

Transient Stability Analysis with PowerWorld Simulator



T2: Transient Stability Data Management



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Transient Stability Data Management



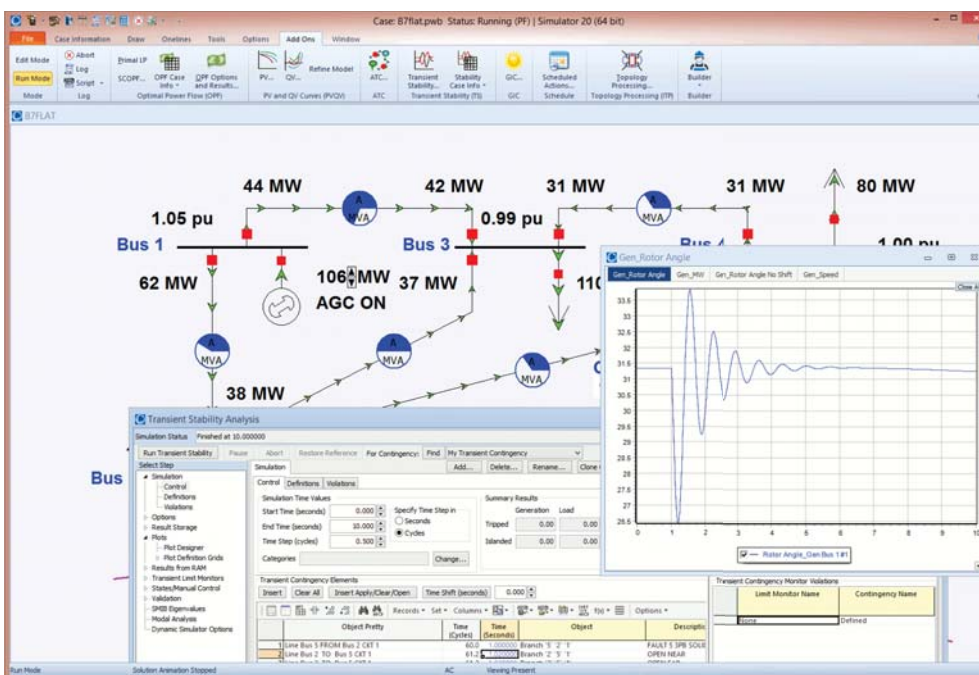
- The Transient Stability tool makes it possible to deal with a large amount of input data (and result data, discussed later)
- Reading/writing to various file formats
 - Input data can be used to define the dynamic models of the system as well as the steady-state model of the system
 - Simulator also makes it easy to save out transient stability information to files
- Navigating available models
 - Model explorer
 - Stability tab of dialog for individual models
- Additional resources are available, including
 - Block diagrams
 - Simulator Help documentation

Design Philosophy



- PowerWorld's design philosophy is to make power system analysis as easy as possible
 - This holds true in the transient stability domain. Our goal is to reduce the entry barrier to allow more power system professions access to transient stability.
- As much as possible we have leveraged our existing methods for data interaction
- Transient stability data augments the power flow model data

Example: Running Transient Stability on the B7Flat Case



Our Philosophy: While doing transient stability solutions on large cases can certainly require large amounts of engineering expertise, the barriers of entry in learning to do such studies should not arise because of the software.

External Data Files

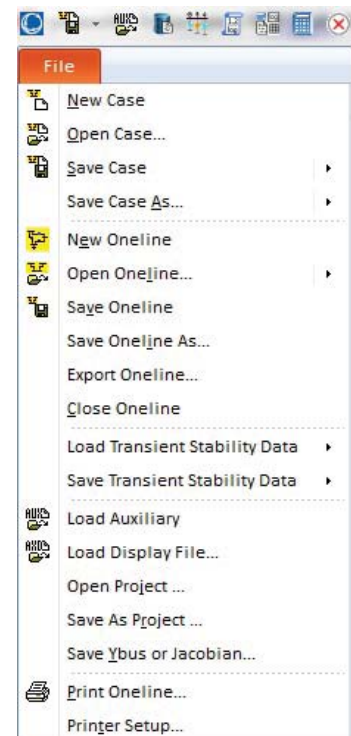


- A particular pwb case may or may not already have dynamic models saved in it, and there must be at least one model to do a transient stability simulation
- Models may be read in from an input file or manually entered
- Several external file types including
 - PowerWorld Auxiliary File (AUX)
 - PTI File (DYR)
 - GE File (DYD)
 - BPA File (SWI)
- PowerWorld Simulator can **read** and **write** Transient Stability data to these formats
- Only models that are available in the specific format can be saved back into that format

External Data Files



- Access for loading and saving these files can be found in several places within Simulator
- Application File Menu by clicking the PowerWorld icon in the top left corner of Simulator
- At the bottom of the specific model pane in the Transient Stability portion of the Model Explorer
- Stability Case Info Menu buttons
- Transient Stability Dialog buttons

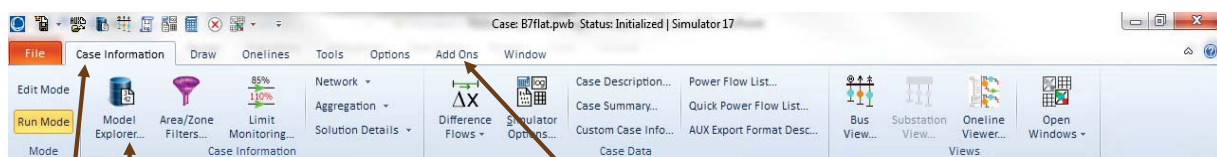


Auxiliary Files (AUX)



- The ability to use AUX files exists throughout Simulator, and it is something that is supported by Transient Stability as well
- Another training course covers AUX files in more detail
- Save to Auxiliary
 - Store any results and settings that need to be retained for future use
 - Easily loaded into different power flow cases
- Load Auxiliary
 - Load relevant option settings to be used during the transient stability analysis
 - Can load the same AUX file into many cases
- Transient-stability specific results and options can also be saved with the pwb case

Transient Stability Case Information and Model Explorer



Model Explorer from Case Information Toolbar

Stability Case Info, Case Information from Add-Ons Toolbar

Transient Stability - Opens the Transient Stability Analysis Dialog

Case Information - Opens the Model Explorer to the appropriate page

Transient Stability Summary

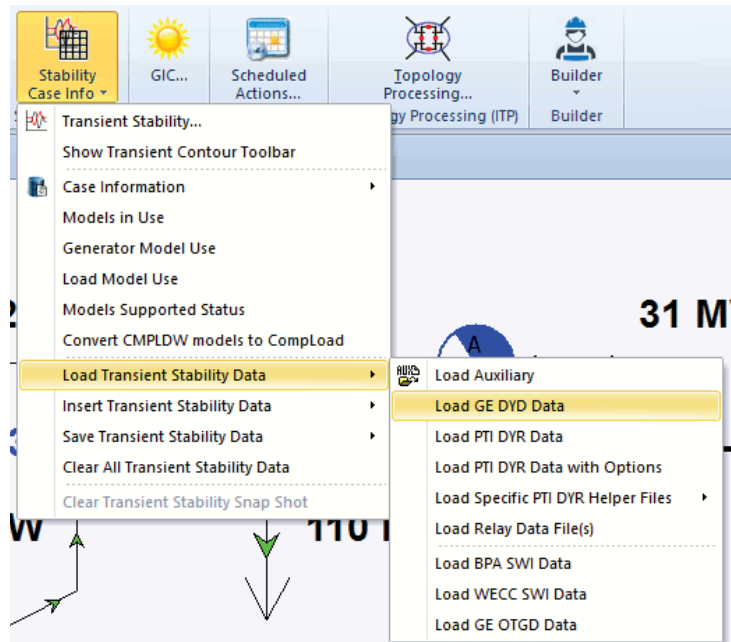
Load/Save Transient Stability Data

Make the Transient Contour Toolbar visible

Example: Loading Data from External File Formats



- Open **WestExample.epc**
- This contains power flow model data
- Go to “Load Transient Stability Data” and “Load GE Data” from the Stability Case Info drop down menu on the main ribbon
- Load in **WestExample.dyd**
- This contains dynamic model data



GE DYD Special Handling: Cross-Compound Units



- Cross-compound units are two generators that both operate off the same steam plant
- Often represented in a DYD file
 - 2 machine models
 - 2 exciters
 - 2 stabilizers
 - 1 governor which is either **IEEEG1** or **CRCMGV**
- Ideally, the power flow model represented by the EPC file will model these two generators separately and will easily link to the DYD models

GE DYD Special Handling: GENCC model



- The **GENCC** model is often modeled as one generator but signals that two generators in the DYD file may be represented by one in the EPC file
- When this situation is found, Simulator will automatically split the existing generator into two
 - An appropriate log message will be written
- Parameters P_{fac} and Q_{fac} determine the percentage of MW and MVar assigned to each of the two generators

Example: Loading Data from External File Formats



- Informational messages, warnings, and errors created by reading in the data will appear in the log
- Save the case as **WestExample.pwb** for future use

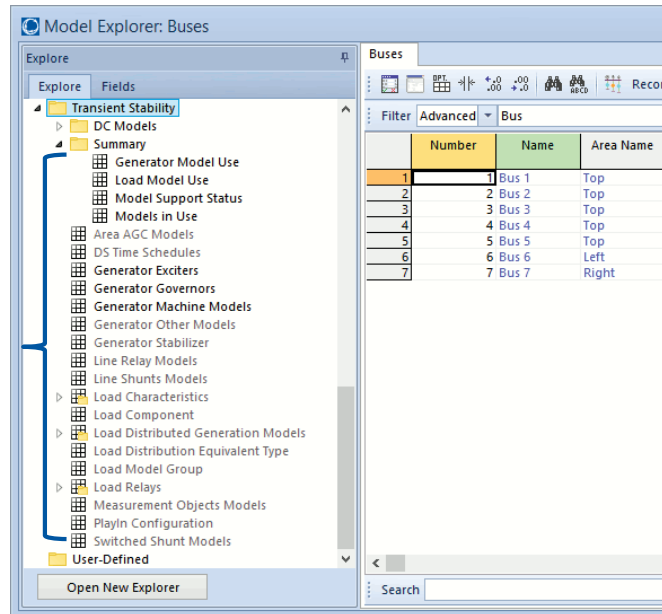
Warning - Switched Shunt at Bus 10931 must have Vhigh > Vlow when on automatic control. Control mode set to fixed.
Warning - Switched Shunt at Bus 12020 must have Vhigh > Vlow when on automatic control. Control mode set to fixed.
Warning - Switched Shunt at Bus 12062 must have Vhigh > Vlow when on automatic control. Control mode set to fixed.
Warning - Switched Shunt at Bus 12138 must have Vhigh > Vlow when on automatic control. Control mode set to fixed.
Validation of G:\pw\version.150\COURSE_Transient\Cases\WestExample.epc ended at June 08, 2010 11:25:31
Initializing Solution Data Structures
Initialization Complete
Reading DYD GE Data Format
Info: New generator created at FCNGN4CC (14914) #L and existing generator ID changed to #H because 2 GENCC records found for Bus FCNGN4CC (14914) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at FCNGN5CC (14915) #L and existing generator ID changed to #H because 2 GENCC records found for Bus FCNGN5CC (14915) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ALAMT3 G (24003) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ALAMT3 G (24003) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ALAMT4 G (24004) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ALAMT4 G (24004) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ALAMT5 G (24005) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ALAMT5 G (24005) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ELSEG3 G (24047) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ELSEG3 G (24047) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ELSEG4 G (24048) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ELSEG4 G (24048) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MTNVIST3 (24052) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MTNVIST3 (24052) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MTNVIST4 (24053) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MTNVIST4 (24053) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at HUNT1 G (24066) #L and existing generator ID changed to #H because 2 GENCC records found for Bus HUNT1 G (24066) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at HUNT2 G (24067) #L and existing generator ID changed to #H because 2 GENCC records found for Bus HUNT2 G (24067) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MANDLY1G (24089) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MANDLY1G (24089) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MANDLY2G (24090) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MANDLY2G (24090) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MOHAV1CC (24095) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MOHAV1CC (24095) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MOHAV2CC (24096) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MOHAV2CC (24096) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at REDON7 G (24123) #L and existing generator ID changed to #H because 2 GENCC records found for Bus REDON7 G (24123) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at REDON8 G (24124) #L and existing generator ID changed to #H because 2 GENCC records found for Bus REDON8 G (24124) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at ALAMT6 G (24161) #L and existing generator ID changed to #H because 2 GENCC records found for Bus ALAMT6 G (24161) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at HUNT3 G (24167) #L and existing generator ID changed to #H because 2 GENCC records found for Bus HUNT3 G (24167) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at HUNT4 G (24168) #L and existing generator ID changed to #H because 2 GENCC records found for Bus HUNT4 G (24168) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at HAYNES5G (26030) #L and existing generator ID changed to #H because 2 GENCC records found for Bus HAYNES5G (26030) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at PTSB 5 (33105) #L and existing generator ID changed to #H because 2 GENCC records found for Bus PTSB 5 (33105) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at PTSB 6 (33106) #L and existing generator ID changed to #H because 2 GENCC records found for Bus PTSB 6 (33106) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at C.COS 6 (33116) #L and existing generator ID changed to #H because 2 GENCC records found for Bus C.COS 6 (33116) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at C.COS 7 (33117) #L and existing generator ID changed to #H because 2 GENCC records found for Bus C.COS 7 (33117) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MOSSLND6 (36405) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MOSSLND6 (36405) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MOSSLND7 (36406) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MOSSLND7 (36406) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MORRO 3 (36409) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MORRO 3 (36409) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at MORRO 4 (36410) #L and existing generator ID changed to #H because 2 GENCC records found for Bus MORRO 4 (36410) with IDs "H" and "L", but only one generator exists in the case at this bu
Info: New generator created at COMAN_3 (70777) #L and existing generator ID changed to #H because 2 GENCC records found for Bus COMAN_3 (70777) with IDs "H" and "L", but only one generator exists in the case at this bu

Messages related to the splitting of the GENCC models

Transient Stability Case Information and Model Explorer



- Model Explorer contains a Transient Stability Folder
- The first item is the Summary sub-folder
- Also, pages are listed for each class of available model
- The same options and Model Explorer pages can also be accessed from the Stability Case Info menu

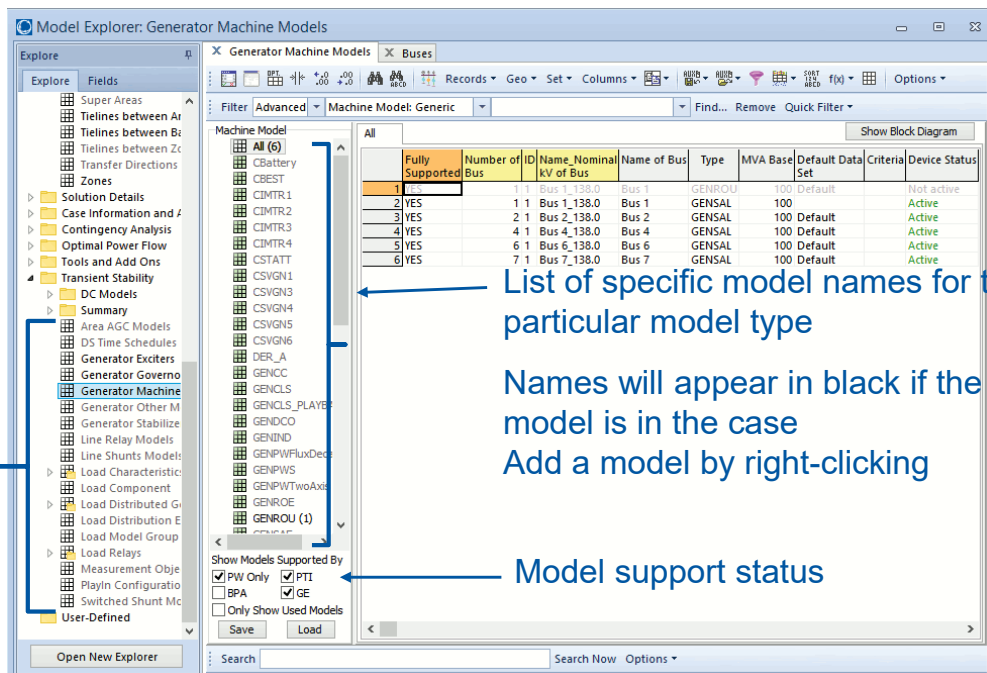


Navigating Available Models



Model Explorer lists the supported models

Classes of models



Navigating a List of Models

- Choose "All" to get a list of all Stabilizers
- Choose specific type to get a list of all the parameters
- Bold** values represent non-default values

The screenshot shows the 'Stabilizer' list with 'All (1047)' selected. Below it, the 'GENROU (882)' parameter list is shown. The 'GENROU' list includes columns for 'Number of Bus', 'Name_Nominal kV of Bus', 'Name of Bus', 'Type', 'MVA Base', 'Device Status', and various parameters like H, D, Ra, Xd, Xq, Xdp, Xqp, Xdp, Xqp, Xd, Tdpp, Tdpp, Tdpp, S(1.0), S(1.2), etc.

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Parameters

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Load Characteristic Models

- Load models apply to either a load, bus, owner, area, or the entire case

Precedence:

1. Load-specific
2. Load Model Group-specific
3. Bus-specific
4. Owner-specific
5. Zone-specific
6. Area-specific
7. System-specific
8. Load Component-specific
9. Default load modeling option with transient stability options

The screenshot shows the 'Load Characteristic' list with 'All (478)' selected. The list includes columns for 'Fully Supported', 'Element Type', 'Number', 'Name_Nominal kV', 'ID', 'Name', and 'MW'. The 'Load Characteristic' list is expanded to show 'Load-Specific', 'Model Group-Specific', 'Bus-Specific (430)', 'Owner-Specific', 'Zone-Specific', 'Area-Specific (21)', and 'System-Specific'.

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Load Characteristic Models



- Models like CMPLDW have up to 130 parameters
- Hundreds or thousands of loads with the same CMPLDW parameters
- Group together models with the same parameters
- Create new objects in Simulator
 - Load Model Groups
 - Load Distribution Equivalent Types

Load Characteristic Models



Model Explorer: Load Model Use

Load Model Summary

Number of Bus	Name of Bus	ID	Status	MW	Mvar	Load Model Group	Distribution Equivalent Type
1	10005 ALCAZAR	1	Closed	18.13	-0.81	HID4	RES 43
2	10008 ALLISON	1	Closed	9.64	3.17	HID	COM31
3	10013 ANDERSON	1	Closed	8.98	-0.97	HID4	RES 11
4	10015 ARNO_1	1	Closed	3.61	0.04		
5	10017 ARRIBA	1	Closed	3.74	-0.32		
6	10020 ASPEN	1	Closed	19.25	3.91	HID4	RES 55
7	10022 AVILA	1	Closed	8.48	2.43	HID4	RES 90
8	10027 BACA	1	Closed	3.86	-0.64		
9	10029 BALL_PRK	1	Closed	1.72	-0.20		
10	10032 BECKNER	1	Closed	13.11	1.78	HID	COM22
11	10034 BEL_AIR	1	Closed	12.90	-0.23	HID4	RES 43
12	10036 ARNO_2	1	Closed	9.21	-0.77	HID4	RES 11
13	10037 FIRST_ST	1	Closed	12.75	4.63	HID4	RES 62
14	10040 BEV_WOOD	1	Closed	7.15	1.26	HID4	RES 35
15	10041 BISTI	1	Closed	7.50	4.28	HID3	RAG47
16	10043 BLCKRA	1	Closed	18.50	4.32	HID4	RES 35
17	10046 BOSQUE_F	1	Closed	4.81	-0.06		
18	10049 BROADWAY	1	Open	0.00	0.00		
19	10050 BUCKMAN	1	Closed	7.54	-1.78	HID	COM32
20	10053 BUCKMAN	1	Closed	1.00	0.00		

Fields

Available Fields

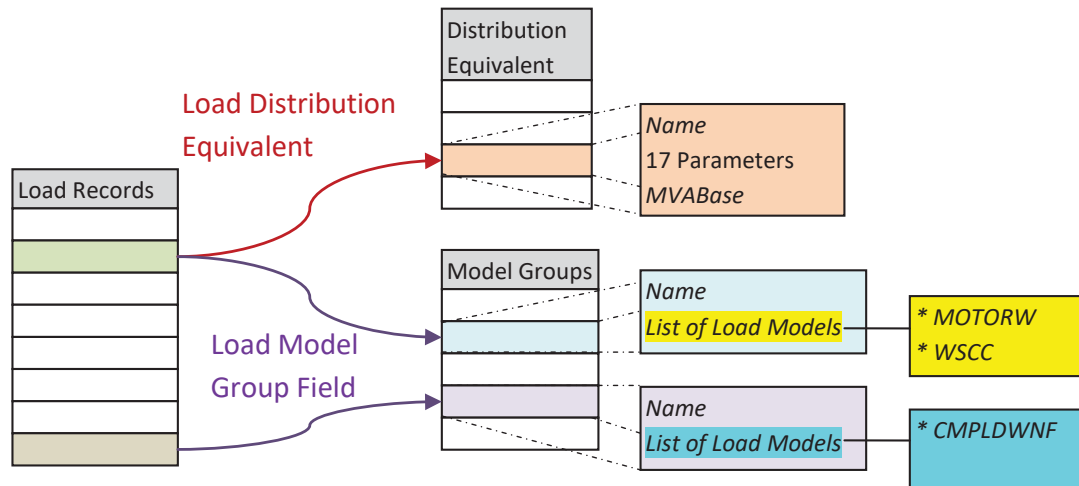
- Sensitivity of Bus
- Substation
- Super Area
- Time Step
- Transient Stability
 - Results
 - Save
 - Load Characteristic Name (Motor)
 - Load Characteristic Name (Static)
 - Load Distribution Equivalent Type
 - Load Model Group
 - Load Relay Name
- Voltage
- Zone
- Key Fields
- Required Fields
- Secondary Key Fields

Expand Collapse

Frozen Columns 1

Reset to Factory Defaults

Load Characteristic Models



Load Model Group



- Load Model Group:
 - Identified by unique name
 - List of Load Characteristic Models assigned to it
 - MOTORW, WSCC, CMPLDWNF, etc.
 - Allows flexibility in grouping load characteristic models with the same parameters that area, zone, etc. aggregations do not
 - May represent the behavior of a climate group
 - “High Desert”

Load Characteristic Models



- Load Model Hierarchy:
 1. Load-specific
 2. Load Model Group-specific
 3. Bus-specific
 4. Owner-specific
 5. Zone-specific
 6. Area-specific
 7. System-specific
 8. Load Component-specific
 9. Default load modeling option with transient stability options

Load Characteristic Models



Load Model Hierarchy

The screenshot displays the 'Model Explorer: Load Characteristics' window. The left pane shows a hierarchical tree of load models. The 'Load Characteristics (60)' folder is expanded, showing sub-folders like 'All (58)', 'CIM5', 'CIM6', 'CIMW', 'CLOD', 'CMPLDW', 'EXTL', 'IEEL', 'LD IPAC', 'LDFR', 'LDRANDOM', 'MOTORW (2)', 'WSCC', 'Bus-Specific (1)', 'Owner-Specific', 'Zone-Specific', 'Area-Specific (21)', and 'System-Specific'. A red box highlights the 'Load Model Group-Specific (58)' folder, and a red arrow points to the 'CMPLDWNF (56)' folder within it. The right pane shows a table of load models for the 'CMPLDWNF' group. The table has columns: Element Type, ID, Name, Type, Device Status, FmA, FmB, FmC, FmD, Fel, PFe, Vd1, Vd2, and frc. The table lists 31 load models, including 'LoadModelGroup AGR', 'LoadModelGroup DSW', 'LoadModelGroup DSW2', 'LoadModelGroup DSW3', 'LoadModelGroup DSW4', 'LoadModelGroup HID', 'LoadModelGroup HID2', 'LoadModelGroup HID3', 'LoadModelGroup HID4', 'LoadModelGroup IND', 'LoadModelGroup IND2', 'LoadModelGroup IND3', 'LoadModelGroup IND4', 'LoadModelGroup IND5', 'LoadModelGroup IND6', 'LoadModelGroup IND7', 'LoadModelGroup NCC', 'LoadModelGroup NCC2', 'LoadModelGroup NCC3', 'LoadModelGroup NCC4', 'LoadModelGroup NCI', 'LoadModelGroup NCI2', 'LoadModelGroup NCI3', 'LoadModelGroup NCI4', 'LoadModelGroup NCV', 'LoadModelGroup NCV2', 'LoadModelGroup NCV3', 'LoadModelGroup NCV4', 'LoadModelGroup NWC', 'LoadModelGroup NWC2', and 'LoadModelGroup NWC3'.

Load Distribution Equivalent



- Supplementary model that defines an equivalent of the distribution system's transformer, capacitors, and feeder
- Created independently of the load characteristic models
- Can be used with any load characteristic model
- Design assumes small number of Load Distribution Equivalent Types with many different loads assigned to each

Load Distribution Equivalent



- First 17 parameters of the CMPLDW load characteristic model along with MVA base

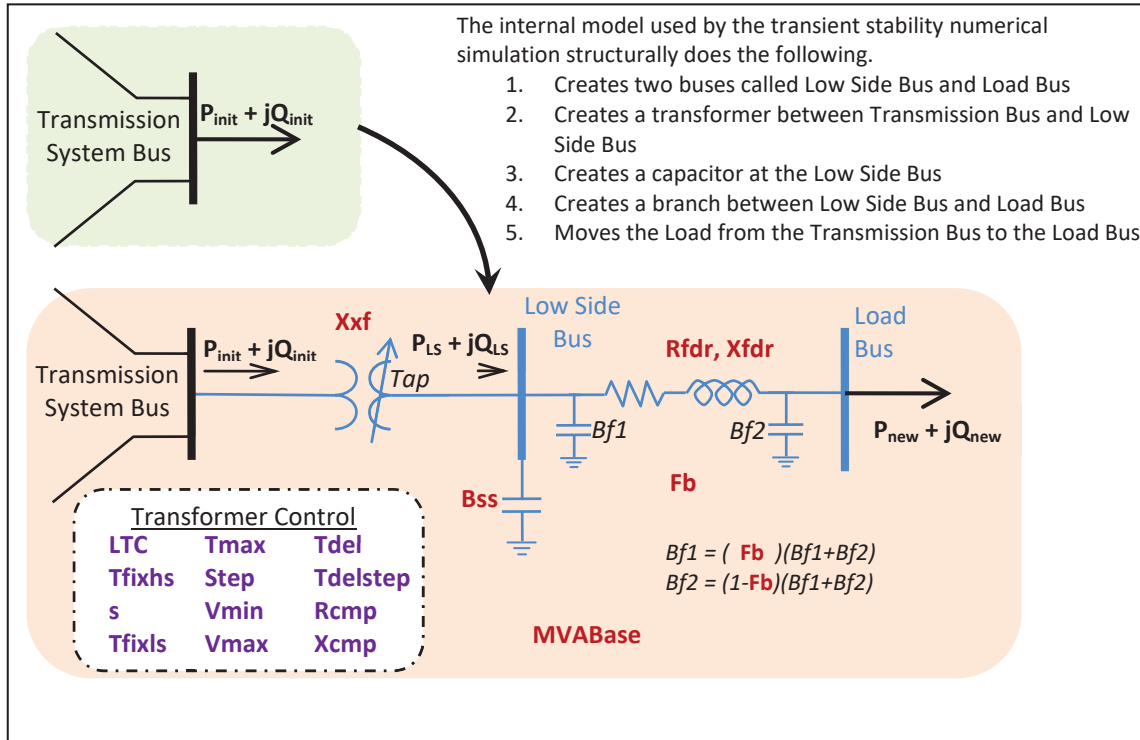
Model Explorer: Load Distribution Equivalent Type

Filter: Find... Remove Quick Filter...

	Name	Long Name	Mbase	Bss	Rfdr	Xfdr	Fb	Xxf	Tfixhs	Tfixs	LTC	Tmin	Tmax	step	Vmin	Vmax	Tdel	Tdelstep	Rcmp	Xcmp
1	AUX	AUX	0	0	0	0.01	1	0.08	1	1	0	0.9	1.1	0.00625	1.025	1.04	0	0	0	0
2	COM	Commercial	0	0	0	0.0216	0.027	0.75	0	1	1	0	1	1	0.001	1	1	0	0	0
3	COM 2	Commercial	0	0	0	0.036	0.045	0.78	0.08	1	1	0.9	1.1	0.00625	1.025	1.04	30	5	0	0
4	COM 3	Commercial	0	0	0	0.0328	0.041	0.75	0.08	1	1	0.9	1.1	0.00625	1	1.02	30	5	0	0
5	COM 4	Commercial	0	0	0	0.036	0.045	0.76	0.08	1	1	0.9	1.1	0.00625	1.025	1.04	30	5	0	0
6	COM 5	Commercial	0	0	0	0.0224	0.028	0.76	0	1	1	0	1	1	0.001	1	1	0	0	0
7	COM 6	Commercial	0	0	0	0.0232	0.029	0.74	0	1	1	0	1	1	0.001	1	1	0	0	0

Search: Search Now Options

Load Distribution Equivalent



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Load Distribution Equivalent



- MVABase determines the *DistEquivMVABase*
 - (MVABase > 0) then *DistEquivMVABase* = MVABase
 - (MVABase < 0) then *DistEquivMVABase* = Pinit/MVABase
 - (MVABase = 0) then *DistEquivMVABase* = Pinit/0.8
- Impedance parameters are on the *DistEquivMVABase* and are converted to system base
- Transformer taps and impedances are converted to the system MVA base on the fixed taps
- Transformer tap ratio set so that Low Side Bus voltage is equal to the average of Vmin and Vmax
- After converting the impedances and taps, Low Side Bus voltage and flow on the Low Side Bus ($P_{LS} + jQ_{LS}$) are calculated exactly
- Iterative process to determine $P_{new} + jQ_{new}$, Bf1, and Bf2 depending on the transient load model

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Load Distribution Equivalent



- If Load Bus voltage falls below 0.95 per unit, feeder impedances Rfdr and Xfdr are reduced so that the Load Bus voltage is 0.95 per unit
 - There is no need to modify the input data to prevent the Load Bus voltage from being too small

New Model CMPLDWNF



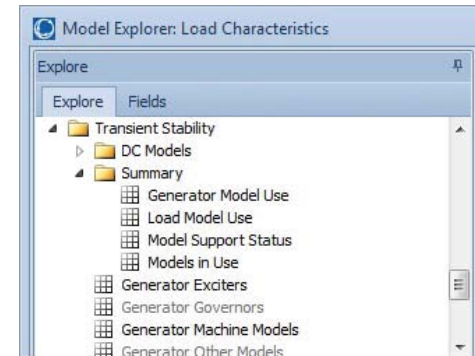
- Identical to CMPLDW except that parameters for Load Distribution Equivalent have been removed (first 17 parameters and MVABase)

Load Characteristic Information			
LoadModelGroup DSW			
Load Characteristics			
Type: Active - CMPLDWNF			
Active (Only One Active, Except for Supplementary Models)			
Parameters			
FmA	0.0960	P2e	1.0000
FmB	0.1680	P2c	0.4526
FmC	0.0270	Pfrq	0.0000
FmD	0.4840	Q1e	2.0000
Fel	0.0880	Q1c	-0.5000
PFel	1.0000	Q2e	1.0000
Vd1	0.7000	Q2c	1.5000
Vd2	0.5000	Qfrq	-1.0000
frcl	0.7000	Mtypa	3.0000
PFs	-0.9973	Mtypb	3.0000
P1e	2.0000	Mtypc	3.0000
P1c	0.5474	Mtypd	1.0000
LFma	0.7500	Rsa_CompPFa	0.0400
Lsa_Vstalla	1.8000	Lpa_Rstalla	0.1200
Lppa_Xstalla	0.1040	Tpoa_Tstalla	0.0950
Tppoa_Frsta	0.0021	Ha_Vrsta	0.0500
Etrqa_Trsta	0.0000	Ftr1a_Fuvra	0.7000
Vtr1a	0.0200	Ttr1a	0.2000
Vtr2a_Vc1o		Vrc1a_Vc2o	
Vrc1a_Vc1o		Vrc2a_Vc2o	
Vrc2a_Vc2o		Trc2a_Tt	
Th		Thi	
T		LF	
Rsb_CompF			

Model Explorer: Transient Stability\Summary\



- On the Model Explorer, under Transient Stability\Summary, there are the following entries:
 - Generator Model Use
 - Lists each generator along with the dynamic models it is using
 - Load Model Use
 - Lists each load along with the dynamic models it is using
 - Model Support Status
 - A list of all the models that Simulator can read/write
 - Listing of models that can be read from or written to the appropriate text based file format for other software packages
 - Models in Use
 - A list of all the models used in this case, along with a count of each



Generator Model Use Example



- For the example case, open the Summary folder
- On the Model Explorer, open the Transient Stability\Summary page
- Open the Generator Model Use page

Number of Bus	Name of Bus	ID	Status	Gen MW	MVA Base	Machine	Exciter	Governor	Stabilizer	Other
2	10261 REEVE_G1	1	Open	0.00	170.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1
2	10262 REEVE_G2	1	Closed	22.00	58.82	GENROU	TEXS	GGOV1	PSS2A	OEL1
4	10263 REEVE_G3	1	Open	0.00	58.82	GENROU	TEXS	GGOV1	PSS2A	OEL1
5	10318 SJUAN_G1	1	Closed	25.00	88.24	GENROU	TEXS	GGOV1	PSS2A	OEL1
6	10319 SJUAN_G2	1	Closed	360.00	410.00	GENROU	EXAC3A	GGOV1	PSS2A	OEL1
7	10320 SJUAN_G3	1	Closed	350.00	410.00	GENROU	REXS	GGOV1	PSS2A	OEL1
8	10321 SJUAN_G4	1	Closed	544.68	616.70	GENROU	EXAC3A, (ESAC2A)	GGOV1	PSS2A	OEL1
9	10394 LEF_G1	1	Closed	444.68	616.70	GENROU	EXAC3A	GGOV1	PSS2A	OEL1
10	10395 LEF_G2	1	Closed	142.50	234.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1
11	10396 LEF_S1	1	Closed	142.50	234.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1
12	10415 LVOT	1	Open	285.00	373.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1
13	10485 AFTONS	1	Open	0.00	29.60	GENROU	EXST4B	GGOV1	PSS2A	OEL1
14	10486 AFTONS	1	Closed	94.00	143.60	GENROU	EXST4B	GGOV1	PSS2A	OEL1
15	10491 LRDSBGG1	1	Closed	140.80	488.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1
16	10491 LRDSBGG1	1	Closed	20.00	20.00	GENROU	EXST4B	GGOV1	PSS2A	OEL1

If multiple models exist, they are listed separated by commas

Use Toggle to change active status of models
Inactive models are shown in parenthesis

Model Support Status Example



- Open the Model Support Status page

Model support statuses for all models

Class	Name	PowerWorld	GE PSLF	PTI PSS/E	BPA IPF
Machine Model	CIMTR1	YES	NO	YES	NO
Machine Model	CIMTR2	YES	NO	YES	NO
Machine Model	CIMTR3	YES	NO	YES	NO
Machine Model	CIMTR4	YES	NO	YES	NO
Machine Model	GENCC	YES	YES	NO	NO
Machine Model	GENCLS	YES	YES	YES	YES
Machine Model	GENCLS_PLAYBACK	YES	YES	NO	NO
Machine Model	GENPWTwoAxis	YES	NO	NO	NO
Machine Model	GENDCO	NO	NO	YES	NO
Machine Model	GENSAE	YES	NO	YES	YES
Machine Model	GENSAL	YES	YES	YES	YES
Machine Model	GENROE	YES	NO	YES	YES
Machine Model	GENROU	YES	YES	YES	YES
Machine Model	GENTPF	YES	YES	NO	NO
Machine Model	GENTPJ	YES	YES	NO	NO
Machine Model	GENTRA	YES	NO	YES	YES
Machine Model	MOTOR1	YES	YES	NO	NO
Machine Model	STCON	YES	YES	NO	NO
Machine Model	CSTAT	YES	NO	YES	NO
Machine Model	GEWITG	YES	YES	NO	NO
Machine Model	GENWRI	YES	YES	NO	NO
Machine Model	WT1G	YES	YES	NO	NO
Machine Model	GENIND	YES	YES	NO	NO
Machine Model	WT1G1	YES	NO	YES	NO
Machine Model	WT2G1	YES	NO	YES	NO
Machine Model	WT2G	YES	YES	NO	NO
Machine Model	WT3G	YES	YES	NO	NO
Machine Model	WT3G1	YES	NO	YES	NO
Machine Model	WT3G2	YES	NO	YES	NO
Machine Model	WT4G1	YES	NO	YES	NO
Machine Model	WT4G	YES	YES	NO	NO
Machine Model	CBEST	YES	NO	YES	NO
Machine Model	GEN_BPA_MM2	YES	NO	NO	YES
Machine Model	GEN_BPA_MM3	YES	NO	NO	YES

Listed models can be read from or written to the appropriate text based file format for other software packages

Models in Use Example



- Open the Models in Use page

Model Class	Object Type	Active and Online Count	Active Count	Inactive Count	Fully Supported
Machine Model	GENSAL	835	1060	0	YES
Machine Model	GENROU	874	1095	0	YES
Machine Model	GENTPF	682	822	0	YES
Machine Model	GENTPJ	4	4	0	YES
Machine Model	GENCC	48	60	0	YES
Machine Model	MOTOR1	37	79	0	YES
Machine Model	STCON	2	2	0	YES
Machine Model	GEWITG	17	34	0	YES
Machine Model	GENWRI	3	19	0	YES
Machine Model	SVCWSC	10	16	0	YES
Machine Model	VWSCC	3	4	0	YES
Gen Other Model	OEL1	367	418	0	YES
Gen Other Model	LCFB1	53	56	0	YES
Gen Other Model	GP1	7	7	0	YES
Exciter	SEXS_GE	0	1	0	YES
Exciter	SCRX	7	11	0	YES
Exciter	IEEET1	48	51	0	YES
Exciter	EVAC1	136	156	0	YES
Exciter	EVAC1A	4	5	0	YES
Exciter	EVAC2	44	49	0	YES
Exciter	EVAC3A	4	4	0	YES
Exciter	EVAC4	9	15	0	YES
Exciter	EVAC6A	3	3	0	YES
Exciter	EVAC8B	140	158	0	YES
Exciter	EXWITG1	3	19	0	YES
Exciter	EXWITGE	17	34	0	YES
Exciter	EXST1_GE	680	864	0	YES
Exciter	EXST2	11	13	0	YES
Exciter	EXST2A	43	49	0	YES
Exciter	EXST3	5	22	0	YES

A summary of the models defined in this case

Includes whether the model is active or inactive, and whether its associated object is online

Transient Stability Model Explorer: Model Classes



- Clicking on a particular model class opens a new pane in the right portion of the Model Explorer showing the available model types for that class
- Gray text indicates a model class or type not presently used by any device
- This pane has the following attributes
 - “All” shows all present models of the model class
 - Number in parenthesis indicates the number of models of that type which are present
 - Green icons indicate that a model is fully supported by Simulator
 - Red icons indicate that a model can be read/written but is not currently supported by the transient stability numerical integration
 - “Show Models Supported By” and a set of four check boxes- *PW Only*, *PTI*, *BPA*, and *GE* to filter the displayed list
 - At the bottom are buttons to save or load dynamic data from an external file

Model Classes Example



- Open the Exciter page

Next to each model type states the total number of that model type in the present data set

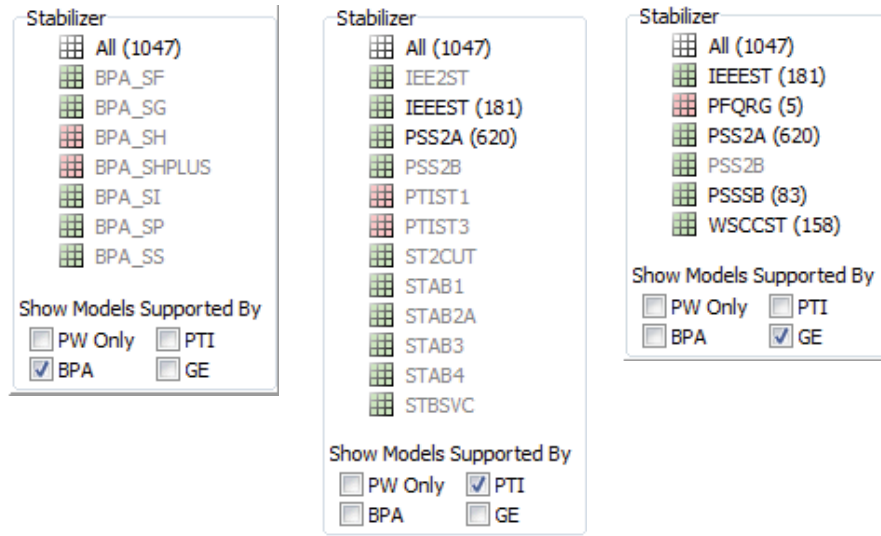
Save or load dynamic models

Green [icon] – supported

Red [icon] – read but not implemented

Model Classes- Filter the Shown Formats

- Types can be further filtered to show only those models supported by other formats



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Model Type Example

- When you choose a particular model type from a model class, additional columns will appear which show all the input parameters for that model type

Specific Machine Model types

GENROU Model Parameters

The screenshot shows the 'Machine Model' list on the left, with 'GENROU (1095)' selected. The main window displays a table of parameters for the selected model type. The table has columns for 'Number of Bus', 'ID', 'Name_Nominal', 'Name of Bus', 'Type', 'MVA Base', 'Device Status', and a large set of parameters including H, D, Ra, Xd, Xq, Xdp, Xap, Xdpp, Xl, Tdop, Tdopp, Tdopp, S(1.0), S(1.2), Rcomp, and Xcomp. The table is filtered to show only GENROU models.

Number of Bus	ID	Name_Nominal	Name of Bus	Type	MVA Base	Device Status	H	D	Ra	Xd	Xq	Xdp	Xap	Xdpp	Xl	Tdop	Tdopp	Tdopp	S(1.0)	S(1.2)	Rcomp	Xcomp		
1	10261	REEVE_G1_1	REEVE_G1	GENROU	58.822	Active	4.2	0	1.73	1.6	0.285	0.8	2036	0.1	7.1	2	0.03	0.2	0.194	4597	0	0		
2	10262	REEVE_G2_1	REEVE_G2	GENROU	58.822	Active	4.2	0	1.73	1.6	0.285	0.8	2036	0.1	7.1	2	0.03	0.2	0.194	4597	0	0		
3	10263	REEVE_G3_1	REEVE_G3	GENROU	88.235	Active	3.48	0	1.76	1.52	0.24	0.7	2036	0.1	7	2	0.03	0.1	0.2196	6399	0	0		
4	10318	SJUAN_G1_2	SJUAN_G1	GENROU	410	Active	3.71	0	0.004	1.7	1.4	0.24	0.33	0.21	0.17	5.5	0.51	0.05	0.06	0.1603	4861	0	0	
5	10319	SJUAN_G2_2	SJUAN_G2	GENROU	410	Active	3.8	0	0.002	1.85	1.4	0.3088	0.33	0.2573	0.17	6.76	0.51	0.05	0.06	0.113	4049	0	0	
6	10394	LEF_G1_18.0	LEF_G1	GENROU	234	Active	4.87	0	0	2.25	1.825	0.275	0.85	2264	0.15	9	0.9	0.036	0.07	0.09	2687	0	0	
7	10395	LEF_G2_18.0	LEF_G2	GENROU	234	Active	4.87	0	0	2.25	1.825	0.275	0.85	2264	0.15	9	0.9	0.036	0.07	0.09	2687	0	0	
8	10396	LEF_G1_18.0	LEF_G1	GENROU	373	Active	2.91	0	0	2.27	1.7	0.33	0.85	0.271	0.231	7.5	0.9	0.036	0.07	0.065	5795	0	0	
9	10415	VEF_18.0	VEF	GENROU	28.5	Active	7.4	0	0.0017	1.855	1.6	0.215	0.83	205	0.11	8	0.5	0.033	0.05	0.0992	348	0	0	
10	10485	AFTONS_13.1	AFTONS	GENROU	143.6	Active	4.35	0	0.0028	1.445	1.382	0.22	0.375	1.185	0.11	5.97	0.52	0.039	0.086	0.0541	3602	0	0	
11	10486	AFTONS_18.1	AFTONS	GENROU	189	Active	4.8	0	0.0025	1.77	1.662	0.235	0.43	195	0.12	7.1	0.539	0.055	0.083	0.0697	3761	0	0	
12	10491	LRDSBG1_1	LRDSBG1	GENROU	60	Active	2.18	0	0.003	2.3	2.25	0.28	1.1	1.226	0.12	6.5	3	0.03	0.2	0.0727	3108	0	-0.05	
13	10492	LRDSBG2_1	LRDSBG2	GENROU	60	Active	2.18	0	0.003	2.3	2.25	0.28	1.1	1.226	0.12	6.5	3	0.03	0.2	0.0727	3108	0	-0.05	
14	10903	VEF_18.0	VEF	GENROU	191	Active	5.7	0	0.003	1.47	1.4	0.212	0.4	0.16	0.12	7.7	0.54	0.039	0.083	0.057	0.441	0	0	
15	11051	COPPER_G_1	COPPER_G	GENROU	89.5	Active	6.96	0	0	2.04	1.8	0.278	0.73	239	0.19	8.2	1	0.05	0.05	0.1	327	0	0	
16	11112	NEWMANG1_1	NEWMANG	GENROU	96	Active	3.79	0	0	1.6	1.48	0.22	0.93	173	0.16	6	0.6	0.03	0.06	0.194	516	0	0	
17	11113	NEWMANG2_1	NEWMANG	GENROU	96	Active	3.54	0	0	1.6	1.5	0.226	0.4	0.19	0.15	8	1	0.025	0.0255	0.094	0.43	0	0	
18	11114	NEWMANG3_1	NEWMANG	GENROU	135.3	Active	3.21	0	0	1.56	1.4	0.255	0.5	0.22	0.15	8.5	1	0.03	0.09	0.085	5557	0	0	
19	11115	NEWMANG4_1	NEWMANG	GENROU	94.444	Active	6.6	0	0	1.54	1.45	0.324	0.7	0.26	0.2	8	1	0.05	0.05	0.2125	0058	0	0	
20	11116	NEWMANG5_1	NEWMANG	GENROU	94.444	Active	6.6	0	0	1.54	1.45	0.324	0.7	0.26	0.2	8	1	0.05	0.05	0.2125	0058	0	0	
21	11117	NEWMANG6_1	NEWMANG	GENROU	133.333	Active	3.58	0	0	1.48	1.2	0.26	0.45	0.18	0.144	10.5	1	0.05	0.05	0.1368	6.76	0	0	
22	11133	RIODG_6_1	RIODG_6	GENROU	58.822	Active	4.7	0	0	1.55	1.3	0.256	0.43	181	0.15	6.7	1	0.03	0.1	0.16	0.5	0	0	
23	11134	RIODG_7_1	RIODG_7	GENROU	58.824	Active	3	0	0	1.7	1.3	0.25	0.6	0.22	0.19	7	0.4	0.025	0.05	0.1808	5848	0	0	
24	11135	RIODG_8_1	RIODG_8	GENROU	185	Active	4.43	0	0	1.5	1.3	0.16	0.6	0.14	0.1	10	0.7	0.05	0.08	0.0578	3644	0	0	
25	11208	NEWMNSG1_1	NEWMNSG	GENROU	114	Active	6.5	0	0	1.94	1.85	0.210	0.425	1.165	0.12	7.9	0.56	0.04	0.083	0.04	0.3	0	0	
26	11209	NEWMNSG2_1	NEWMNSG	GENROU	114	Active	6.5	0	0	1.94	1.85	0.210	0.425	1.165	0.12	7.9	0.56	0.04	0.083	0.04	0.3	0	0	
27	11226	RIODG_9_1	RIODG_9	GENROU	100	Active	-9474	0	0	0.00331	9.571	6.24	0.302	0.624	0.243	0.13	2.96	0.35	0.073	0.07	0.152	0.59	0	0
28	11227	RIODG10_1	RIODG10	GENROU	100	Active	-9474	0	0	0.00331	9.571	6.24	0.302	0.624	0.243	0.13	2.96	0.35	0.073	0.07	0.152	0.59	0	0

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Transient Stability Data: Object Dialogs



- In general, Simulator devices have Information Dialogs, and models can be edited both by using these dialogs and by using the Model Explorer
- On the various dialogs for devices such as Generators, Loads, Switched Shunts, etc., there will be a tab labeled “Stability”
- This tab can be used to define the transient stability models for the device
- Stability tab attributes
 - Insert button
 - Delete button
 - Type of model and whether it is active
 - Show Diagram (displays the model’s block diagram)
 - Parameter list

Example Object Dialog



- Right click on a model in the Model Explorer and select “Show Dialog”
- An example of an exciter’s dialog is shown here

Models can be inserted or deleted here

Model parameters can be modified here for the selected type of model

Hovering the mouse will cause a hint to appear with a description of the parameter

Several model class tabs

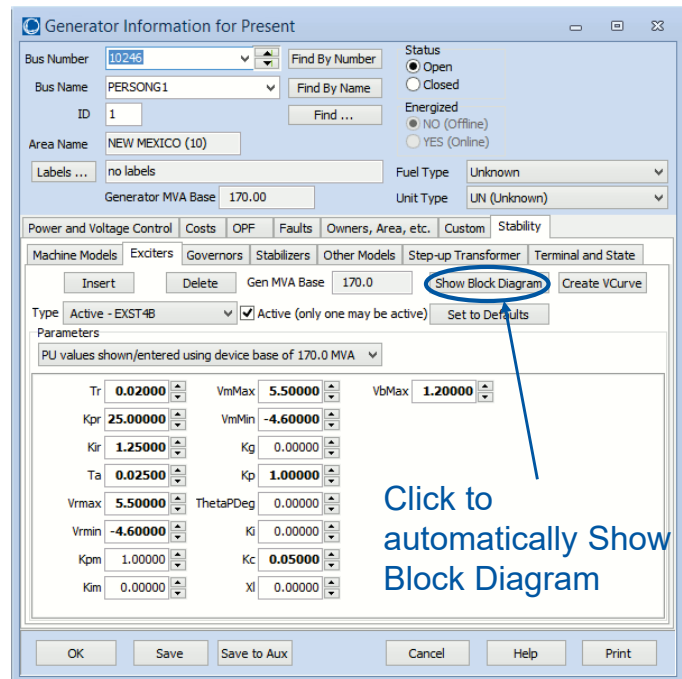
Checkbox indicates if the model is active

Generator Information for Present

Bus Number: 10225
Bus Name: PERSONG1
ID: 1
Area Name: NEW MEXICO (10)
Labels: no labels
Generator MVA Base: 170.00
Status: ☒ Open
☐ Closed
Energized: ☒ NO (Offline)
☐ YES (Online)
Fuel Type: Unknown
Unit Type: UN (Unknown)
Machine Models | Exciters | Governors | Stabilizers | Other Models | Step-up Transformer | Terminal and State
Power and Voltage Control | Costs | OPF | Faults | Owners, Area, etc. | Custom | Stability
Insert | Delete | Go | MVA Base: 170.0 | Show Block Diagram | Create YCurve
Type: Active - EXST4B ☒ Active (only one may be active) | Set to Defaults
Parameters
PU values shown/entered using device base of 170.0 MVA
Tr: 0.02000 | VmMax: 5.50000 | VoMax: 1.20000
Kpr: 25.00000 | VmMin: -4.60000
Kp: 1.25000 | Kg: 0.00000
Ta: 0.02500 | Kp: 1.00000
Vrmax: 5.50000 | ThetaPdeg: 0.00000
Vrmin: -4.60000 | KI: 0.00000
Kpm: 1.00000 | Kc: 0.05000
Klm: 0.00000 | XI: 0.00000
OK | Save | Save to Aux | Cancel | Help | Print

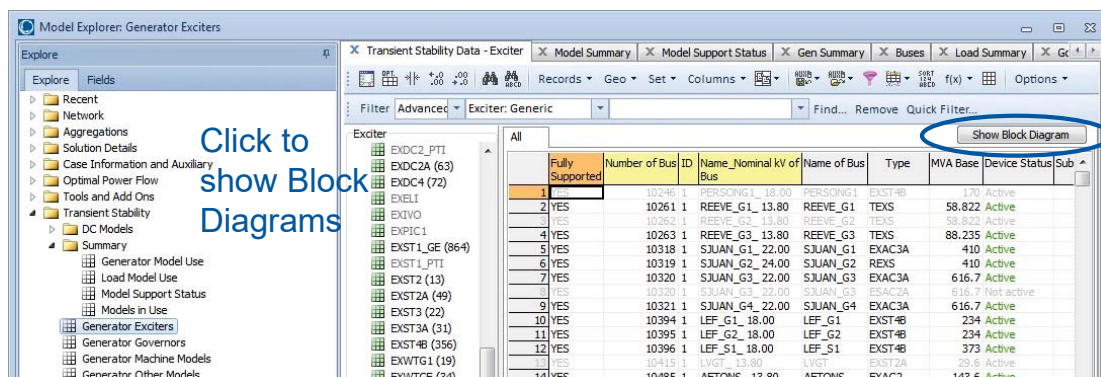
Object Dialog: Block Diagrams

- The “Show Block Diagram” button is available on the Stability tab of the individual dialogs for objects with Transient Stability models
- To view, click on the “Show Block Diagram” button



Block Diagrams

- The “Show Block Diagram” button is also available on the Model Explorer
- The block diagram document will be navigated to the page containing the model that is currently selected
- If “All” is selected, the list of the object models will open



GE DYD Special Handling



- Generator Baseload Flag
 - When loading GE EPC files, a flag for each generator record exists called the *Baseload flag* which determines how governor limits are handled during a transient stability run
 - Supported by a Simulator generator field called *Transient Stability\Governor Response Limits*- options are *Normal*, *Down Only*, or *Fixed*
 - *Baseload flag* of *0* maps to *Normal*, *Normal* means that the limits specified in the governor model will be used for the simulation
 - *Baseload flag* of *1* maps to *Down Only*, *Down Only* means that the upper limit is set equal to the initial condition value (and thus control can only go down.
 - *Baseload flag* of *2* or more maps to *Fixed*, *Fixed* means that both the upper and lower limits are set equal to the initial condition, thus control will be approximately constant
 - The *Governor Response Limits* field is shown when looking at governor case information displays

GE DYD Special Handling



- EPCMOD models
 - Often used to represent a user-defined model of a Series Capacitor Relay and a Capacitor Relay Model
 - Since these models were so common, PowerWorld added them as two new kinds of relay models
 - *CAPRELAY* can be assigned to a switched shunt record which, based on voltage, can open and close a switched shunt
 - Created when “MSC01.p” is read from an EPCMOD record
 - An appropriate log message will be written upon creation
 - *SERIESCAPRELAY* can allow a series capacitor to be bypassed during a fault and placed back in service when appropriate
 - Created when “MSC01.p” is read from an EPCMOD record
 - An appropriate log message will be written upon creation

GE DYD Special Handling



- **CMPLDW** models:
 - Automatically split into separate Load Distribution Equivalent Type and **CMPLDWNF** models when reading a DYD file
 - Individual loads are assigned to a Load Model Group containing the **CMPLDWNF** model
 - **Long ID** field in the EPC file determine the names of the Load Model Groups and Load Distribution Equivalent Types
 - Three characters for **climate zone** separated by an underscore followed by three characters for the feeder type
 - First three characters used to name **Load Model Group**
 - Last three characters used to name the **Load Distribution Equivalent Type**
 - “HID_RES” for High Desert climate zone with Residential feeder type

GE DYD Special Handling



- **CMPLDW** models:
 - Unique Load Distribution Equivalent Types
 - First 17 CMPLDW parameters
 - MVABase for the CMPLDW record
 - Last three characters (feeder type) of GE Long ID determine the Name
 - Name appended with numeric identifiers to ensure uniqueness
 - Unique Load Model Group
 - Parameters 18 through 129 of CMPLDW record
 - First three characters (climate zone) of GE Long ID determine the Name
 - Name appended with numeric identifiers to ensure uniqueness

GE DYD Special Handling



- CMPLDW models:

Model Explorer: Loads

Fields

Available Fields

- EPC File
 - EPC Modification Status
 - Flagged for Delete in EPC
 - GE In Service Date
 - GE Long ID
 - GE Normal Status
 - GE Project ID
 - GE Retirement Date
- Fault Analysis
- Geography
- Island
- Labels
- MVA
- Mvar
- MW
- OPF
- OPF Input
- Owners
- Scheduled Actions
- Sensitivity of Bus
- Substation
- Super Area
- Time Step
- Topology
- Transient Stability
 - Results
 - Save
 - Breaker Delay
 - Load Characteristic Name (Motor)
 - Load Characteristic Name (Static)
 - Load Distributed Generation MVABase Used
 - Load Distributed Generation Name
 - Load Distribution Equivalent MVABase
 - Load Distribution Equivalent MVABase Used
 - Load Distribution Equivalent Type
 - Load Distribution Equivalent Type Used
 - Load Model Group

Fields

Filter: Advanced

Load

Number of Bus	Name of Bus	GE Long ID	Dist Equiv Type Used	Load Model Group
1	10005 ALCAZAR	HID_RES	HID_RES(Load)	HID_RES
2	10008 ALLISON	HID_COM		
3	10013 ANDERSON	HID_RES		
4	10015 ARNO_1	HID_RES		
5	10017 ARRIBA	HID_RES		
6	10020 ASPEN	HID_RES	HID_RES(Load)	HID_RES
7	10022 AVILA	HID_RES	HID_RES(Load)	HID_RES
8	10027 BACA	HID_MIX		
9	10029 BALL_PPK	HID_RES		
10	10032 BECKNER	HID_COM	HID_COM2(Load)	HID_COM2
11	10034 BEL_AIR	HID_RES	HID_RES(Load)	HID_RES
12	10036 ARNO_2	HID_RES	HID_RES(Load)	HID_RES
13	10037 FIRST_ST	HID_RES	HID_RES(Load)	HID_RES
14	10040 BEV_WOOD	HID_RES	HID_RES(Load)	HID_RES
15	10041 BISTI	HID_RAG	HID_RAG2(Load)	HID_RAG2
16	10043 BLCKRA	HID_RES	HID_RES(Load)	HID_RES
17	10046 BOSQUE_F	HID_RES		
18	10048 BUCKMAN	HID_COM		
19	10050 BUCKMAN	HID_COM		
20	10052 BURNHAM	HID_RAG		
21	10053 CAMEL_TR	HID_COM		
22	10056 CANYON	HID_RES		
23	10058 CAPITOL	HID_COM		
24	10061 CENTRALP	HID_RES	HID_RES(Load)	HID_RES
25	10064 CHURCH_R	HID_RES		
26	10067 CLAREMNT	HID_COM	HID_COM2(Load)	HID_COM2
27	10068 CLAYTON	HID_RES		
28	10070 COAL	HID_RES	HID_RES(Load)	HID_RES
29	10072 WNDWROCK	HID_COM	HID_COM2(Load)	HID_COM2
30	10074 COCHITI	HID_RES		
31	10076 COLINAS	HID_RES		
32	10078 COLLGE	HID_RES		
33	10081 CORNELL	HID_RES	HID_RES(Load)	HID_RES
34	10084 COTTONWD	HID_COM	HID_COM2(Load)	HID_COM2
35	10087 CUCHILLA	HID_OTH		
36	10090 DENING_W	HID_RES		
37	10093 EASTRDGE	HID_RES	HID_RES(Load)	HID_RES
38	10097 EL_CERRO	HID_RES	HID_RES(Load)	HID_RES
39	10101 ELDORADO	HID_RES		
40	10104 EMBUDO	HID_RES	HID_RES(Load)	HID_RES
41	10106 FOURHILL	HID_RES	HID_RES(Load)	HID_RES
42	10108 FT_MARCY	HID_RES	HID_RES(Load)	HID_RES
43	10111 GALLEGOS	HID_RAG		
44	10112 GALLINAS	HID_RES	HID_RES(Load)	HID_RES
45	10115 GIRARD	HID_RES	HID_RES(Load)	HID_RES

Expand Collapse

Frozen Columns 1

Reset to Factory Defaults

Search Search Now

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