

**SAARC Workshop
on
Load/Power Flow Studies using PSS/E for Efficient National &
Cross Border Interconnected Power Systems in South Asia**

Agenda

**Thimphu, Bhutan
18th to 20th July 2018**

Day-1 (18-July-2018)

Time	Description
1115-1300	Session-I “Introduction to power system simulation using PSSE” - Views in Power flow interface - File types in PSSE - Program settings - PSSE Documentation <i>Creating a new case</i> <i>Familiarization with data types / Adding and Modifying power flow data</i>
1300-1400	<i>Lunch</i>
1400-1530	Session-II “Getting started in power flow with PSSE” <i>Power flow solution</i> <i>Hands-on exercise in power flow</i>
1530-1700	Session-III “Diagrams in PSSE” <i>Diagram view and Diagram Toolbar</i> <i>Diagram options</i> <i>Creating diagram of a subsystem</i> <i>Hands-on exercise</i>

Day-2 (19-July-2018)

Time	Description
0930-1030	Session-I “Toolbars and Diagrams” • Usage of common toolbars • Program preferences
1045-1200	Session-I “Reporting and Limit checking in power flow” • Viewing power flow results • Limit checking reports • Hands-on exercise: Examining power flow results
1200 - 1300	Session-III “Introduction to Fault Analysis” • Generator and Load conversion • Setting up a sav case for fault analysis • Balanced switching options • ASCC and IEC fault analysis options • Hands-on exercise on : a) fault level calculation at network buses b) Charging studies

Day-2 (19-July-2018)...contd..

Time	Description
1300 - 1400	Lunch
1400-1515	Session- IV “Data checking in PSSE” • Using program features for bad data detection • Handling a blown-up power flow case • Hands-on exercise
1515 - 1630	Session- V “Contingency Analysis using PSSE” • Setting up files for contingency analysis • Ranking contingencies • TLTG analysis

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SAARC Workshop on Load/Power Flow Studies using PSS/E for Efficient National & Cross Border Interconnected Power Systems in South Asia

Session I : Diagrams and Toolbars

Day-2

**Thimphu, Bhutan
18th to 20th July 2018**

Common Toolbars

File Toolbar

- Create new case or diagram
- Open existing document
- Save active document
- Cut/Copy/Paste/Delete
- Undo
- Toggle output bar
- Toggle command line input
- About



Source : PSSE 34.2 PAG-1

Common Toolbars...(2)

Zoom Toolbar

Applies to Spreadsheet View or Diagram View

- Combo box - to select predefined zoom factor
- Zoom In/Out - to zoom the center of the View
- Zoom to extent of diagram
- Zoom to 100%
- Zoom to window
- Previous zoom setting
- Pan view



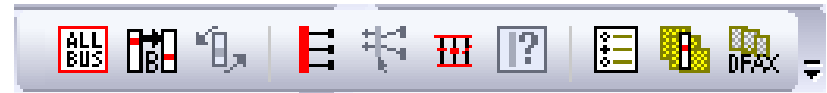
Source : PSSE 34.2 PAG-1

Common Toolbars...(3)

General Toolbar

Select data by subsystems in Spreadsheet View

- Applied to power flow solution, or to power flow graphics
 - Select all buses
 - Select bus subsystem
 - Toggle bus subsystem
 - GOUT / GEXM
 - Autodraw
 - Locate bus
 - Program settings (OPTN)
 - Create/Modify configuration file (SUB, MON, CON)
 - Create DFAX file



Source : PSSE 34.2 PAG-1

Common Toolbars...(4)

Results Toolbar

- Toggle labels
- Diagram annotation
- Display powerflow results
- Display impedance data
- Display case comparison data
- Display ASCC fault analysis results
- Display IEC fault analysis results
- Display reliability analysis results
- Display dynamics model
- Display ACCC results
- Animate flows
- Current loadings
- Multi-section line reporting
- Lock Diagram



Source : PSSE 34.2 PAG-1

Topology Toolbar

- For power flow applications
 - Scale
 - Split bus
 - Join buses
 - Tap line
 - Move network elements
 - Delete network elements
 - Disconnect / reconnect bus
- After making topology changes, remember to update the diagram
- To have diagram updated automatically, right click on item in diagram to apply topology change from menu

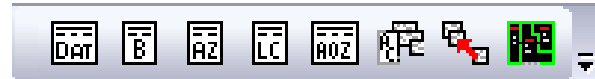


Source : PSSE 34.2 PAG-1

Common Toolbars...(6)

Reporting Toolbar

- List data
- Bus-based reports
- Area-zone reports
- Limit checking reports
- Area / owner / zone total reports
- AC contingency report
- Append AC contingency output
- Graphical Report GRPG (V31)
- Export to Excel



Source : PSSE 34.2 PAG-1

Common Toolbars...(7)

Automation Toolbar

- Start / Stop recording (PYTHON, IDEV file)
- Run automation file (PYTHON, IDEV, IPLAN file)
- Re-run automation file (V33)
- Edit last run automation file
- Edit last recorded automation file



Source : PSSE 34.2 PAG-1

Common Toolbars...(8)

Analysis Toolbar

- Solution Settings
- PV analysis
- QV analysis
- PV Analysis using previous results
- QV Analysis using previous results
- Solve
- AC Contingency Solution (ACCC)
- Multi-level AC Contingency Solution
- AC Corrective Action
- Network Connectivity Check (TREE)
- Reliability Assessment
- Substation Reliability Assessment
- Solve for Switching
- Inertial Power Flow
- N-1-1 AC Contingency Solution



Source : PSSE 34.2 PAG-1

Common Toolbars...(9)

Diagram Toolbar

Only accessible in the diagram view

- **Manipulating Tools:**

- Selection
- Rotate Symbols
- +/- 90° rotation (+ is clockwise)
- Show Grid
- Grid Snap

- **Annotations Items**

- Annotation text
- Diagram title, legend, file name
- Summation
- Report node (V32.0)

- **Network Items:**

- Bus Bar & Bus Node
- Branch, Breaker & Switch
- Load, Generator & Induction Machine
- Switched Shunt, Fixed Shunt
- Facts Device
- Two-Winding and Three-Winding Transformers
- Two Terminal DC Lines and Voltage Source Converter DC Lines
- Insert Diagram Template
- Knee Point (turning a Link into two or more straight-line segments)



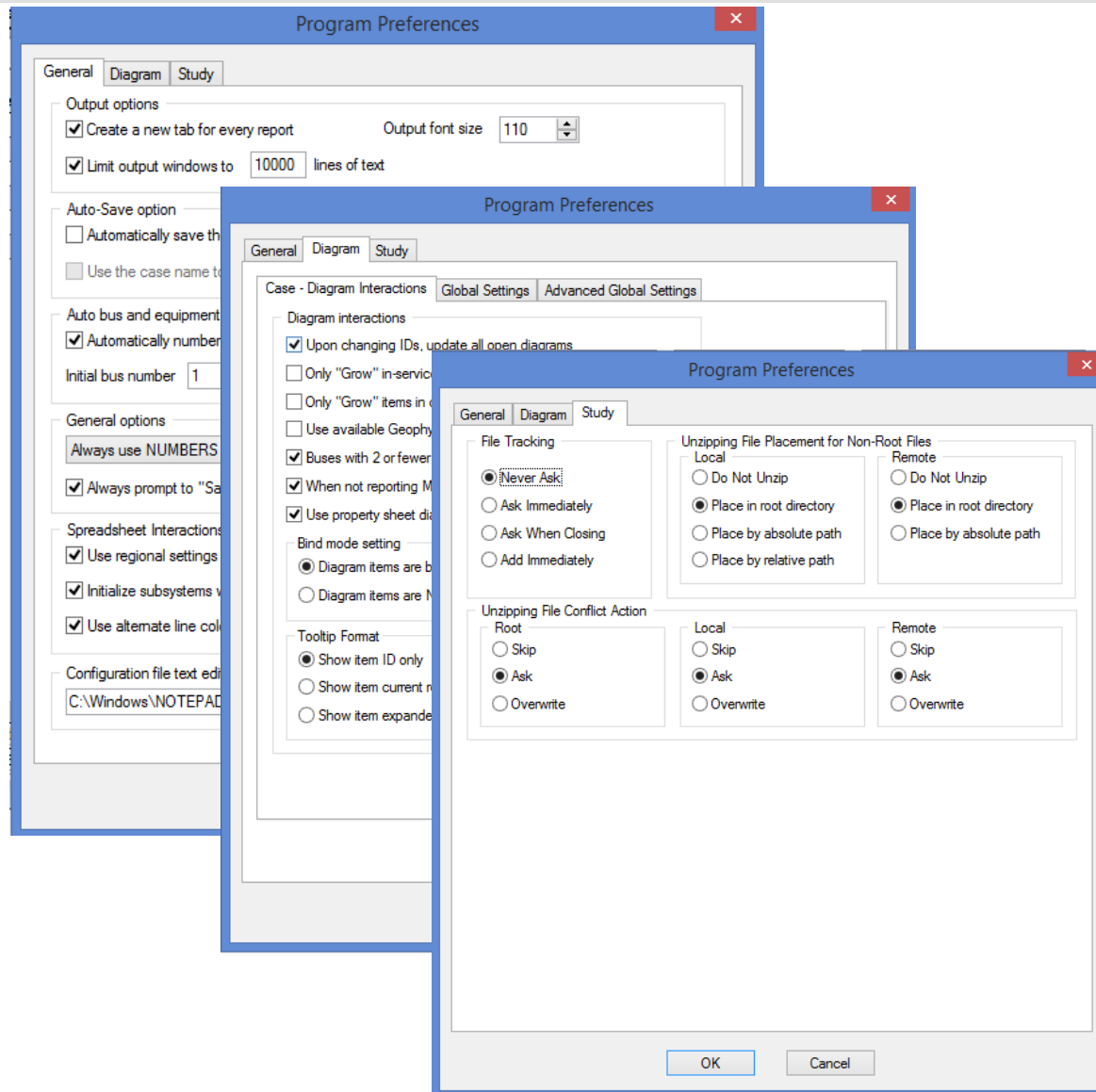
Source : PSSE 34.2 PAG-1

Program Preferences

Edit > Preferences

Program Preferences

- General preferences
- Diagram preferences (related to diagram)
- Study preferences (related to file saving and root directory)



Source : PSSE 34.2 PAG-1

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Session II : Power flow reports and Limit checking

Day-2

**Thimphu, Bhutan
18th to 20th July 2018**

Viewing of Power Flow Results

Results can be monitored in 3 formats:

- Graphics
- List
- Report

Subsystem Selector

- Selective area, owner & Zone
- Selective voltage level
- Selective buses



Subsystem > Bus (Ctrl+Shift+U)

Bus Subsystem Selector

Area	Owner	Zone	Base kV	Bus *
Unselected buses				
101	STEAM		220.00	
202	STEAM1		220.00	
303	HYDRO		21.000	
505	LOAD-OLD		33.000	
Selected buses				
				404 [LOAD-NEW 220.00]

Filter

Bus number

☐ Multiple parsing mode

☐ All buses

OK Apply Reset Memorize Recall Close

Bus Subsystem Selector

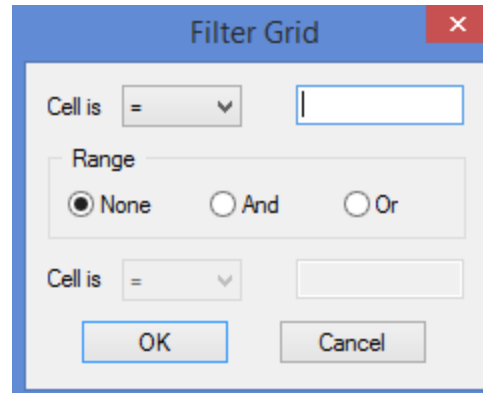
Area	Owner	Zone	Base kV *	Bus *
Base kV Range				
Max	220.000			
Min	220			
Select by kV				
☒ Yes				
☐ No				

☐ All buses

OK Apply Reset Memorize Recall Close

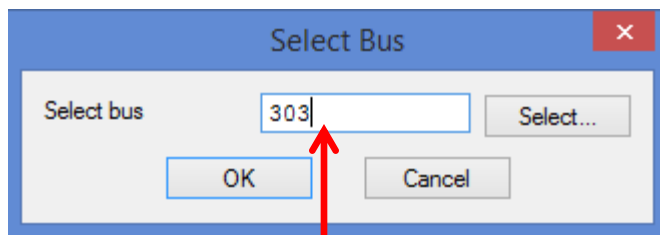
Viewing of Power Flow Results...(2)

- Filtering of data in spreadsheet view
 - Sorting by double click on any column heading
 - Filtering: Select a column – Right click on heading- Filter > Filter grid
 - AND/OR operators may be applied for selection
 - New spreadsheet will be created consisting of filtered data

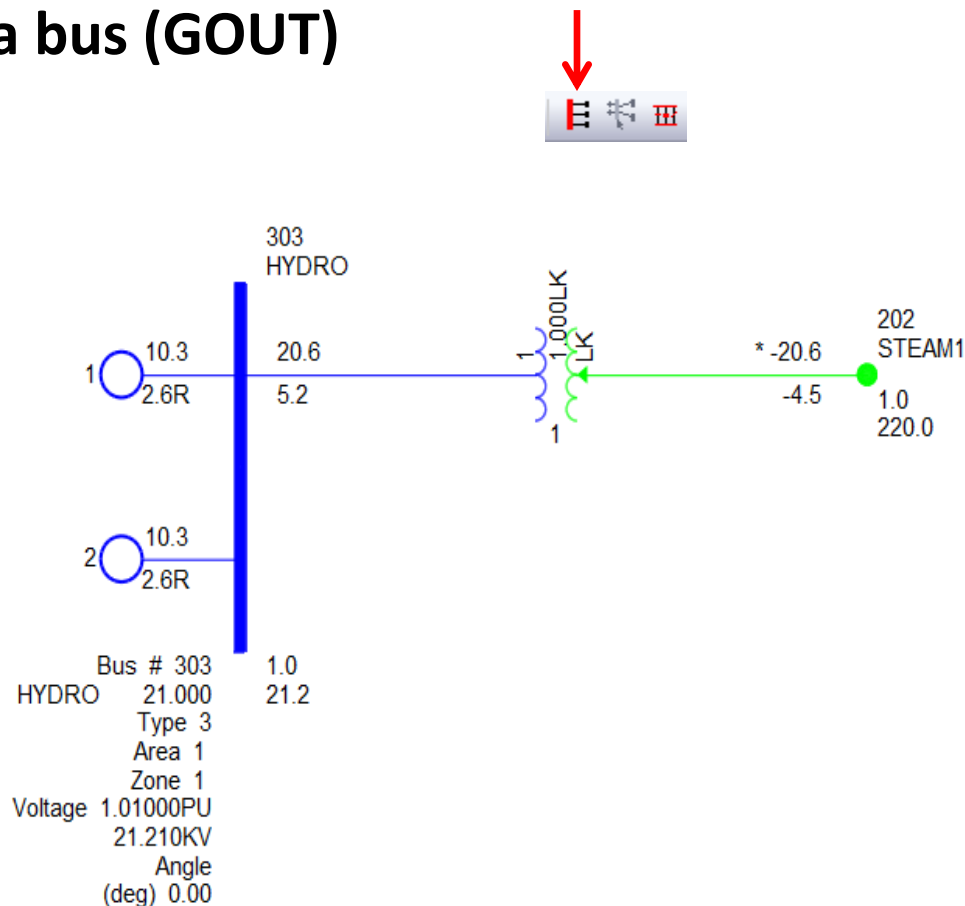


Viewing of Power Flow Results: Graphical Overview

Power flow solution result on a bus (GOUT)



Bus Number

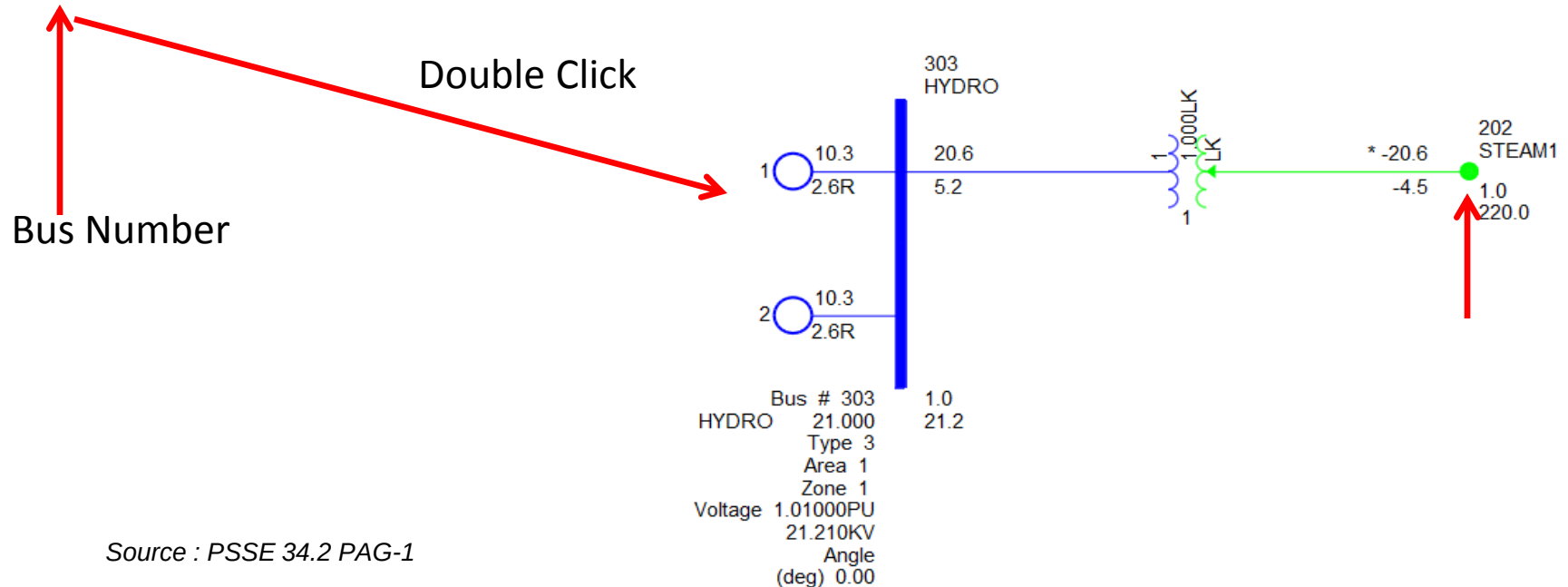


Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(2)

Output bar to GOUT

Output Bar											
1	0.0000 (	404	)	0.0000 (	202	)					
Reached tolerance in 1 iterations											
Largest mismatch:		-0.00 MW	0.00 Mvar	0.00 MVA at bus 101	[STEAM	220.00]					
System total absolute mismatch:				0.00 MVA							
SWING BUS SUMMARY:											
BUS#	-SCT	X--	NAME	--X	BASKV	PGEN	PMAX	PMIN	QGEN	QMAX	QMIN
303			HYDRO		21.000	20.6	46.0	0.0	5.2	20.0	0.0



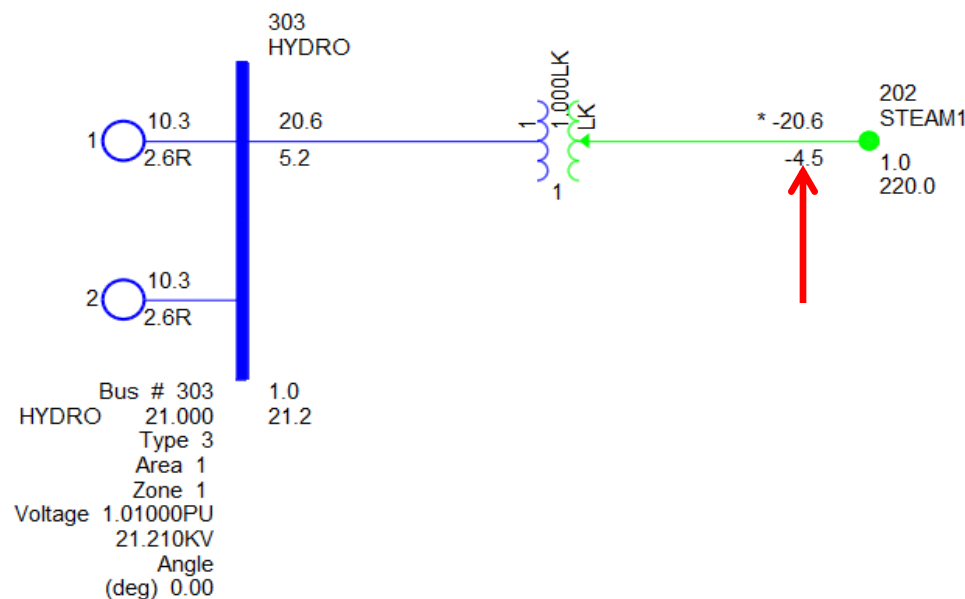
Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(3)

Display different data on bus or branch (GEXM)



Diagram > Results to show > Power flow results



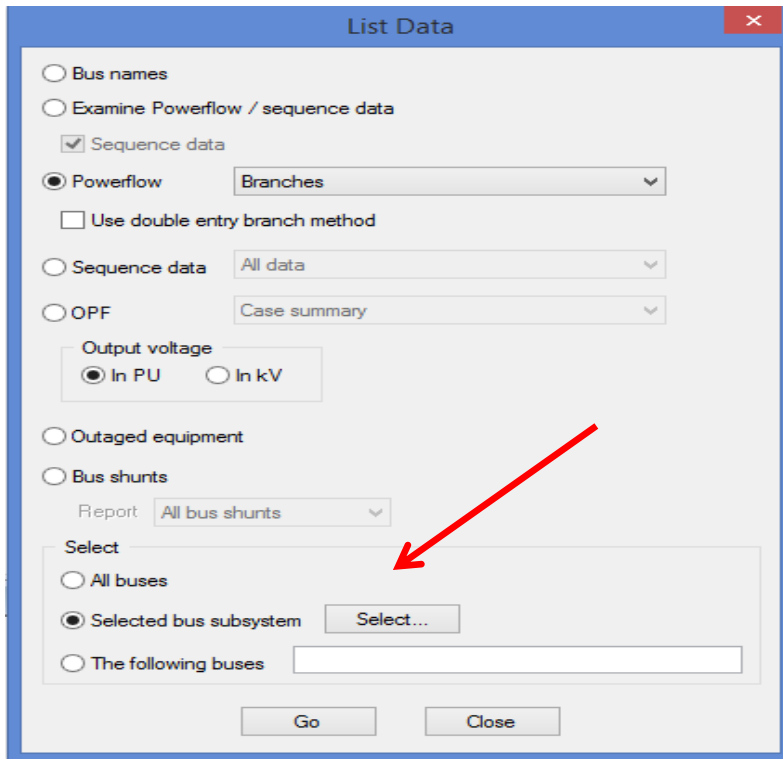
Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(4)

Report Generation

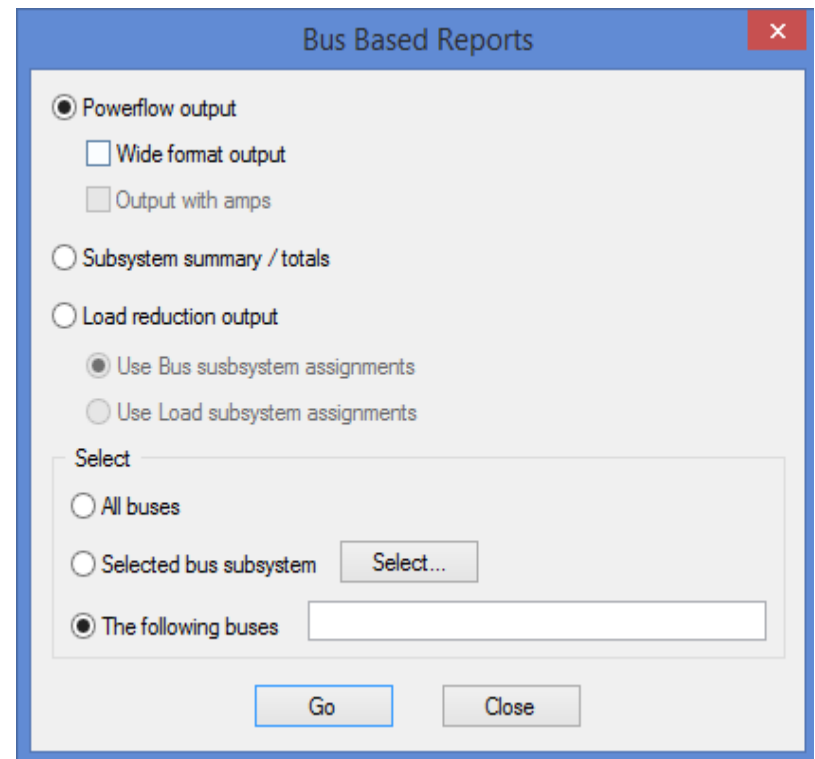


Power flow > Reports > List data/bus based/Area or zone based/Limit checking/total/Graphical



List Data

☐ Bus names
☐ Examine Powerflow / sequence data
☒ Sequence data
☒ Powerflow Branches
☐ Use double entry branch method
☐ Sequence data All data
☐ OPF Case summary
 Output voltage
☒ In PU ☐ In kV
☐ Outaged equipment
☐ Bus shunts
 Report All bus shunts
 Select
☐ All buses
☒ Selected bus subsystem Select...
☐ The following buses
Go Close



Bus Based Reports

☒ Powerflow output
☐ Wide format output
☐ Output with amps
☐ Subsystem summary / totals
☐ Load reduction output
☒ Use Bus subsystem assignments
☐ Use Load subsystem assignments
 Select
☐ All buses
☐ Selected bus subsystem Select...
☒ The following buses
Go Close

Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(5)

Report Generation

Power flow > Reports > List data/bus based/Area or zone based/Limit checking/total/Graphical

Area / Zone Based Reports [X]

Type of summary

☐ Inter area / zone flow

☒ Tie line

Output for

☒ Areas

☐ All

☒ Selected

☐ Zones

☐ All

☒ Selected

Limit Checking Reports [X]

Reactive capability	Generator bus	Machine terminal	Branches
Regulated buses		Controlling transformer	
Out-of-limit bus voltage		Voltage limits	

Voltage limits

Min .01 pu

Max .01 pu

Select

☐ All buses

☒ Selected bus subsystem

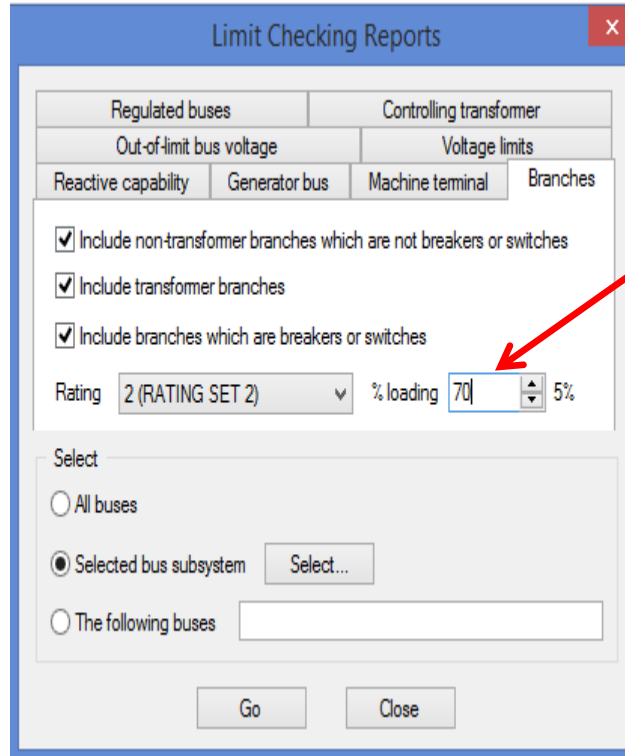
☐ The following buses

Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(6)

Limit Checking Reports

- Reactive capability
- Generator bus
- Machine terminal
- Branches
- Regulated buses
- Controlling transformers
- Out-of-limit bus voltage



Listing the lines and transformers loaded above 70% of rating in a selected subsystem

Source : PSSE 34.2 PAG-1

Viewing of Power Flow Results: Graphical Overview...(7)

Exercise

Please list all the nodes where voltages are out of limit, assuming that normal operating range is 0.97 pu to 1.03 pu.

Source : PSSE 34.2 PAG-1

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Session III : Fault analysis

Day-2

**Thimphu, Bhutan
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Fault Analysis

- **System modeling**

- Resistances & reactance, including all shunts and line charging in the three sequences
- Ratios and phase shift angles of transformers
- Loads converted to equivalent shunt admittances

- **Input data**

- Generator sequence data
- load sequence data
- Transformer sequence data
- Zero sequence non transformer branch data

- **Fault analysis calculation**

- **Automatic sequence fault calculation**

- Negative sequence data is supplied only where load is different than positive sequence.
- If not supplied negative sequence load is assumed to equal the positive sequence value.
- All positive sequence loads (from power flow case) are automatically converted to constant shunt admittance values.
- Where no zero sequence load record is specified, PSS[®]E assumes no shunt load component (open circuit in zero sequence).

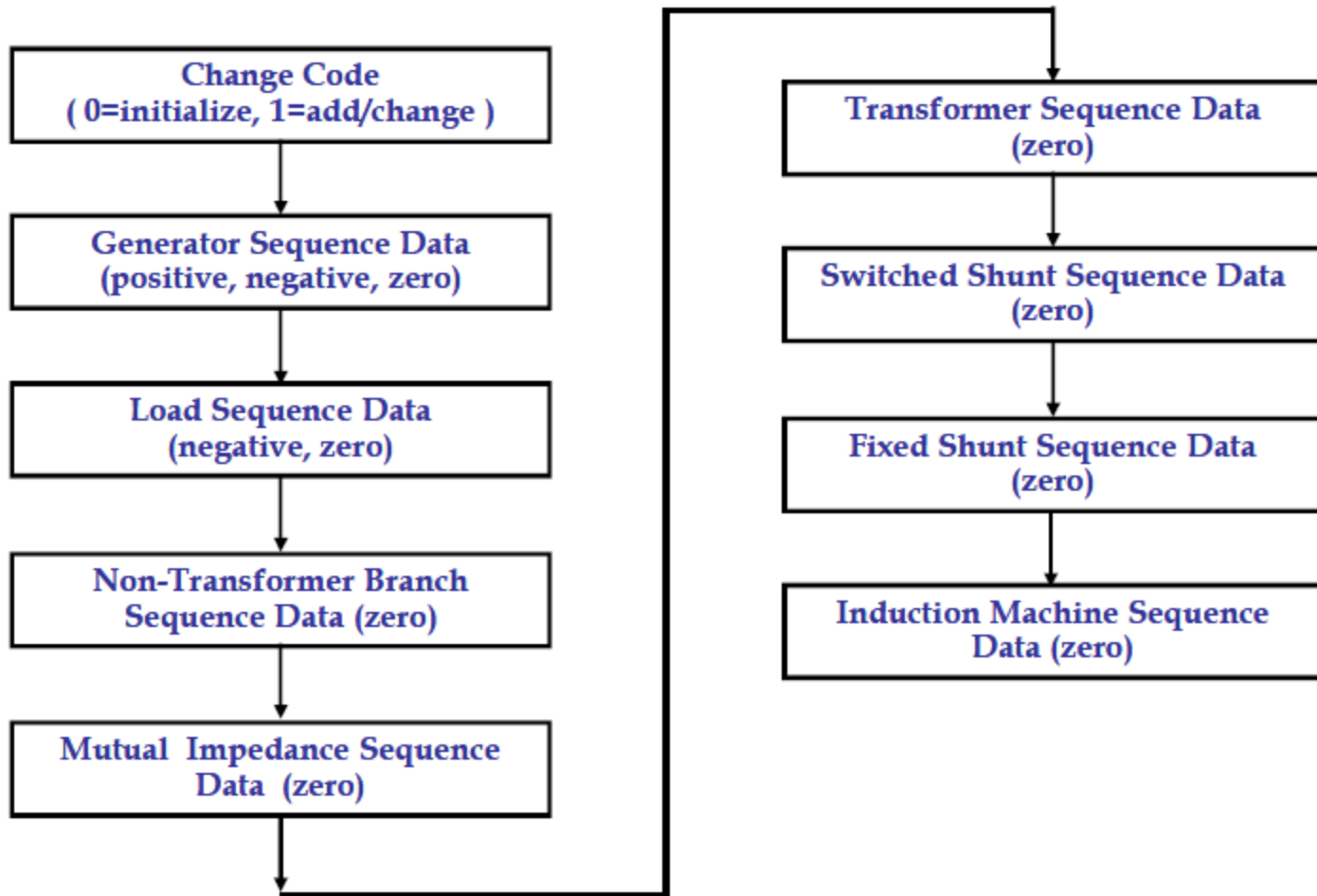
Source : PSSE 34.2 PAG-1

Assumptions in modeling of negative and zero sequence networks

- All branches (lines & transformers) have the same impedance, charging and line shunts in the negative sequence as in the positive.
- All transformers have phase shift in the negative sequence equal and opposite to that in the positive sequence.
- All zero sequence branches and shunts are assumed to have infinite impedance, unless a different value is entered specifically.
- All loads are represented by the same shunt admittance in the negative sequence as in the positive, unless a different value is entered for negative sequence specifically.
- Loads are open circuits in the zero sequence unless represented specifically by entry of a value for zero sequence shunt admittance.
- User appends negative and zero sequence data to the Power Flow Model. Data is saved and retrieved with SAVE and CASE.
- DC and FACTS devices are assumed either as a load or blocked. The default option is blocked, and thus they are ignored.

Source : PSSE 34.2 PAG-1

Fault Analysis Modeling



Source : PSSE 34.2 PAG-1

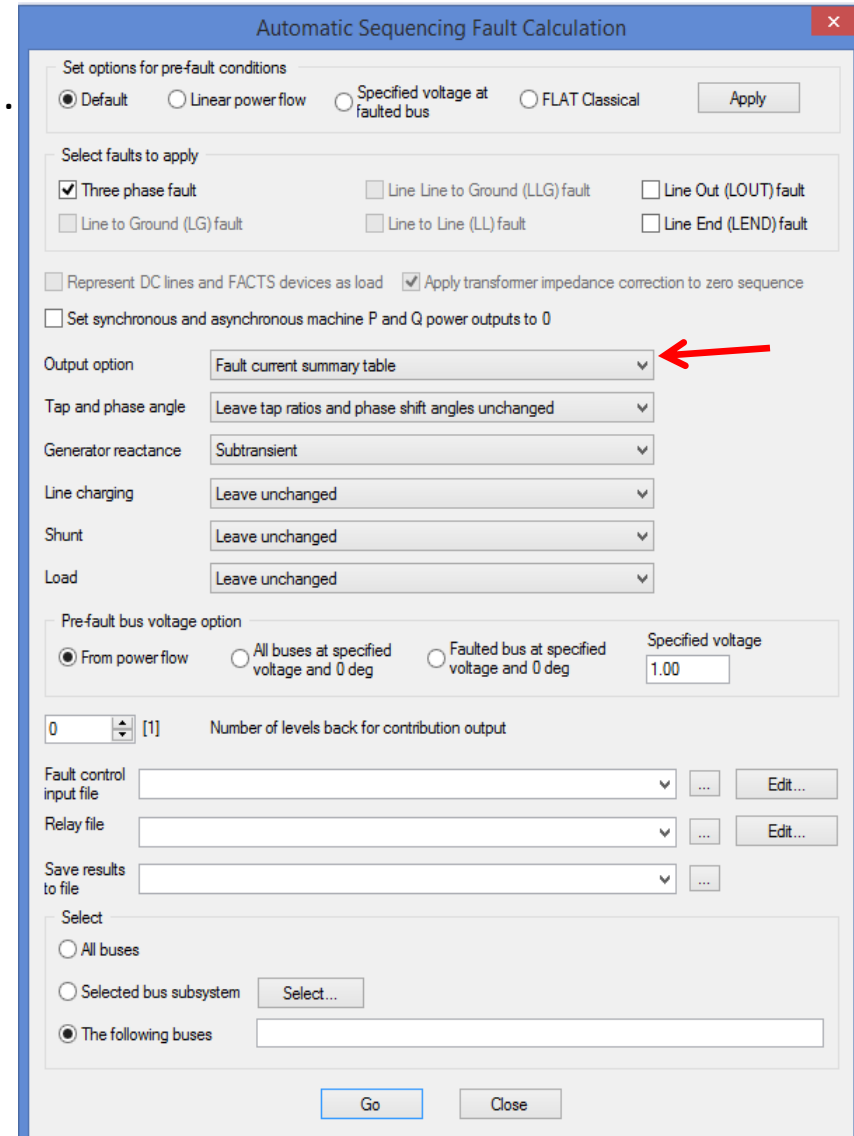
Automatic Sequencing Fault Analysis (ASCC)

Fault Options:

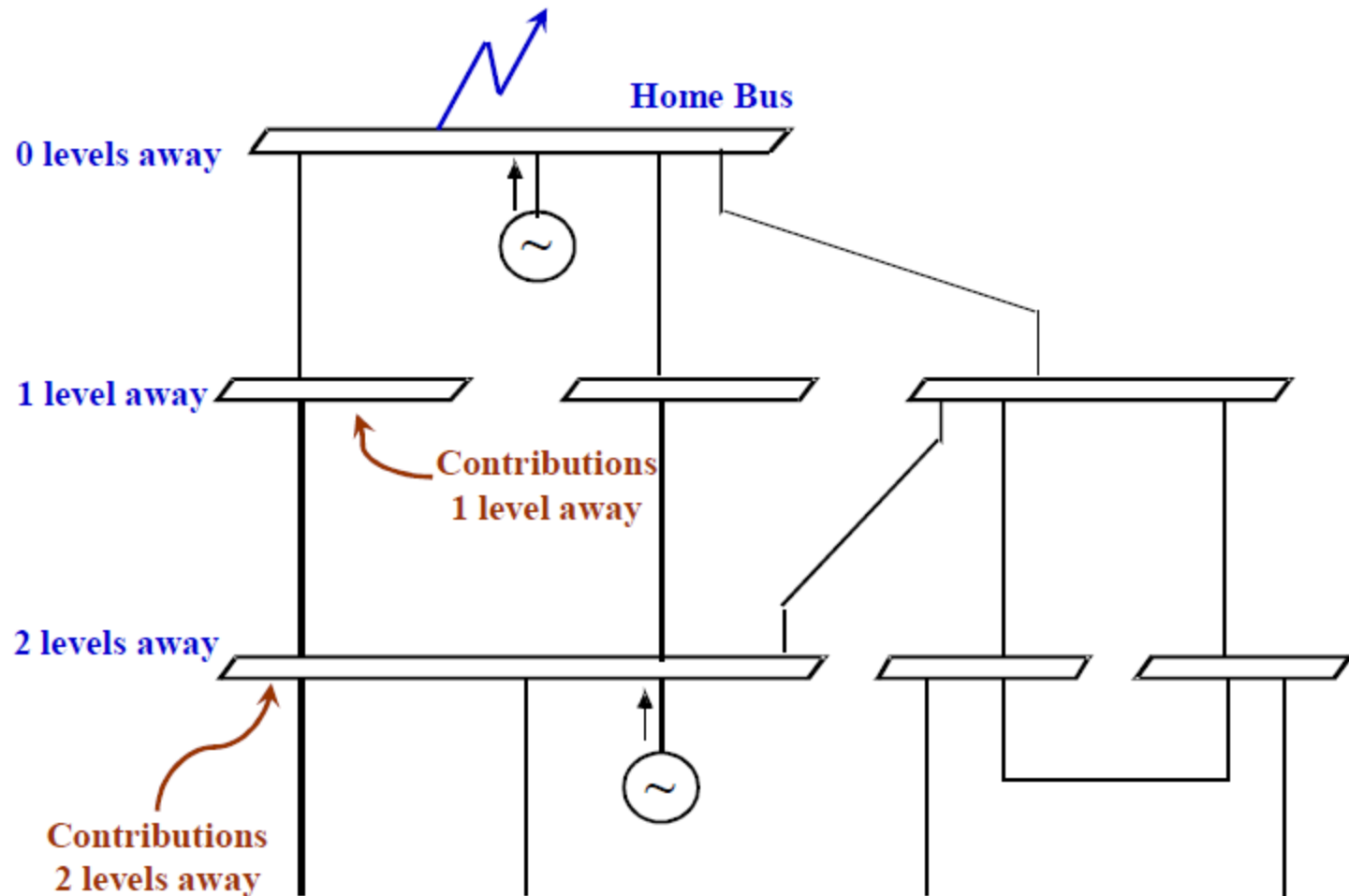
- Fault types: 3Ph, SLG, LLG, L-L, line out, line end.
- FLAT,CL pre-fault conditions, if desired
- Fault calculations with each branch connected to “faulted” bus in turn removed from service
- Fault calculations with far end of each branch connected to “faulted” bus in turn opened, and fault applied at line end location

Output Options:

- Outputs momentary symmetrical RMS fault current and branch current contributions up to N levels away from “faulted” bus
- Selection of Relay Output File containing summary of calculation for each fault.
- Fault current calculation carried out for:
 - All system buses
 - All buses of a selected bus subsystem
 - Individually selected buses



Bus And Branch Contribution References For ASCC



Source : PSSE 34.2 PAG-1

Balanced Switching

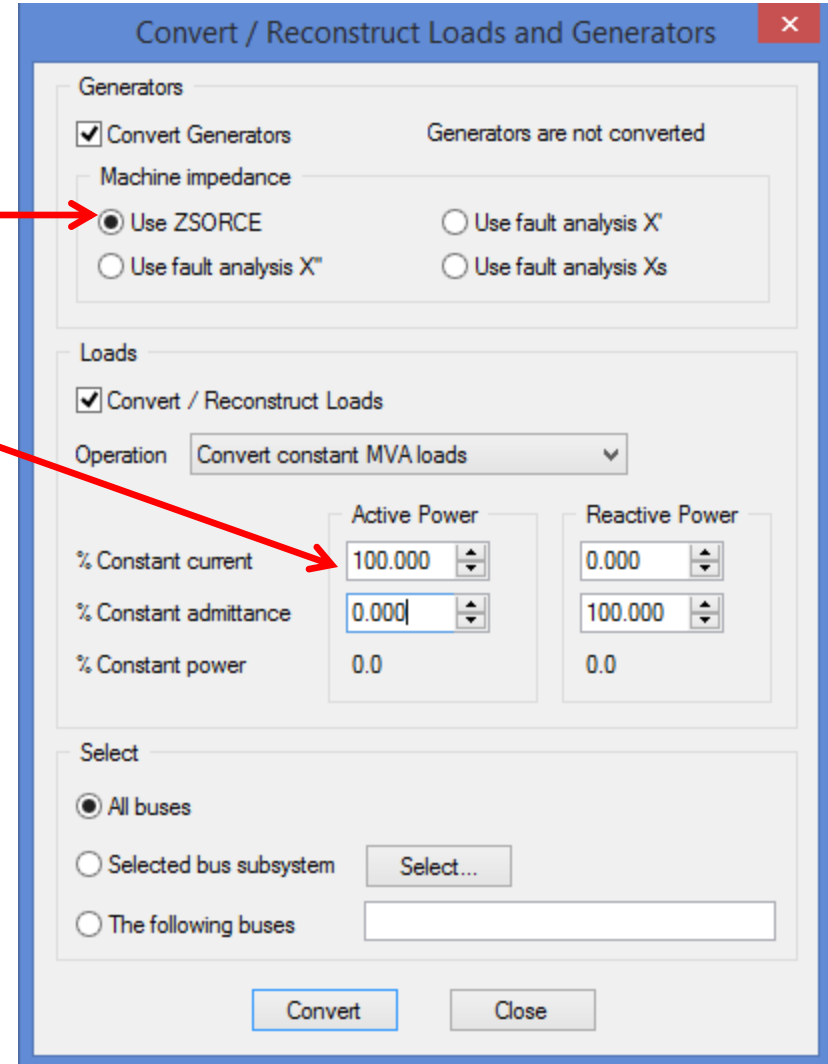
- Basic power flow model (positive sequence representation) allows the User to study the “instant” after a balanced switching event (T+).
- Analysis beyond the first “instant” requires detailed dynamic modeling data.
⇒ Dynamic Simulation Section of PSS®E.
- Unbalanced fault analysis requires negative and zero sequence modeling data.
⇒ Unbalanced Fault Analysis Section of PSS®E.

Source : PSSE 34.2 PAG-1

Balanced Switching Calculation

Steps to follow:

- Generator Conversion
- Load Conversion
- Solve pre-switching network
- Apply a fault
- Solve post-switching network
- View results



Convert / Reconstruct Loads and Generators

Generators

☒ Convert Generators Generators are not converted

Machine impedance

☒ Use ZSORCE ☐ Use fault analysis X'

☐ Use fault analysis X'' ☐ Use fault analysis Xs

Loads

☒ Convert / Reconstruct Loads

Operation: Convert constant MVA loads

Active Power

% Constant current: 100.000

% Constant admittance: 0.000

% Constant power: 0.0

Reactive Power

% Constant admittance: 100.000

% Constant power: 0.0

Select

☒ All buses

☐ Selected bus subsystem Select...

☐ The following buses

Convert Close

Source : PSSE 34.2 PAG-1

Steps to follow:

- Generator Conversion
- Load Conversion
- Solve pre-switching network
- Apply a fault
- Solve post-switching network
- View results

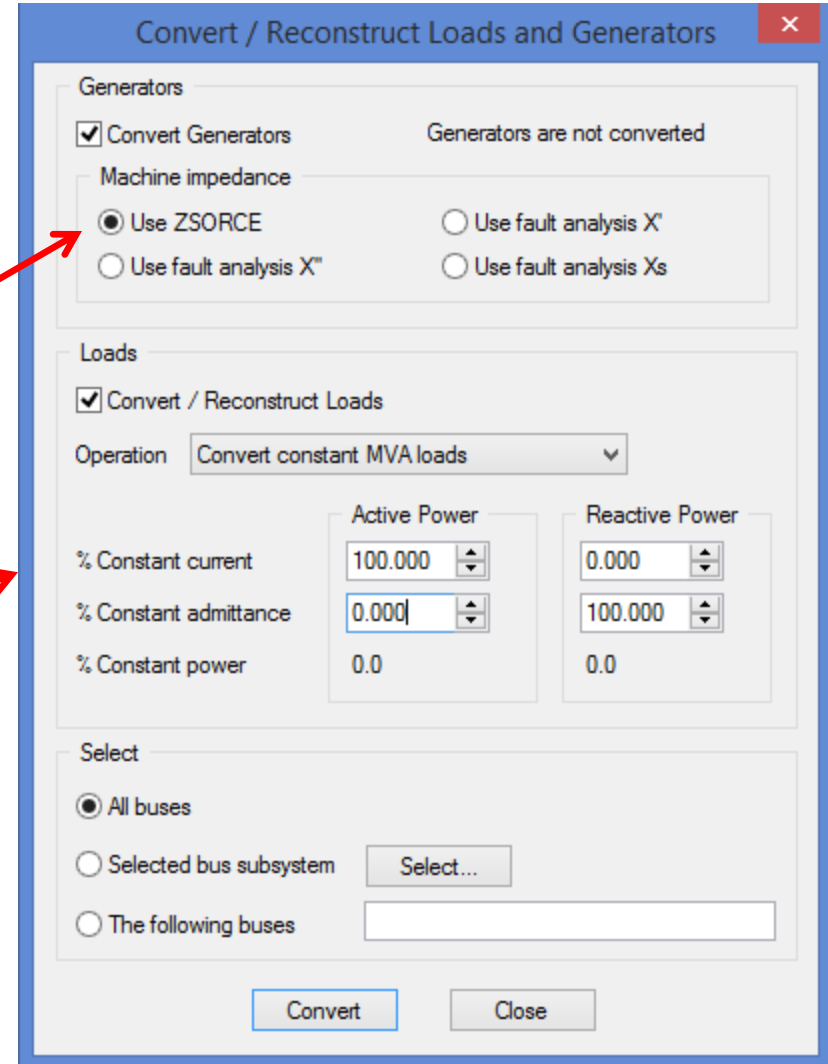
Source : PSSE 34.2 PAG-1

Balanced Switching Calculation...(2)

Generator and Load Conversion

Power Flow > Convert Loads and Generators

- Convert generators using ZSORCE machine impedance
- Convert loads using 100% constant current active power and 100% constant admittance reactive power



Convert / Reconstruct Loads and Generators

Generators

☒ Convert Generators Generators are not converted

Machine impedance

☒ Use ZSORCE ☐ Use fault analysis X'

☐ Use fault analysis X'' ☐ Use fault analysis Xs

Loads

☒ Convert / Reconstruct Loads

Operation: Convert constant MVA loads

	Active Power	Reactive Power
% Constant current	100.000	0.000
% Constant admittance	0.000	100.000
% Constant power	0.0	0.0

Select

☒ All buses

☐ Selected bus subsystem Select...

☐ The following buses

Convert Close

Source : PSSE 34.2 PAG-1

Solving the Pre-Switching Network

- Factorize admittance matrix (FACT)
[Power Flow > Solution > FACT]
- Solve for pre-switching (T -) network conditions (TYSL)
[Power Flow > Solution > TYSL]

Applying a Fault

- 3-Phase fault: Use Data Editor to apply a large shunt reactor at the bus (Approx. $-2E10$) to drive the voltage to zero.
- Voltage Rise (on open end of transmission line). Use Data Changing Activities (e.g., SPLT) to set up network for the opening of one end of a branch. Then use Data Editor to change branch status to simulate switching.

Solving the Post-Switching Network

- Factorize admittance matrix (FACT)
- Solve for pre-switching (T +) network conditions (TYSL)

Source : PSSE 34.2 PAG-1

Exercise

- Calculate the fault level of a bus (say bus number 404 in example case).
- Observe the voltage rise on switching the line in savcase (branch 202 to 404 in example case).

Source : PSSE 34.2 PAG-1

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Session IV : Data checking in PSSE

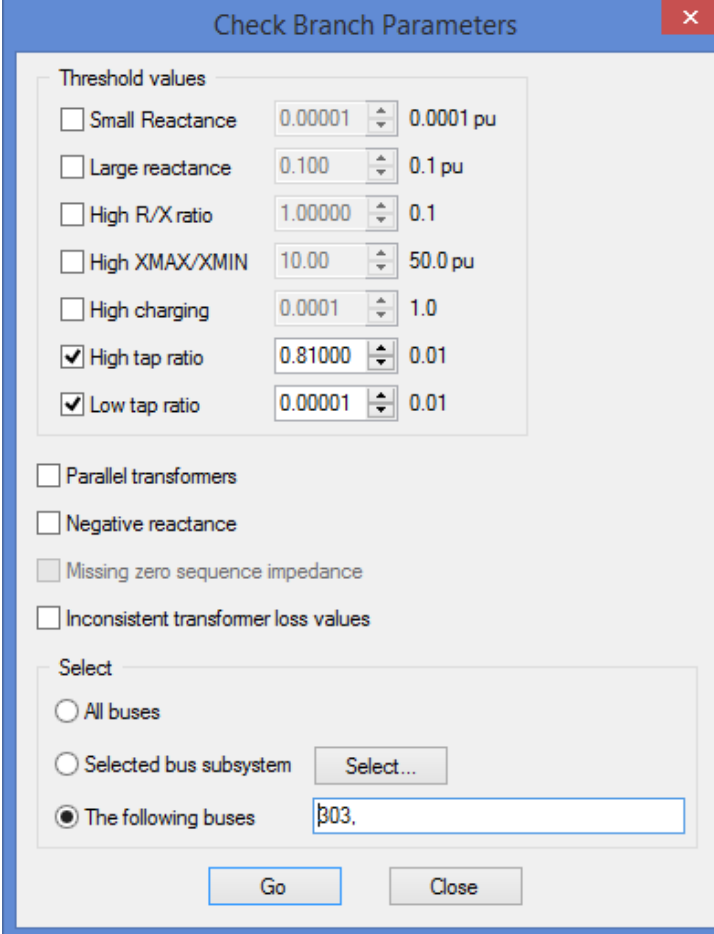
Day-2

**Thimphu, Bhutan
18th to 20th July 2018**

Branch Data Checking

Power Flow > Check Data > Branch Parameters (BRCH)

- Scans Working Case for “suspect” Branch Data.



Check Branch Parameters

Threshold values

☐ Small Reactance	0.00001	0.0001 pu
☐ Large reactance	0.100	0.1 pu
☐ High R/X ratio	1.00000	0.1
☐ High XMAX/XMIN	10.00	50.0 pu
☐ High charging	0.0001	1.0
☒ High tap ratio	0.81000	0.01
☒ Low tap ratio	0.00001	0.01

☐ Parallel transformers

☐ Negative reactance

☐ Missing zero sequence impedance

☐ Inconsistent transformer loss values

Select

☐ All buses

☐ Selected bus subsystem Select...

☒ The following buses 303.

Go Close

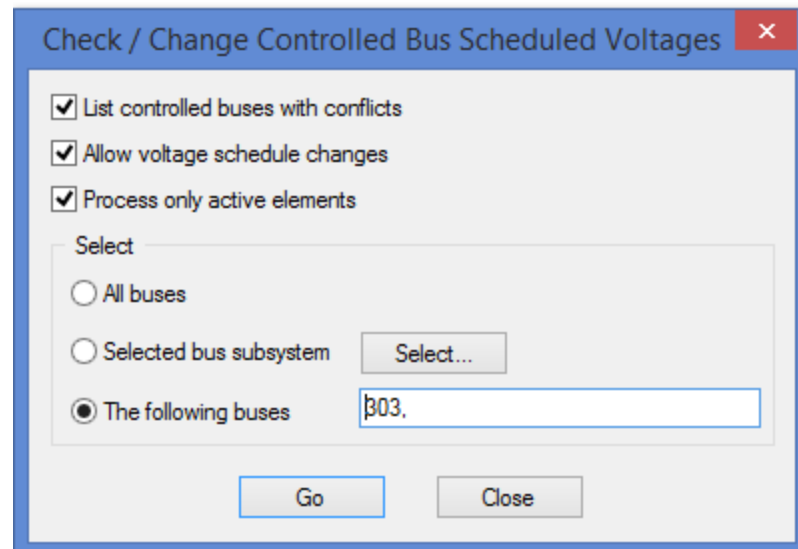
Source : PSSE 34.2 PAG-1

Data Checking....(2)

Scheduled Voltage Checking

Power Flow > Check Data > Check/Change Controlled Bus Scheduled Voltages (CNTB)

- Scans Working Case for conflicting voltage schedules.

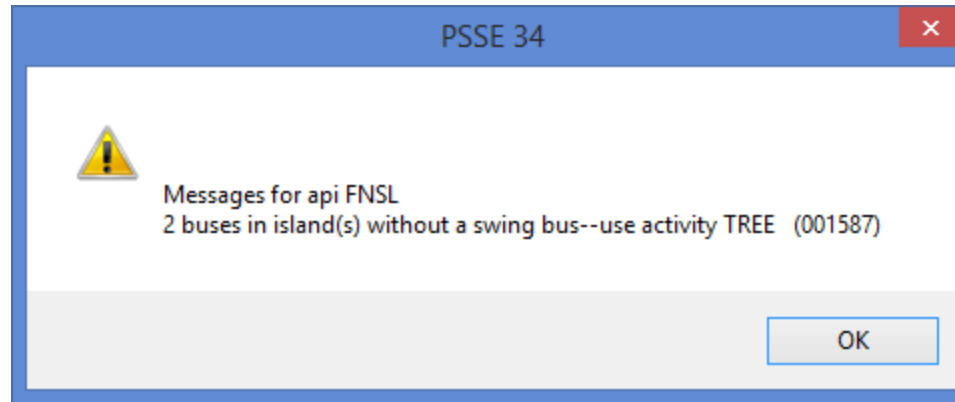


Source : PSSE 34.2 PAG-1

Finding the Buses Not Present in Swing Bus Tree (Islanded System)

Power Flow > Check Data > Buses not in swing bus tree (TREE)

- Finds out the islanded buses i.e. the buses not connected to swing bus.

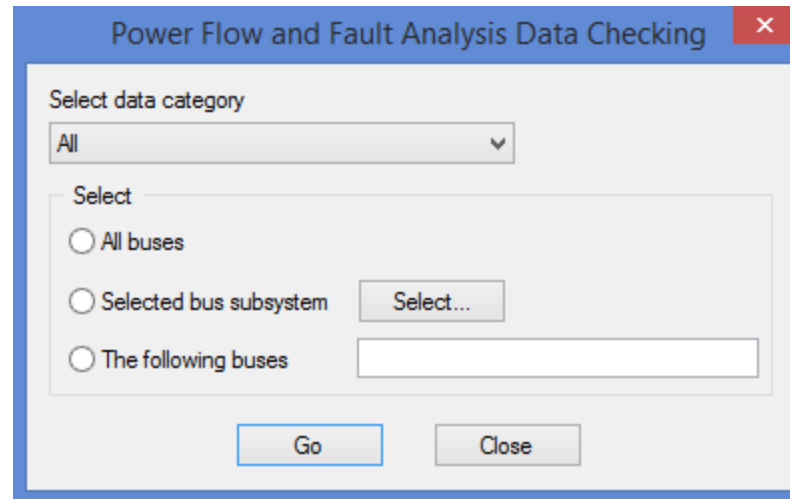


Source : PSSE 34.2 PAG-1

Data Checking Report

Power Flow > Check Data > Data checking report(TREE)

- Generates the data checking report.



Source : PSSE 34.2 PAG-1

Handling a Blown Up Power Flow Case

Steps to follow

- Try a new solution method:
 - Flat start
 - Ignore VAR limit
 - Non-divergent solution
- Check data:
 - Branch
 - Transformer
 - Conflicting voltage schedules (Generating plants)
 - Gentaps (unusual value)
 - Sudden inadvertent change in load or generation

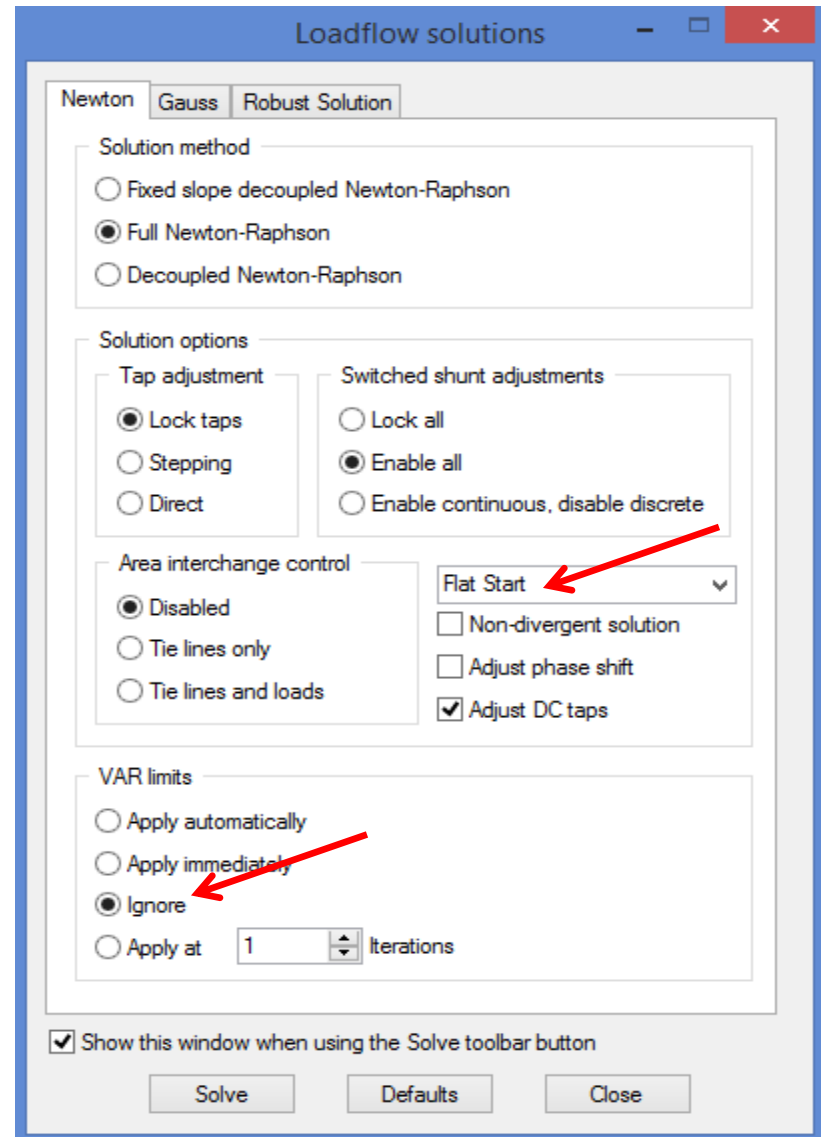
Output Bar									
4	30.9971 (	202	)	20.4219 (	404	)	0.99000 (	101	)
							1.85545 (	505	)
5	6.3091 (	505	)	1.7107 (	404	)	0.79595 (	505	)
							0.78823 (	101	)
							0.99000 (	505	)
							3.19309 (	505	)
Blown up after 6 iterations									
Largest mismatch: 239.05 MW 207.27 Mvar 316.40 MVA at bus 202 [STEAM1 220.00]									
System total absolute mismatch: 664.57 MVA									
SWING BUS SUMMARY:									
BUS#-SCT	X--	NAME	--X	BASKV	PGEN	PMAX	PMIN	QGEN	QMAX
303		HYDRO		21.000	68.5*	46.0	0.0	114.0*	20.0
									QMIN
									0.0

Source : PSSE 34.2 PAG-1

Handling a Blown Up Power Flow Case...(2)

Use Flat Start and Ignore Var limits

- Flat start is a fresh solution point which sets all voltages at PQ buses to unity and phase angles to zero.
- Generators can inject or absorb as much Var as needed to maintain the voltage by ignoring the Var limits.



Loadflow solutions

Newton Gauss Robust Solution

Solution method

☐ Fixed slope decoupled Newton-Raphson

☒ Full Newton-Raphson

☐ Decoupled Newton-Raphson

Solution options

Tap adjustment

☒ Lock taps

☐ Stepping

☐ Direct

Switched shunt adjustments

☐ Lock all

☒ Enable all

☐ Enable continuous, disable discrete

Area interchange control

☒ Disabled

☐ Tie lines only

☐ Tie lines and loads

Flat Start

☐ Non-divergent solution

☐ Adjust phase shift

☒ Adjust DC taps

VAR limits

☐ Apply automatically

☐ Apply immediately

☒ Ignore

☐ Apply at 1 iterations

☒ Show this window when using the Solve toolbar button

Solve Defaults Close

Source : PSSE 34.2 PAG-1

Exercise

- Make a blown up example case to converge.
- Familiarization with typical problems in large cases

Source : PSSE 34.2 PAG-1

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Session V : Contingency Analysis

Day-2

**Thimphu, Bhutan
18th to 20th July 2018**

Contingency Analysis options

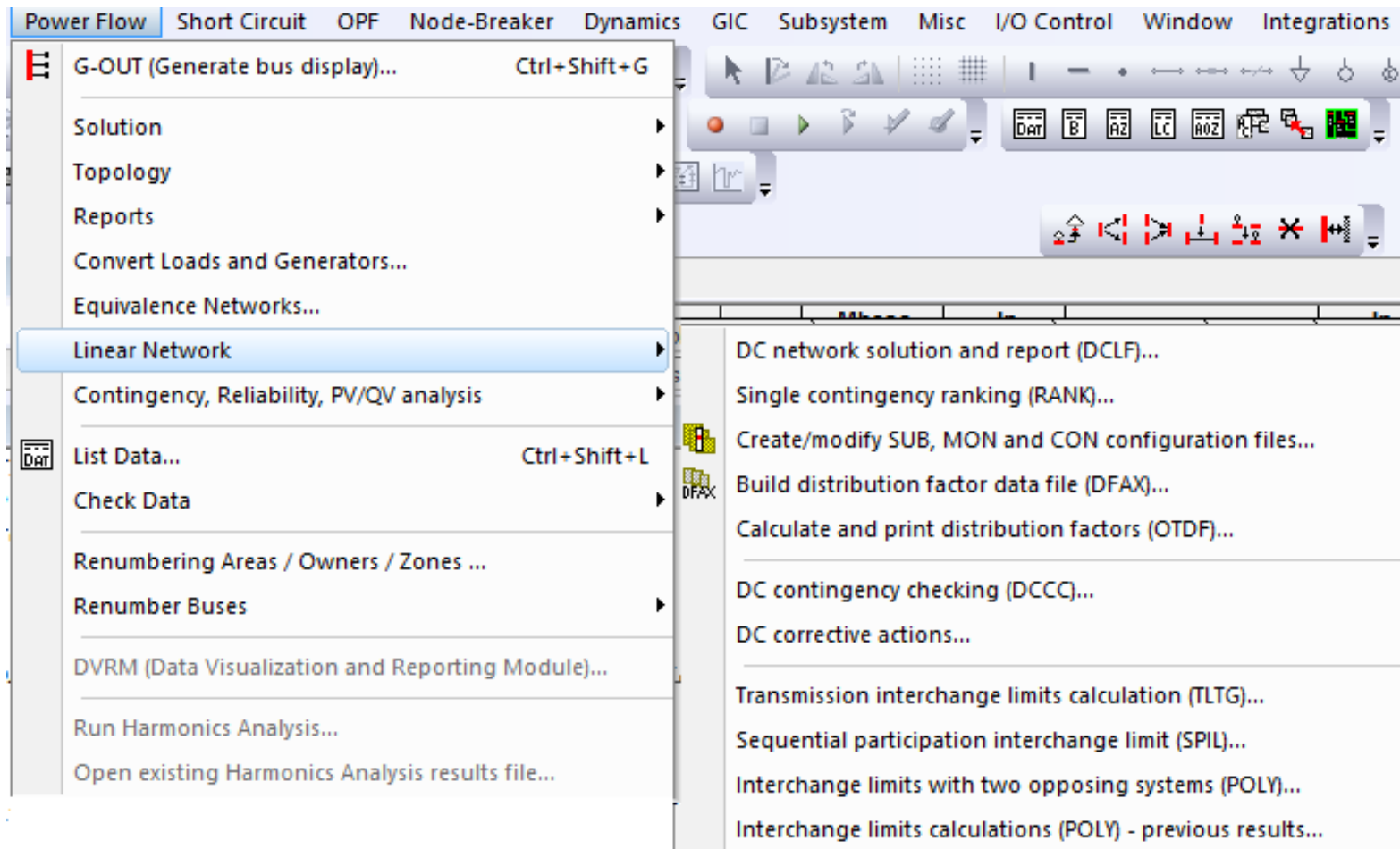
1) Fast Contingency Analysis:

- DFAX : Distribution Factor Calculation
- RANK : Contingency Ranking
- OTDF : Outage Distribution Factor Reporting
- ACCC : Contingency Checking (AC Power Flow)

2) Transfer Limits calculation:

- TLTG : Transfer Limit Analysis (One opposing system)
- SPIL : TLTG with sequential participation of generators
- POLY : Transfer Limit Analysis (Two opposing systems)

Contingency Analysis in PSSE

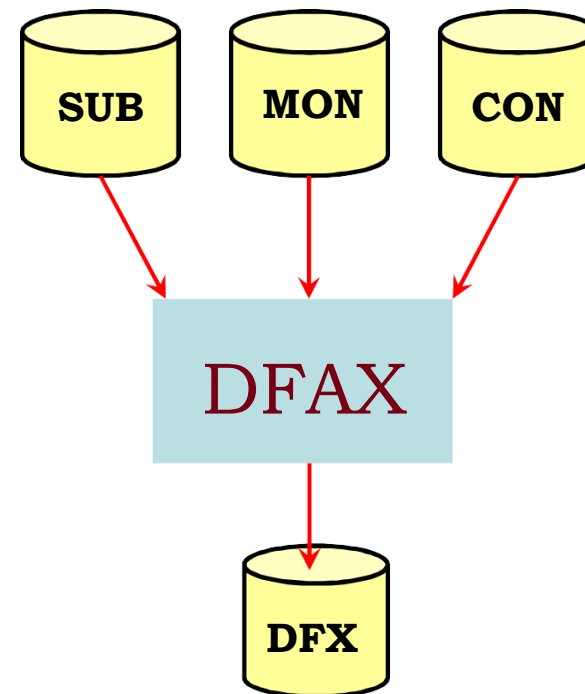


Linearized power flow for Contingency Analysis

- Approximation to conventional non-linear problem which provides an estimate of the branch real power flows.
- Considerable speed advantage over non-linear solution.
 - Useful for processing many solutions and screening contingency cases on thermal overload.
- Used by PSS/E for different contingency analysis functions like RANK, TLTG, POLY etc.

Activity DFAX

- (*Power Flow > Linear Network > DFAX*)
- Processes information from:
 - Subsystem Description File
 - Monitored Element Description File
 - Contingency Description File



Creating Sub, Mon, Con files

Configuration File Builder

Files to create/modify

☒ Create/modify SUB
☐ Create/modify MON
☐ Create/modify CON

Subsystem Description Data file

☒ Append Subsystem description to existing file

Subsystem name

Select bus subsystem

Subsystem description file

Monitored Element Data file

☒ Append Monitored elements to existing file

☒ Bus voltage range

Vmin
Vmax

☐ Bus voltage deviation

Drop
Rise

☐ All branch flows
☐ All tie-line flows

Monitored element file

Contingency Description Data file

☒ Append Contingency descriptions to existing file

☒ Single contingency
☐ Double contingency

☐ Bus-double contingency
☐ Parallel circuit contingency

☐ Include tie-lines

Contingency description data file

A set of buses may be excluded from a subsystem with the following data records:

SKIP BUS WITH [IN-SERVICE]	LOAD	LESS	r	MW
	GENERATION	GREATER		MVAR
	GENUPLIMIT			MVA
	GENLOWLIMIT			
	SHUNT			

Contingency Description File Contents

```
savnw - Notepad
File Edit Format View Help
CONTINGENCY TRIP1NUCLEAR
REMOVE UNIT 1 FROM BUS 101
END
CONTINGENCY TRIP2NUCLEAR
REMOVE UNIT 1 FROM BUS 101
REMOVE UNIT 1 FROM BUS 102
END
CONTINGENCY ADDLARGELOAD
INCREASE BUS 154 LOAD BY 50 PERCENT
END
CONTINGENCY LOSEWESTGEN
REMOVE UNIT 1 FROM BUS 3018
END
CONTINGENCY LOSEWESTBIGT
TRIP LINE FROM BUS 3004 TO BUS 152
END
CONTINGENCY LOSEEASTBIGT
TRIP LINE FROM BUS 151 TO BUS 201
END
CONTINGENCY LOSEEASTLOAD
SET BUS 205 LOAD TO 0 MW
END
CONTINGENCY LOSE2LINESWE
TRIP LINE FROM BUS 3004 TO BUS 152
TRIP LINE FROM BUS 3006 TO BUS 153
END
CONTINGENCY LOSE2LINEEA
TRIP LINE FROM BUS 151 TO BUS 201
TRIP LINE FROM BUS 152 TO BUS 202
END
CONTINGENCY XFMR204-205
DISCONNECT BRANCH FROM BUS 204 TO BUS 205
END
END
```

Monitored Element File Contents

File Edit Format View Help

MONITOR BRANCHES

3004 152

3006 153

3008 154

201 151

202 152

203 154

205 154

3001 3002

3004 3005

3005 3008

3008 3018

END

MONITOR INTERFACE WEST RATING 200 MW

3004 152

3006 153

3008 154

END

MONITOR INTERFACE EAST RATING 350 MW

201 151

202 152

203 154

205 154

END

MONITOR VOLTAGE RANGE BUS 3001 0.95 1.05

MONITOR VOLTAGE RANGE AREA 2 0.94 1.06

MONITOR VOLTAGE DEVIATION ZONE 5 0.06 0.055

END

Activity DFAX...(1)

×

Build Distribution Factor Data File

Input files

Subsystem definition file

C:\Users\NLDCPSSE3\Documents\PTI\PSSE34\EXAMPLE\savnw.sub

...

Edit...

Monitored element file

C:\Users\NLDCPSSE3\Documents\PTI\PSSE34\EXAMPLE\savnw.mon

...

Edit...

Contingency description file

C:\Users\NLDCPSSE3\Documents\PTI\PSSE34\EXAMPLE\savnw.con

...

Edit...

☒ Sort Monitored elements for reporting

☐ Monitor out-of-service lines

Prepare file for use with

AC and/or DC analysis

▼

Distribution factor output file

C:\Users\NLDCPSSE3\Documents\PTI\PSSE34\EXAMPLE\Run1

▼

...

OK

Cancel

Activity RANK

Single Contingency Ranking

MW mismatch tolerance

Small reactance threshold

☒ Allow ties from subsystem as contingency

Overload contingencies

Number of branch contingencies in file

Number of mach. contingencies in file

Contingency case rating

Percent of rating

☐ Convert ratings to estimate MW ratings

Island contingencies

☐ Include contingencies creating swingless islands

MW threshold to include island contingencies

Voltage contingencies

Number of contingencies in file

Lines, used in voltage ranker PI

☐ Only with non-zero rating

☒ All

Files

Subsystem description

Monitored element description

Contingency output

Select

☒ All buses

☐ Selected bus subsystem

☐ The following buses

In the overload ranker, the performance index, PI, is defined as:

$$PI = \sum_{i=1}^L \left(\frac{P_i}{P_{MAX_i}} \right)^2$$

where:

P_i Is the active power flow on branch i.

P_{MAX_i} Is the rating of branch i.

L Is the set of monitored branches contributing to PI.

In the voltage ranker, the performance index is defined as:

$$PI = \sum_{i=1}^L X_i P_i^2$$

where:

X_i Is the reactance of branch i.

P_i Is the active power flow on branch i.

L Is the set of monitored branches contributing to PI.

```

classTest - Notepad
File Edit Format View Help
CONTINGENCY 'OVRLOD 152-153(1)'
OPEN LINE FROM BUS 152 TO BUS 153 CKT 1 / PI= 4.8284 'MID500 500.00' TO 'MID230
END
CONTINGENCY 'OVRLOD 154-205(1)'
OPEN LINE FROM BUS 154 TO BUS 205 CKT 1 / PI= 2.7108 'DOWNTN 230.00' TO 'SUB230
END
CONTINGENCY 'OVRLOD 151-152(1)'
OPEN LINE FROM BUS 151 TO BUS 152 CKT 1 / PI= 2.4744 'NUCPANT 500.00' TO 'MID500
END
CONTINGENCY 'OVRLOD 153-154(1)'
OPEN LINE FROM BUS 153 TO BUS 154 CKT 1 / PI= 2.2882 'MID230 230.00' TO 'DOWNTN
END
CONTINGENCY 'OVRLOD 153-154(2)'
OPEN LINE FROM BUS 153 TO BUS 154 CKT 2 / PI= 2.1225 'MID230 230.00' TO 'DOWNTN
END
CONTINGENCY 'OVRLOD 152-3004(1)'
OPEN LINE FROM BUS 152 TO BUS 3004 CKT 1 / PI= 1.8485 'MID500 500.00' TO 'WEST
END
CONTINGENCY 'OVRLOD 3004-3005(1)'
OPEN LINE FROM BUS 3004 TO BUS 3005 CKT 1 / PI= 1.8278 'WEST 500.00' TO 'WEST
END
CONTINGENCY 'OVRLOD 3005-3007(1)'
OPEN LINE FROM BUS 3005 TO BUS 3007 CKT 1 / PI= 1.8045 'WEST 230.00' TO 'RURAL
END
CONTINGENCY 'OVRLOD 3005-3008(1)'
OPEN LINE FROM BUS 3005 TO BUS 3008 CKT 1 / PI= 1.6806 'WEST 230.00' TO 'CATDOG
END
CONTINGENCY 'OVRLOD 154-3008(1)'
OPEN LINE FROM BUS 154 TO BUS 3008 CKT 1 / PI= 1.6733 'DOWNTN 230.00' TO 'CATDOG
END

CONTINGENCY 'VLTAGE 201-204(1)'
OPEN LINE FROM BUS 201 TO BUS 204 CKT 1 / PI= 10.6590 'HYDRO 500.00' TO 'SUB500
END

```

Activity TLTG

Transmission Interchange Limits Calculation

Distribution factor data file
Run1.dfx
DFAX...

Initial condition mismatch

☒ Abort if MW mismatch exceeds tolerance

MW mismatch tolerance
0.10
0.1

Subsystem selection

Study system
CTRLAR_BASE

Opposing system
CTRLAR_CON

Solution options

Base case rating
2 (RATING SET)

Contingency case rating
2 (RATING SET)

Percent of rating
95
10

☒ Convert ratings to estimated MW ratings

Line flow code
AC base case

Phase shifter in base case
Lock

Base case constraints in contingency cases
Ignore

☒ Add study system ties to monitored lines

Minimum contingency case pre-shift flow change
5.00
1

Minimum contingency case distribution factor change
100.0000
0.005

Study system generation shift
50
10

Summary table output options

Maximum import / export
1000
100

Minimum distribution factor magnitude
100.0000
0.005

Maximum time report same element
10
1

Contingency descriptions
Labels and events

Output options

☐ List study system buses

☒ List opposing system buses

☐ List study system tie lines

Output code
Summary

Interchange limit output
Incremental

Elements in flow tables
100
10

☐ Apply summary minimum distribution factor to report

Optional interface output

Interface 1
None
Interface 3
None
Interface 5
None
Interface 2
None
Interface 4
None
Interface 6
None

OK
Cancel

Thank You !!