
LAB5 – MULTIPLE ACCC REPORT
WESTERN AREA POWER ADMINISTRATION

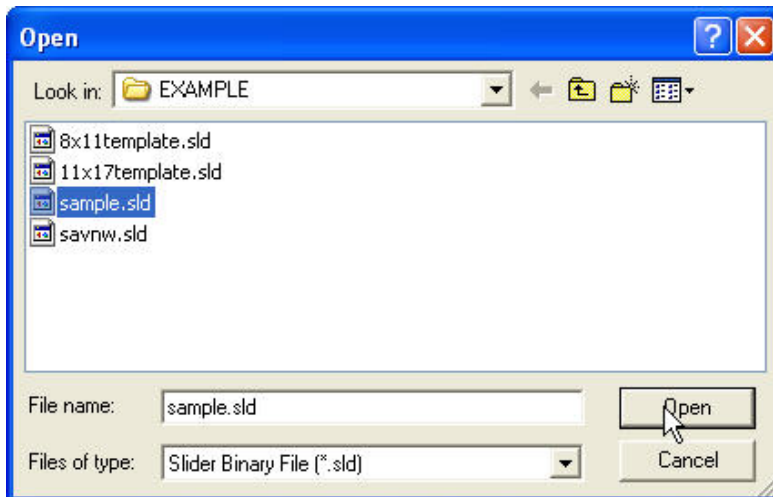
Lab5 – Multiple ACCC Report

PURPOSE: The purpose of this lab is to gain an understanding of how to modify the contingency file, monitor file, and the subsystem files previously introduced in lab 4. This lab will explain how the Multiple AC Contingency calculation report feature of PSS/E creates a single report with multiple ACCCs into one file. This lab will introduce the following aspects:

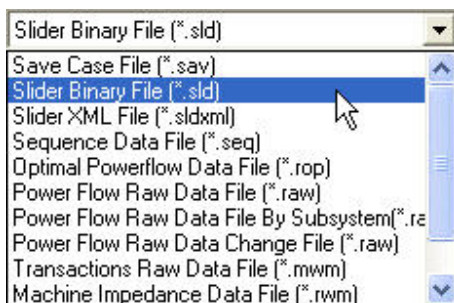
- Modify contingency file (*.con)
- Modify monitor file (*.mon)
- Modify subsystem file (*.sub)
- ACCC
- Multiple AC contingency calculation report

To properly perform this lab, start PSS/E and open the sample.sav file. Refer to Lab 1 on how to do this.

Open the sample.sld slider file included with PSS/E.

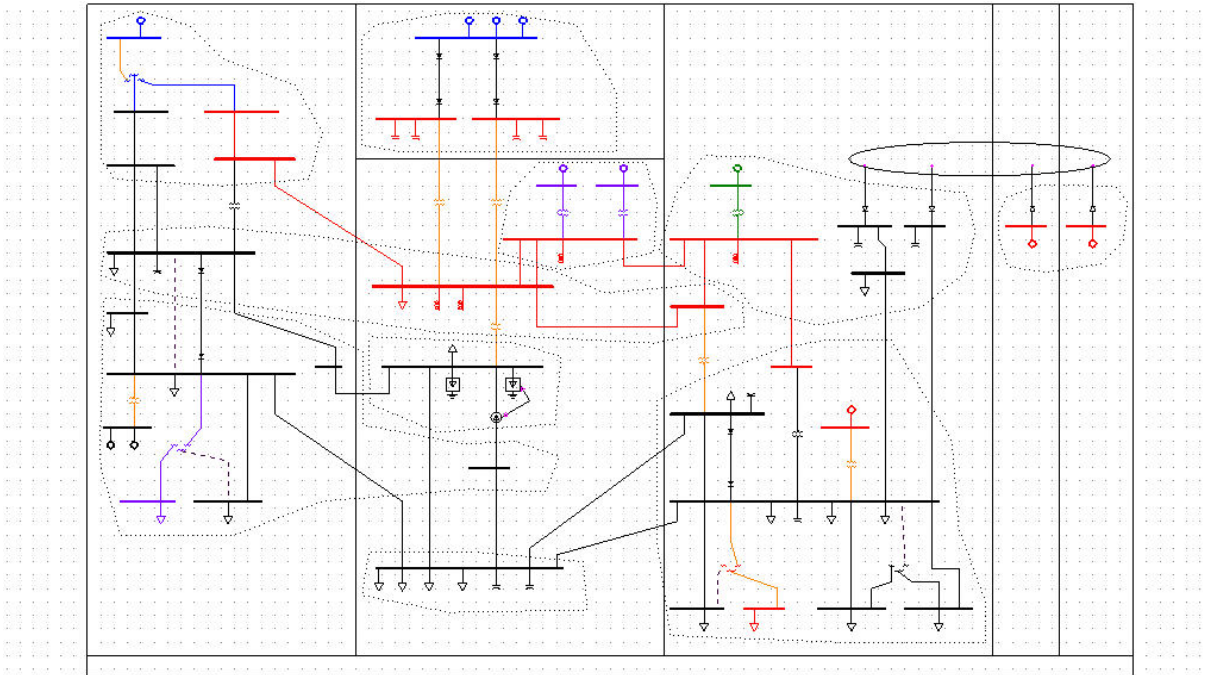


Make sure to select “Slider Binary File (*.sld)” file in the Files of type: drop down menu.



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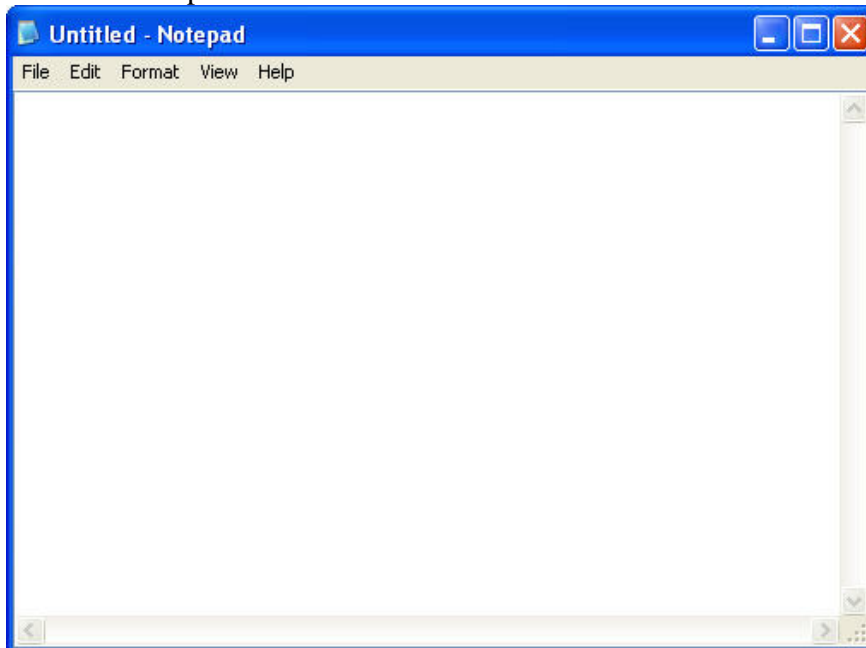
The sample.sld slider file provided is shown below:



This slider file illustrates the sample grid broken up into 9 zones. The zones are shown within the dotted lines. From this point a *.con, *.mon and *.sub file need to be created for each zone to create an ACCC output file for that zone. The ACCC output files can then be implemented in a multiple AC contingency calculation report.

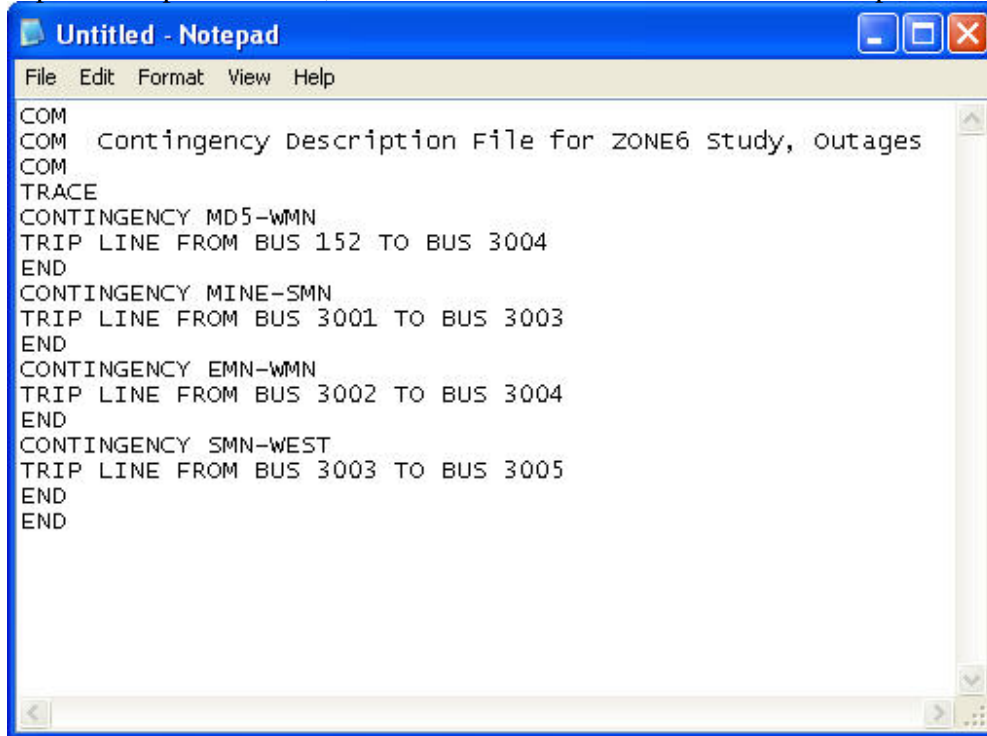
The *.con, *.mon and *.sub files were explained in lab 4, and can be referred to if needed. These files are created and edited in notepad then saved as their specified file types.

Open a blank notepad document



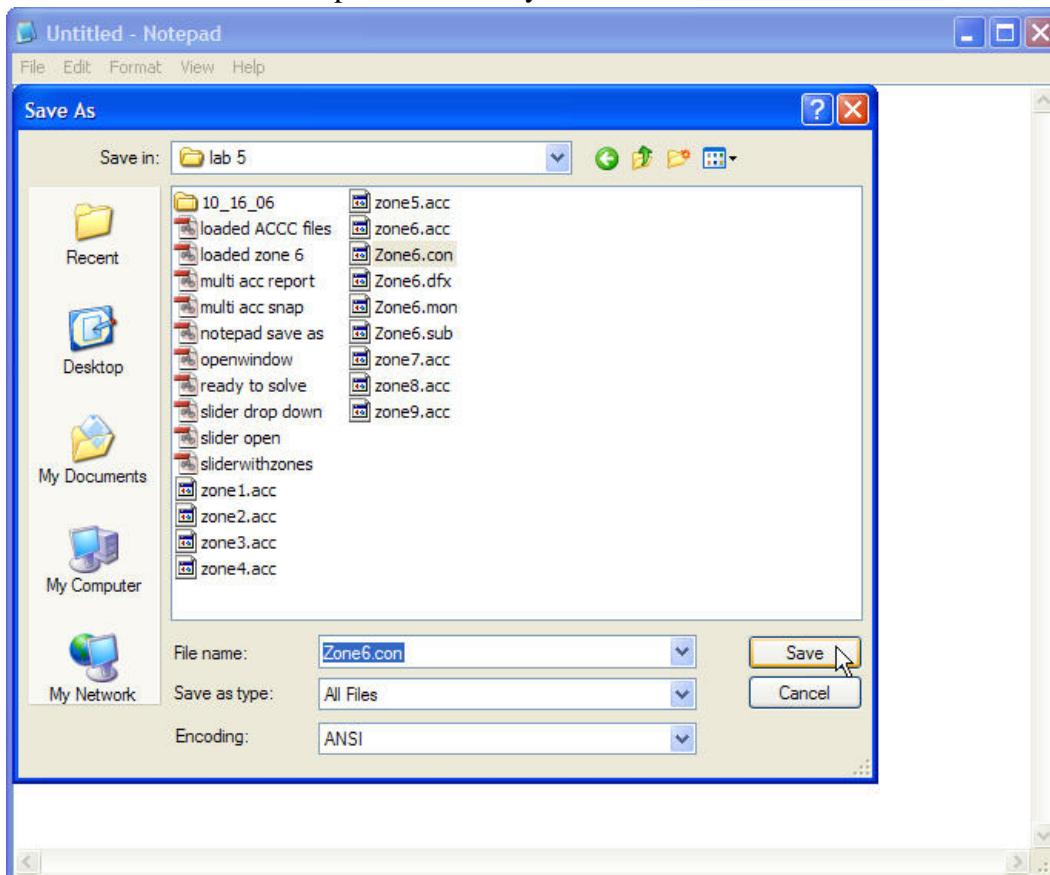
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Complete the specific *.con, *.mon & *.sub files. The Zone6.con file is provided as an example.



```
COM
COM Contingency Description File for ZONE6 study, outages
COM
TRACE
CONTINGENCY MD5-WMN
TRIP LINE FROM BUS 152 TO BUS 3004
END
CONTINGENCY MINE-SMN
TRIP LINE FROM BUS 3001 TO BUS 3003
END
CONTINGENCY EMN-WMN
TRIP LINE FROM BUS 3002 TO BUS 3004
END
CONTINGENCY SMN-WEST
TRIP LINE FROM BUS 3003 TO BUS 3005
END
END
```

The Zone6.con file is completed and ready to be saved.

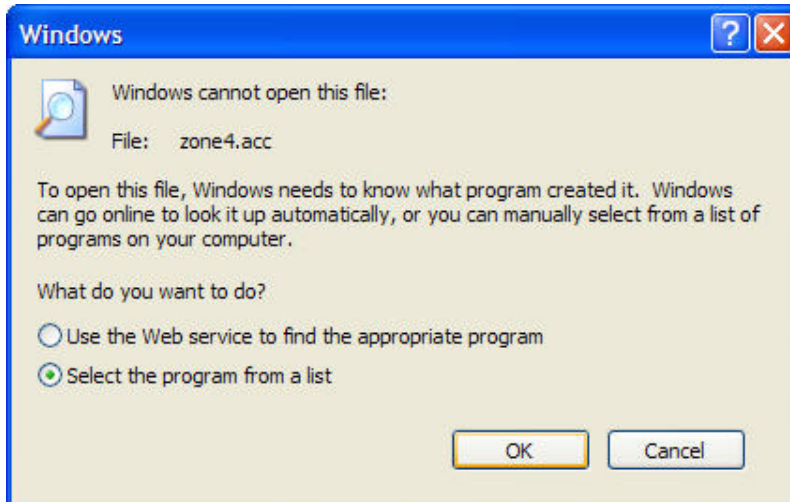


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Select All Files in the Save as type drop down menu, type in the name of the specific file and click save.

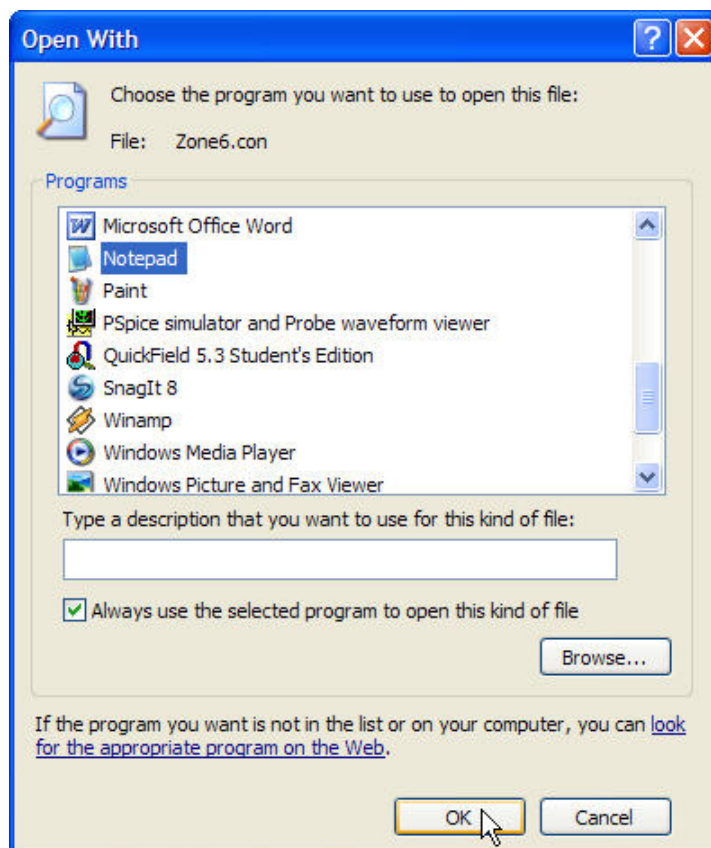
Examples of Zone6.con, zone6.mon and zone6.sub files are created in notepad, and provided.

Note: In order to edit *.con, *.mon and *.sub files notepad needs to be associated to the file types.



Double click on the *.con, *.mon or *.sub file, choose the “Select the program from a list” radial button and click OK.

The “Open With” window is displayed.



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Scroll down and select “Notepad” from the list of programs. Next, check the box next to “Always use the selected program to open this kind of file” and click OK. This will allow *.con, *.mon and *.sub files to be opened and edited in notepad by double clicking the files.

Single out zones

The easiest way to write the files is to find the “Create Bus Subsystem” button in the toolbar and click it. Then you will go to the “zones” tab and choose the desired zone and use the arrows provided to move it to the right side box. Now only the zones shown in the right side box will be shown in the sample.sav file and you can easily write the .con, .mon, and .sub files from this. To write the .con file you will trip every branch shown in the “branches tab” of the chosen zone. To determine buses to include in the .sub file you will include all buses in the “bus” tab of the chosen zone. For this method to work you must only have one zone chosen and placed in the right hand window at a time.

Modify contingency file (*.con)

Create the Zone#.con in notepad and save it. The Zone6.con file can be copied into notepad, edited and saved to the specific zone file as needed to help with the editing process. The zone6.con file is provided below as an example. In the contingency file we want to trip every Branch that connects two buses. In this lab we will ignore branches connecting transformers and such.

```
COM
COM Contingency Description File for ZONE6 Study, Outages
COM
TRACE
CONTINGENCY MD5-WMN
TRIP LINE FROM BUS 152 TO BUS 3004
END
CONTINGENCY MINE-SMN
TRIP LINE FROM BUS 3001 TO BUS 3003
END
CONTINGENCY EMN-WMN
TRIP LINE FROM BUS 3002 TO BUS 3004
END
CONTINGENCY SMN-WEST
TRIP LINE FROM BUS 3003 TO BUS 3005
END
END
```

Modify monitor file (*.mon)

Create the Zone#.mon in notepad and save it. The Zone6.mon file can be copied into notepad, edited and saved to the specific zone file as needed to help with the editing process. The zone6.mon file is provided below as an example. For this lab all .mon files will be the same except for the subsystem names. “ZONE#” will change for each subsystem obviously. The voltage ranges monitored is an industry standard as well as the deviation given below and therefore will remain the same for each zone throughout this lab.

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```

COM
COM Monitored Element Description File for ZONE6 Study, Outage
COM
MONITOR BRANCHES IN SUBSYSTEM ZONE6
MONITOR VOLTAGE RANGE SUBSYSTEM ZONE6 0.90 1.10
MONITOR VOLTAGE DEVIATION SUBSYSTEM ZONE6 0.5 0.5
END
END
    
```

The monitor interface ratings are taken from the branches tab of the sample.sav data file as shown below:

From Bus Number/Name	To Bus Number/Name	Id	Line R (pu)	Line X (pu)	Charging (pu)	In-Service	Metered	Rate A (MVA)	Rate B (MVA)	Rate C (MVA)	Line G From (pu)	Line G To (pu)
151 [NUCLPLNT 500.00]	152 [MID500 500.00]	1	0.00260	0.04600	3.50000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	1200.0	1100.0	1000.0	0.01000	-0.01000
151 [NUCLPLNT 500.00]	152 [MID500 500.00]	2	0.00261	0.04610	3.51000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	1205.0	1105.0	1005.0	0.01300	-0.01300
151 [NUCLPLNT 500.00]	201 [HYDRO 500.00]	1	0.00100	0.01500	1.20000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	1206.0	1106.0	1006.0	0.00000	0.00000
152 [MID500 500.00]	202 [EAST500 500.00]	1	0.00080	0.01000	0.95000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> From	1207.0	1107.0	1007.0	0.00000	0.00000
152 [MID500 500.00]	3004 [WEST 500.00]	1	0.00300	0.03000	2.50000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	0.0	0.0	0.0	0.00000	0.00000
153 [MID230 230.00]	154 [DOWNTN 230.00]	2	0.00600	0.05400	0.15000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	350.0	0.0	0.0	0.00000	0.00000
153 [MID230 230.00]	3006 [UPTOWN 230.00]	1	0.00000	0.00010	0.00000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	0.0	0.0	0.0	0.00000	0.00000
154 [DOWNTN 230.00]	155 [FACTS TE 230.00]	1	0.00500	0.04500	0.10000	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/> From	400.0	0.0	0.0	0.00000	0.00000
154 [DOWNTN 230.00]	203 [EAST230 230.00]	1	0.00400	0.04000	0.10000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	400.0	0.0	0.0	0.00000	0.00000
154 [DOWNTN 230.00]	205 [SUB230 230.00]	1	0.00033	0.00333	0.09000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	600.0	0.0	0.0	0.00000	0.00000
154 [DOWNTN 230.00]	3008 [CATDOG 230.00]	1	0.00270	0.02200	0.30000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	800.0	0.0	0.0	0.00000	0.00000
201 [HYDRO 500.00]	202 [EAST500 500.00]	1	0.00200	0.02500	2.00000	<input checked="" type="checkbox"/>	<input type="checkbox"/> From	1200.0	0.0	0.0	0.00000	0.00000

Modify subsystem file (*.sub)

Create the Zone#.sub in notepad and save it. The Zone6.sub file can be copied into notepad, edited and saved to the specific zone file as needed to help with the editing process. The zone6.sub file is provided below as an example. In order to complete the .sub file refer above to the single out zones section and make sure to include all buses in the “bus” tab of the chosen zone.

```

COM
COM System discription file for ZONE6 FLOW STUDY
COM
SUBSYSTEM ZONE6
BUS 3001
BUS 3002
BUS 3003
BUS 3004
BUS 3011
END
END
    
```

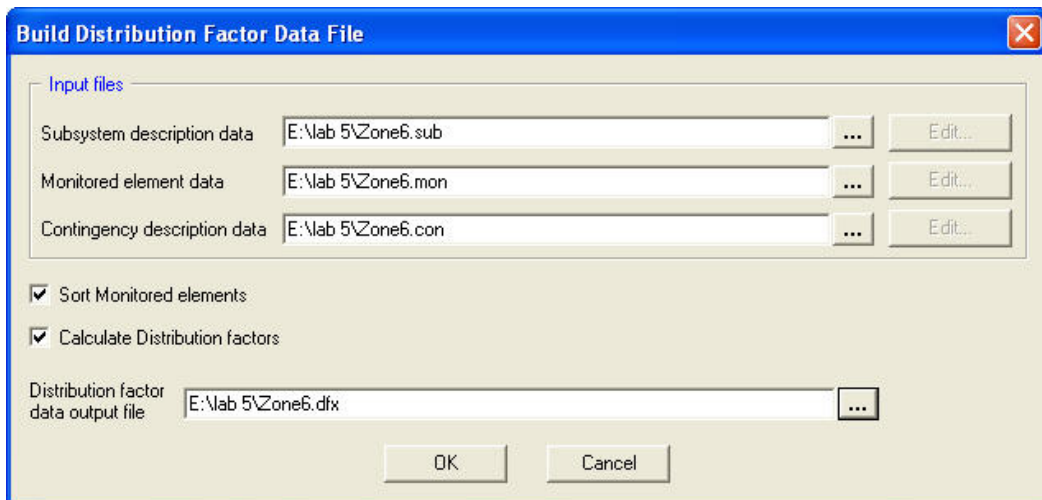
The buses tab below shows the zone Number/Name that each particular bus belongs too:

Bus Number	Bus Name	Base kV	Area Number/Name	Zone Number/Name	Owner Number/Name	Code	G-Shunt (MW)	B-Shunt (MVAR)	Voltage (pu)	Angle (deg)	G-leg (pu)	B-leg (pu)
101	NUC-A	21.6	1 CENTRAL	1 NORTH_A1	1 OWNER 1	2	0.00	0.00	1.0100	-10.87	0.00000	0.00000
102	NUC-B	21.6	1 CENTRAL	1 NORTH_A1	1 OWNER 1	2	0.00	0.00	1.0100	-11.22	0.00000	0.00000
151	NUCLPLNT	500.0	1 CENTRAL	1 NORTH_A1	1 OWNER 1	1	11.12	-600.00	1.0022	-14.01	0.00000	0.00000
152	MID500	500.0	1 CENTRAL	2 MID_A1_A2_A5	1 OWNER 1	1	1.63	50.00	1.0436	-23.85	0.00000	0.00000
153	MID230	230.0	1 CENTRAL	3 DISCNT_IN_A1	1 OWNER 1	1	0.00	0.00	1.0568	-25.59	0.00000	0.00000
154	DOWNTN	230.0	1 CENTRAL	3 DISCNT_IN_A1	1 OWNER 1	1	2.45	200.00	0.9917	-33.00	1.00240	0.00000
155	FACTS TE	230.0	1 CENTRAL	4 SOUTH_A1_A5	1 OWNER 1	1	0.00	0.00	1.0171	-24.15	0.00000	0.00000
201	HYDRO	500.0	2 EAST	7 NORTH_A2	2 OWNER 2	1	3.67	-500.00	0.9900	-19.17	0.99240	0.00000
202	EAST500	500.0	2 EAST	2 MID_A1_A2_A5	2 OWNER 2	1	0.00	0.00	1.0210	-26.11	0.00000	0.00000
203	EAST230	230.0	2 EAST	8 SOUTH_A2	2 OWNER 2	1	0.00	50.00	1.0000	-29.59	0.00000	0.00000
204	SUB500	500.0	2 EAST	8 SOUTH_A2	2 OWNER 2	1	0.00	0.00	1.0302	-31.39	0.00000	0.00000
205	SUB230	230.0	2 EAST	8 SOUTH_A2	2 OWNER 2	1	2.78	300.00	1.0000	-33.69	0.00000	0.00000

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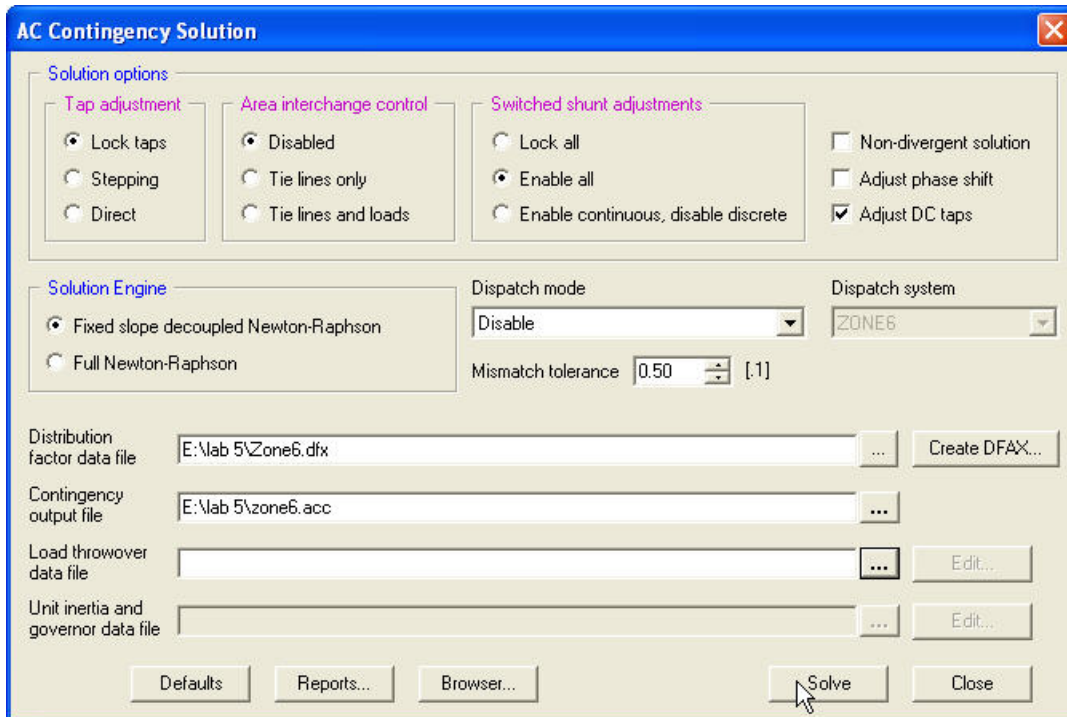
ACCC

An ACCC needs to be created for each zone. This is done after the *.con, *.mon and *.sub files for each zone are made. These are used to create the zone#.acc files required for the multiple AC contingency calculation report. The ACCC function of PSS/E was covered in lab 4 and should be referred to as needed. An example of what should be included when creating the Zone6.dfx file and Zone6.acc file is provided below:



The "Build Distribution Factor Data File" dialog box is used to specify input files and output for the distribution factor calculation. It includes the following fields and options:

- Input files:**
 - Subsystem description data: E:\lab 5\Zone6.sub
 - Monitored element data: E:\lab 5\Zone6.mon
 - Contingency description data: E:\lab 5\Zone6.con
- Sort Monitored elements
- Calculate Distribution factors
- Distribution factor data output file: E:\lab 5\Zone6.dfx
- Buttons: OK, Cancel



The "AC Contingency Solution" dialog box is used to configure the AC contingency solution. It includes the following sections and options:

- Solution options:**
 - Tap adjustment:** Lock taps, Stepping, Direct
 - Area interchange control:** Disabled, Tie lines only, Tie lines and loads
 - Switched shunt adjustments:** Lock all, Enable all, Enable continuous, disable discrete
 - Non-divergent solution
 - Adjust phase shift
 - Adjust DC taps
- Solution Engine:** Fixed slope decoupled Newton-Raphson, Full Newton-Raphson
- Dispatch mode:** Disable
- Dispatch system:** ZONE6
- Mismatch tolerance:** 0.50 [1]
- Distribution factor data file: E:\lab 5\Zone6.dfx (Create DFAX... button)
- Contingency output file: E:\lab 5\zone6.acc
- Load throwover data file: (Edit... button)
- Unit inertia and governor data file: (Edit... button)
- Buttons: Defaults, Reports..., Browser..., Solve, Close

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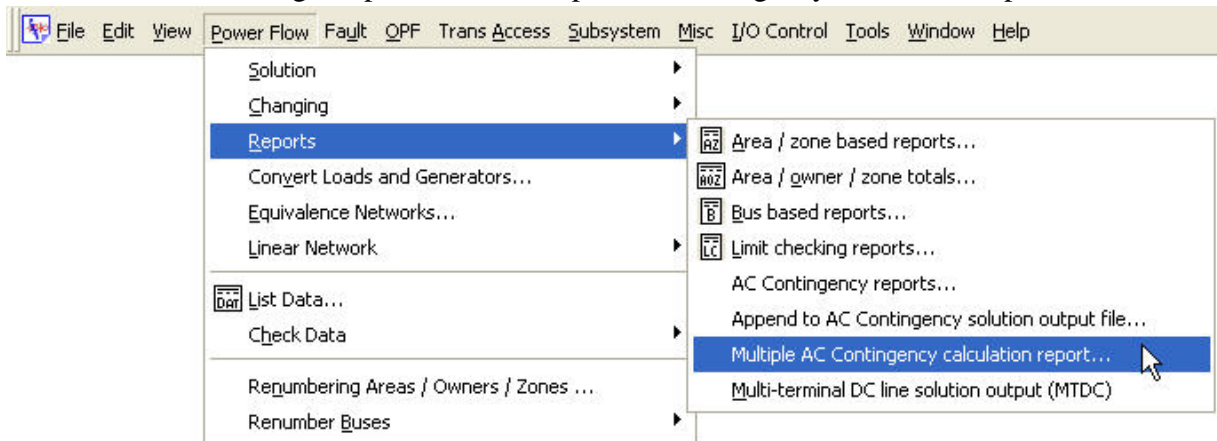
Click the “Solve” button to create the Zone#.acc output file.

Note: This process will need to be repeated for all 9 zones that are displayed in the sample.sld slider file.

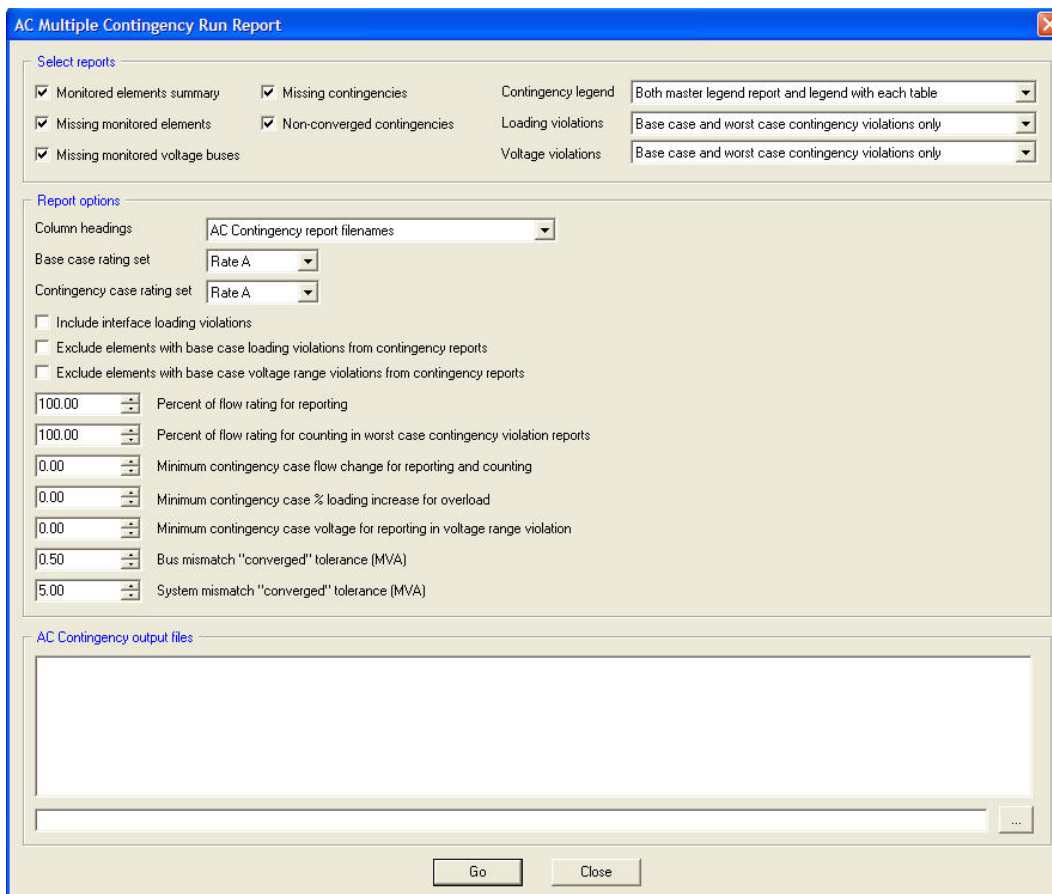
Multiple AC Contingency calculation report

The multiple AC contingency calculation report utilizes the Zone#.acc output files created with the ACCC feature of PSS/E. A report is generated which includes the information from all the Zone#.acc files that are used. This is a very powerful tool when side by side study comparisons are needed.

Once all of the Zone#.acc files have been created, the multiple AC contingency calculation report feature of PSS/E can be utilized. This is done by clicking on the “Power Flow” drop down menu and selecting “Reports” → “Multiple AC Contingency calculation report” as shown:



The AC Multiple Contingency Run Report window will be displayed:



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Questions

The “sample.sav” data file as well as the “sample.sld” slider file must be open to perform this section of the lab.

Inspect the “sample.sld” slider file and note which buses are included in which zone. Also note which of the branches without transformers are contained within, or originate from, each zone. This information will be used to create “zone#.con”, “zone#.mon” and “zone#.sub” files for each of the nine zones. Zone 6 was given as an example in this lab. Compare this example to what can be seen from the slider file. Notice that the subsystem file contains only the buses contained within Zone 6. Also notice that the contingency file contains all of the branches that are not connected to a transformer that are either contained within or originate from Zone 6. In particular, notice how the monitor file creates an interface for each of the different power ratings of the branches contained in the contingency file. Please note that when a redundant line occurs (multiple branches between the same two buses), the connection between those two buses is only listed once. This is exactly how the rest of the files will look for each zone, except for with the appropriate buses and branches.

A Multi-ACCC report will now be created.

- Create a contingency, a monitor and a subsystem file for Zone 1 through Zone 9. There will be a total of 27 files created. Refer to Lab 4 if you have difficulties.
- Create an ACCC and a DFAX file for Zone 1 through Zone 9. There will be a total of 18 files created. Refer to Lab 4 if you have difficulties.
- Create a Multi-ACCC report by loading all nine “*.acc” file that were created. This process is laid out in detail earlier in this lab. Print out this report and include it in the lab write-up. All the information that this lab will focusing on will be in the AC CONTINGENCY REPORT FOR 9 AC CONTINGENCY CALCULATION RUNS section on pages 8 and 9. Just pages 8 and 9 can be printed by simply highlighting those pages and right-clicking the mouse to bring up the sub-menu and selecting print. This will only print the highlighted region and will save a few pages of unnecessary printing. Also, these reports tend to print nicer if they are printed in landscape mode.

Use the printed report to answer the following questions. Review the tables that were created on page 8 and page 9. The table on page 8 shows all of the overloads that occur in the “Base Case” contingency. The table on page 9 shows all of the overloads that occur, or greater overloads then that occurred in the “Base Case” condition, in each of the contingencies.

- 1) Which zone contains the most overloads during the “Base Case” contingency? _____
Which zone contains the most overloads during the other contingencies? _____
- 2) Which branch suffered from the largest overload (compared to the “Base Case”) and what is the overload? _____
During what contingency did this occur (which branch was taken out)? _____

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- 3) What happens to the branch connecting the buses “SUB500” and “SUB230” when the branch between bus #154 and bus #205 is taken out of service? _____
- 4) Which contingency causes the branch between “MINE_G” and “3WNDSTAT1” to see an increase in the overage caused during “Base Case”? _____
How much of an increase occurred? _____
Were there any other overloads that occurred under this contingency? _____
To which branch did this occur? _____
How much was the overload? _____

Answer these questions and include the printed section of the Multi-ACCC report with your lab write-up.