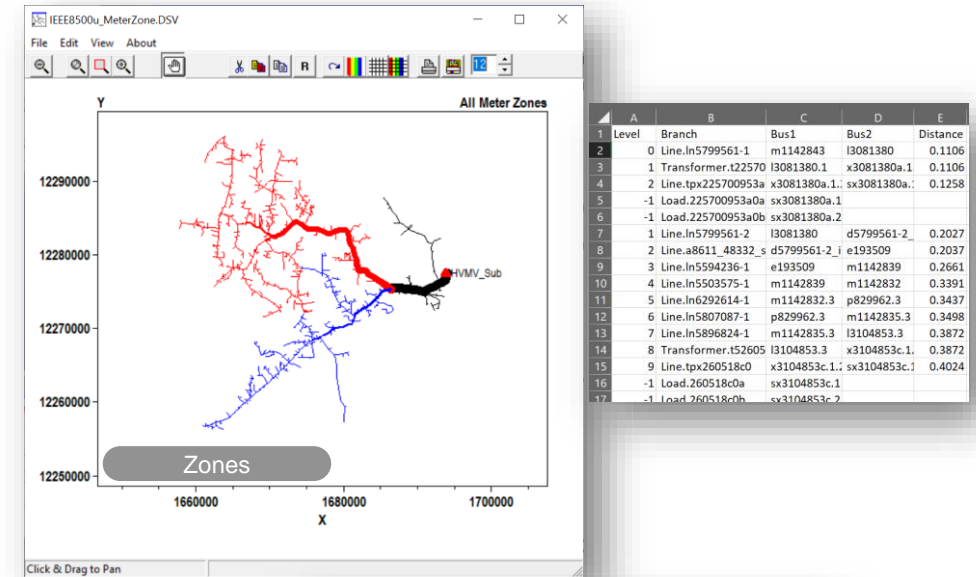
```
Set markercode=24 nodewidth=0.005
```

Export voltages

```
plot General quantity=5 Max=0 dots=y labels=n subs=y
```

```
~ object=IEEE8500u_EXP_VOLTAGES.CSV C1=blue
```

```
~ C2=$000000FF ! C1=$0080FFFF C2=$000000FF
```





Questions ??

A blue-tinted photograph of four people standing in a row. From left to right: a man with curly hair and glasses wearing a lab coat; a man with glasses wearing a lab coat; a woman wearing a hard hat and a lab coat; and a man with glasses and a beard wearing a button-down shirt. The text 'Together...Shaping the Future of Energy®' is overlaid in white in the center.

Together...Shaping the Future of Energy®