

Transient Stability Analysis with PowerWorld Simulator



T10: Transient Limit Monitors



2001 South First Street
Champaign, Illinois 61820
+1 (217) 384.6330

support@powerworld.com
<http://www.powerworld.com>

Traditional Transient Stability Analysis



- For decades, transient stability analysis has consisted of the following general steps
 - 1. Setup a stability run
 - 2. Save results to a file – a really large file
 - 3. Query the results through the use of plots and other post-processing to determine if any reliability criteria were violated.
 - PowerWorld Simulator supports this through Results Storage to RAM and to Storage to Hard Drive as well as the integrated plotting tools

Pros and Cons



- Pros
 - All the results are available in your results files to look at later
 - Plots reaffirm that the software (and you) are doing something
 - Plots are needed for displaying your results when violations occur
- Cons
 - Storing all these results can get a little large extreme
 - What if we run 1000 stability runs?
 - Terabit hard-drives
 - Reduce storage by only saving results every 10 time-steps
 - May miss something
 - Frequency dip for only 2 time steps may be missed.

Analogy to Contingency Analysis



- Keeping all these results is like storing every branch flow and every bus voltage for every contingency solution
- Is this really necessary?
- Alternative: run transient stability and only store violations (like contingency analysis)
 - Options: Generic Limit Monitors
 - Transient Limit Monitors

Generic Limit Monitors: Synchronous Generators



- Synchronous Generators Limit Monitors
 - **Absolute Angle Deviation**
 - Monitors change in rotor angle change relative to initial rotor angle
 - Crude attempt to monitor for out-of-step generators
 - **Over Frequency Action**
 - Monitors high bus frequency
 - **Under Frequency**
 - Monitors low bus frequency
 - Can specify that they not be applied to generators which already have relay models

Generic Limit Monitors



- Available under Options\Generic Limit Monitors

Options

Note: Changes made to option entries are saved immediately and will be applied during the next transient stability run.

General Power System Model Result Options Generic Limit Monitors User Defined Models Distributed Computing

Synchronous Generator Limit Monitors

Only Apply to Generators Without Relays

Monitor Type	Action to Take	Pickup Value	Pickup Time
Absolute Angle Deviation	Ignore	180.0 Deg	0.000 Seconds
Over Speed	Ignore	1.02 pu	2.000 Seconds
Under Speed	Ignore	0.97 pu	2.000 Seconds

Note: speed pickup values are in per unit. Thus a value of 1.0 means synchronous speed for the generator.

Breaker Delay Time (Cycles) 0.0

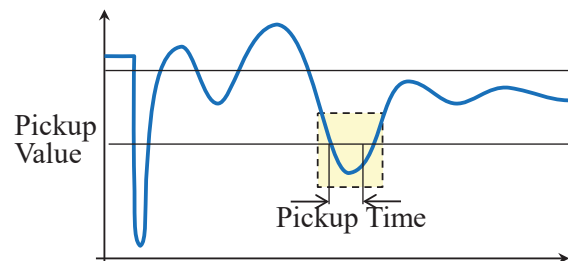
Maximum Allowable Angle Difference (degrees) 1080.0

Generic Limit Monitors: Action to Take



- **Pickup Value, Pickup Time**

- For Under Frequency, value must fall below the pickup value and stay below the pickup value for a duration of Pickup Time
- For Over Frequency and Absolute Angle Deviation are same except they must go above the pickup value.
- This will cause the monitor to be violated and the **Action to Take** will be used



Generic Limit Monitors: Action to Take



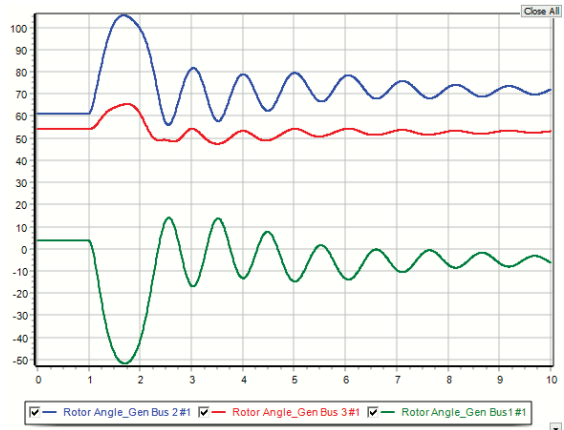
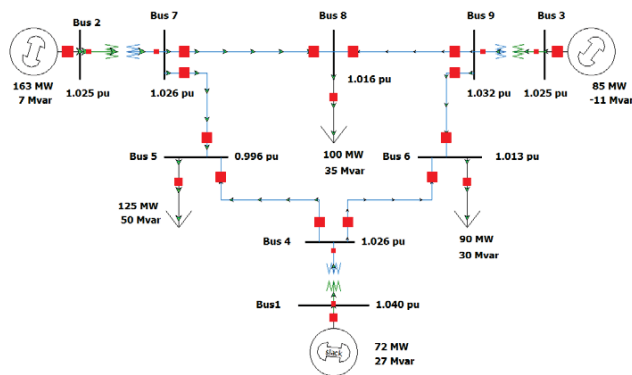
- **Action to Take**

- *Ignore*
 - Don't do anything. Disable the Monitor.
 - Default for Absolute Angle Deviation monitor
 - Default for Over Frequency and Under Frequency monitors for systems smaller than 100 buses
- *Log Warning*
 - Will create an Event in the Transient Stability Results indicating that a violation occurred and when it occurred
- *Trip*
 - Will cause the generator to trip after a time delay specified by **Breaker Delay Time**
 - Default for Over Frequency and Under Frequency for system larger than or equal to 100 buses
- *Abort*
 - Will immediately abort the simulation

Example: Generic Limit Monitors

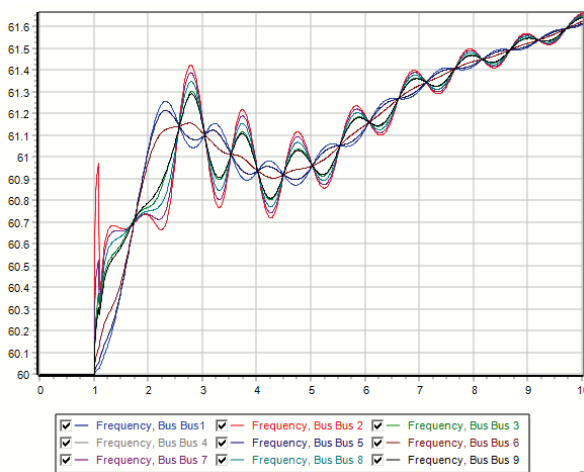


Open "WSCC_9Bus"



The left figure shows the initial power flow solution for the WSCC 9 bus case. The right figure shows the generator angles for a fault on the line between buses 5 and 7 near the bus 7 terminal, which is cleared after 0.077 seconds by opening the bus 5 to 7 line. Change the fault clearing time to verify that system loses stability for a clearing time between 0.079 and 0.08. **This fault and the associated plots are already set up in the case, starting with a clearing at 0.077 seconds.**

Example: Generic Limit Monitors



Screenshot of the Transient Stability Analysis software interface. The "Generic Limit Monitors" tab is selected, and the "Synchronous Generator Limit Monitors" section is expanded. The "Only Apply to Generators Without Relays" checkbox is checked. The "Over Speed" monitor is configured with the following settings:

Monitor Type	Action to Take	Pickup Value	Pickup Time
Absolute Angle Deviation	Ignore	180.0 deg	0.000 Seconds
Over Speed	Trip (Open)	1.02 pu	2.000 Seconds
Under Speed	Trip (Open)	0.97 pu	2.000 Seconds

Annotations in the screenshot indicate: "Change to 1.02 pu" pointing to the Over Speed Pickup Value field, and "Set to Trip" pointing to the Over Speed Action to Take dropdown menu.

- Because this case has no governors and no infinite bus, the bus frequency keeps rising throughout the simulation, even though the rotor angles are stable.
- Go to the Generic Limit Monitors tab of the Options page. Set the generators to automatically trip as above.

Example: Generic Limit Monitors

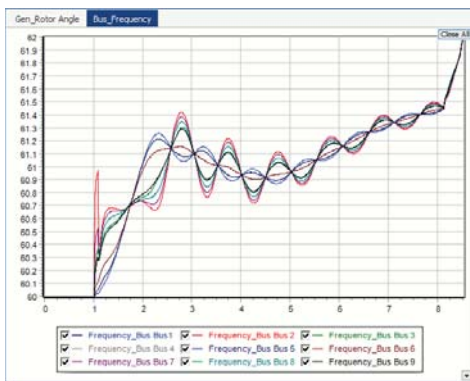
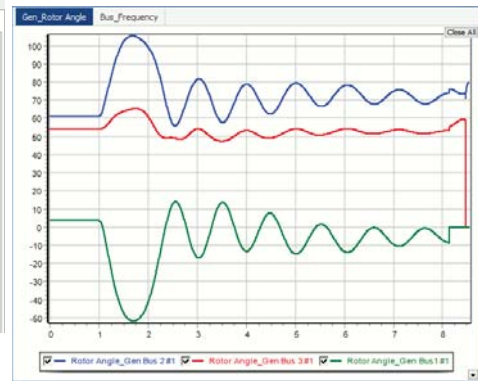


Results from RAM

Time Values Minimum/Maximum Values Summary Events Solution Details

Choose which Events to display by level AND Object Type. (Note: Events are still recorded and stored according to the Result Options settings. Unchecking this box only hides them in this

Event Levels:	Contingent Name	Time (Cycles)	Time (Seconds)	Object	Model Type	Description	Level
<input checked="" type="checkbox"/> Error	1 My Transien	60.0	1.077000	Branch '7' '5' '1'	TXLine	Apply Solid Fault (SPB)	User
<input checked="" type="checkbox"/> Info	2 My Transien	64.6	1.077000	Branch '7' '5' '1'	TXLine	Open	User
<input checked="" type="checkbox"/> Skipped	3 My Transien	488.0	8.533333	Gen '1' '1'	TXGenericGen	GENROU Over Speed: Open (TripMW=71.64)	Info
<input checked="" type="checkbox"/> User	4 My Transien	508.0	8.466567	Gen '3' '1'	TXGenericGen	GENROU Over Speed: Open (TripMW=85)	Info
<input type="checkbox"/> Transition	5 My Transien	512.0	8.533333	Gen '2' '1'	TXGenericGen	GENROU Over Speed: Open (TripMW=163)	Info
<input type="checkbox"/> Model Trip	6 My Transien	512.0	8.533333	Bus '1'	Bus	Topology Processing Open	Info
<input checked="" type="checkbox"/> Relay Trip	7 My Transien	512.0	8.533333	Bus '2'	Bus	Topology Processing Open	Info
<input type="checkbox"/> Relay Trip	8 My Transien	512.0	8.533333	Bus '3'	Bus	Topology Processing Open	Info
<input checked="" type="checkbox"/> Simulation	9 My Transien	512.0	8.533333	Bus '4'	Bus	Topology Processing Open	Info
<input checked="" type="checkbox"/> Bus	10 My Transien	512.0	8.533333	Bus '5'	Bus	Topology Processing Open	Info
<input checked="" type="checkbox"/> Gen	11 My Transien	512.0	8.533333	Bus '6'	Bus	Topology Processing Open	Info
<input checked="" type="checkbox"/> Load	12 My Transien	512.0	8.533333	Bus '7'	Bus	Topology Processing Open	Info
	13 My Transien	512.0	8.533333	Bus '8'	Bus	Topology Processing Open	Info
	14 My Transien	512.0	8.533333	Bus '9'	Bus	Topology Processing Open	Info
	15 My Transien	512.0	8.533333	PW/Caselnformation	Island	Number of Viable Islands Changed from 1 to 0	Info



- Now, All Generators tripped out between 8 and 9 seconds (with a 0.077 seconds clearing).
- When all generators tripped out, the simulation aborts as there are no longer any viable islands.

T10: Transient Limit Monitoring

Transient Limit Monitors



- Transient Limit Monitors in Simulator provide a great deal of flexibility for automatic monitoring during the simulation without having to store much data
- Similar to Limit Monitoring in traditional power-flow-based contingency analysis, only violations of limits will be reported
- Monitor a particular field for all objects of a type to meet a specified transient performance requirement
 - You will choose a field of a type of object
 - Then build a description of what is considered a limit violation

On the Transient Limit Monitors page of the Transient Stability Analysis dialog

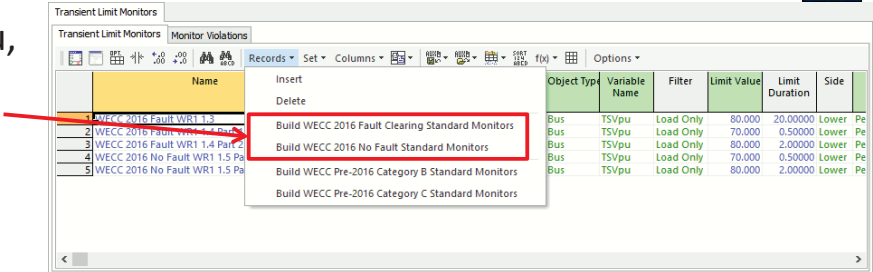
Name	Active	Category	Abort	Abort Delay	Max Violations	Object Type	Variable Name	Filter	Limit Value	Limit Duration	Side
1 WECC Category B Voltage Dip Non-Load Bus	YES	Log	Log	0.00	100	Bus	TSVpu	Non-Load	-30.000	0.00000	Lower Pe
2 WECC Category B Voltage Dip Load Bus	YES	Log	Log	0.00	100	Bus	TSVpu	Load Only	-25.000	0.00000	Lower Pe
3 WECC Category B Voltage Dip Load Duration	YES	Log	Log	0.00	100	Bus	TSVpu	Load Only	-20.000	0.33333	Lower Pe
4 WECC Category B Frequency	YES	Log	Log	0.00	100	Bus	TSFrequent	Load Only	59.600	0.10000	Lower Ac

T10: Transient Limit Monitoring

Built-In Transient Limit Monitors



- Under **Records** menu, choices are available to **Build WECC Category B Standard Monitors** (also C)

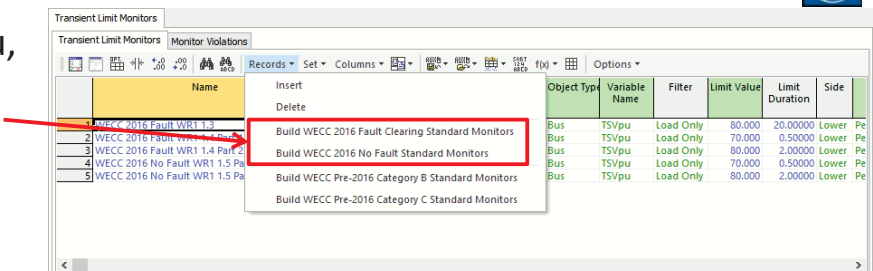


- WECC 2016 Fault Clearing Standard Monitors WR1 1.3
 - Monitor all load buses for voltages below to 80% of the initial value voltages for a duration of 20 seconds.
- WECC 2016 Fault Clearing Standard Monitors WR1 1.4 Part 1
 - Monitor all load buses for voltages below to 70% of the initial value voltages for a duration of 30 cycles. Will start monitoring voltages if they are above 80% of the initial value.
- WECC 2016 Fault Clearing Standard Monitors WR1 1.4 Part 2
 - Monitor all load buses for voltages below to 80% of the initial value voltages for a duration of 2 seconds. Will start monitoring voltages if they are above 80% of the initial value.

Built-In Transient Limit Monitors



- Under **Records** menu, choices are available to **Build WECC Category B Standard Monitors** (also C)



- WECC 2016 No Fault Standard Monitors WR1 1.5 Part 1
 - Monitor all load buses for voltages below to 70% of the initial value voltages for a duration of 30 cycles.
- WECC 2016 No Fault Standard Monitors WR1 1.5 Part 2
 - Monitor all load buses for voltages below to 80% of the initial value voltages for a duration of 2 seconds.

Built-In Transient Limit Monitors



- Under **Records** menu, choices are available to **Build WECC Category B Standard Monitors** (also C)

Name	Object Type	Variable Name	Filter	Limit Value	Limit Duration	Side
1 WECC Category B Voltage Dip L	Bus	TSVpu	Non-Load	-30.000	0.00000	Lower Pe
2 WECC Category B Voltage Dip L	Bus	TSVpu	Load Only	-25.000	0.00000	Lower Pe
3 WECC Category B Voltage Dip L	Bus	TSVpu	Load Only	-20.000	0.33333	Lower Pe
4 WECC Category B Frequency	Bus	TSFrequent	Load Only	59.500	0.10000	Lower Ac
5 WECC Category C Voltage Dip A	Bus	TSVpu		-30.000	0.00000	Lower Pe
6 WECC Category C Voltage Dip A	Bus	TSVpu	Load Only	-20.000	0.66667	Lower Pe
7 WECC Category C Frequency	Bus	TSFrequent	Load Only	59.000	0.10000	Lower Ac

- WECC Pre-2016 Category B Voltage Dip for Non-Load Buses
 - Monitor all non-load buses for any voltage dip of 30% below the initial voltage value at any time
- WECC Pre-2016 Category B Voltage Dip for Load Bus
 - Monitor all load buses for a voltage dip of 25% below the initial voltage at any time
- WECC Pre-2016 Category B Voltage Dip for Load Bus Duration
 - Monitor all load buses for a voltage dip of 20% below the initial voltage for a duration of 0.3333 seconds (20 cycles)
- WECC Pre-2016 Category B Frequency
 - Monitor all load buses for a frequency dip below 59.6 Hz for a duration of 0.10 seconds (6 cycles)

Built-In Transient Limit Monitors



- Differences as compared to Category B standards are highlighted in **Red**.
- WECC Pre-2016 Category C Voltage Dip for Any Bus
 - Monitor **all** buses for any voltage dip of 30% below the initial voltage value at any time
- WECC Pre-2016 Category C Voltage Dip for Any Bus Duration
 - Monitor **all** buses for a voltage dip of 20% below the initial voltage for a duration of **0.66667 seconds (40 cycles)**
- WECC Pre-2016 Category C Frequency
 - Monitor all load buses for a frequency dip below **59.0 Hz** for a duration of 0.10 seconds (6 cycles)

Example: Transient Limit Monitors



- Open “GSO_37Bus”
- Open the Transient Stability Analysis dialog to the Transient Limit Monitors page
- In the current case, there are several Transient Limit Monitors which are all initially inactive
- Toggle all items in the Active column to YES

This case has Bus and Gen Object monitors

Transient Limit Monitors										Limit details			
Name	Active	Category	Abort	Abort Delay	Max Violations	Object Type	Variable Name	Filter	Limit Value	Limit Duration	Side	Type	Al V:
1 WECC Category B Voltage Dip Non-Load Bus	YES		Log	0.00	100	Bus	TSVpu	Non-Load Only	-30.000	0.00000	Lower	Percent Deviation N	
2 WECC Category B Voltage Dip Load Bus	YES		Log	0.00	100	Bus	TSVpu	Load Only	-25.000	0.00000	Lower	Percent Deviation N	
3 WECC Category B Voltage Dip Load Bus Duration	YES		Log	0.00	100	Bus	TSVpu	Load Only	-20.000	0.33333	Lower	Percent Deviation N	
4 WECC Category B Frequency	YES		Log	0.00	100	Bus	TSFrequency	Load Only	59.600	0.10000	Lower	Actual	N
5 Generator Out-of-Step	YES		Log	0.00	100	Gen	TSRotorAngleNoShift		180.000	0.00000	Upper	Actual Deviation	YE

Toggle to YES to enable the Transient Limit Monitors

Field that the limit monitor applies to

Object filters in use

Transient Limit Monitors Dialog



- Right click on a Transient Limit Monitor and select “Show Dialog”
- Same options are available here as on the case information display

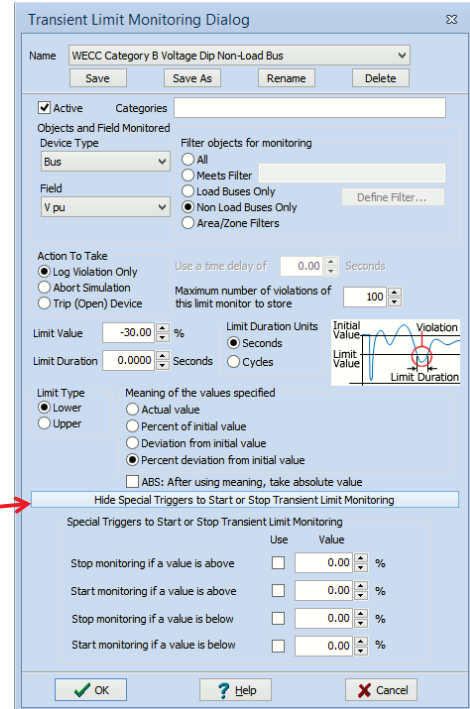
• Meaning of values specified (Examples)

- For a system with 60 Hz nominal frequency, the following are equivalent
 - Actual value, Limit Value = 59.6 Hz
 - Deviation from initial value, Limit Value = -0.4 Hz
- When monitoring voltage, the following are equivalent
 - Percent of initial value, Limit Value = 70%
 - Percent deviation from initial value, Limit Value = -30%

Transient Limit Monitoring Dialog



- When does transient limit monitoring start?
 - Normally transient limit monitoring does not start until AFTER the last user contingency event
 - Special options can be specified to start or stop limit monitoring as well
 - Click **Show Special Triggers to Start or Stop Transient Limit Monitoring**
 - Values specified in special triggers obey the **Meaning of values specified**



Defining Transient Limit Monitors



- When creating a new Transient Limit Monitor, give it a name and check the “Active” checkbox to make it active
- Set a particular object type and a particular field or variable name to which the limit should apply
- Set the value and type of the limit (Actual, Deviation, Percent Actual, Percent Deviation)
- Optionally, set the simulation to stop when limits are violated
- Optionally, set when monitoring of the limit should start and stop
 - “Stop below,” “Start below,” “Stop above,” “Start above” values, plus YES/NO fields to enable each
 - This allows the monitoring of a limit to be used for customizable situations

Stop Below Use	Stop Below	Start Below Use	Start Below	Stop Above Use	Stop Above	Start Above Use	Start Above
NO	0.000	NO	0.000	NO	0.000	NO	0.000
NO	0.000	NO	0.000	NO	0.000	NO	0.000
NO	0.000	NO	0.000	NO	0.000	NO	0.000
NO	0.000	NO	0.000	NO	0.000	NO	0.000
NO	0.000	NO	0.000	NO	0.000	NO	0.000

Transient Limit Monitoring Dialog



Define what is monitored

Uncheck to ignore monitoring temporarily

Choose a particular Field and Device Type

Can abort the simulation or trip device a specified time after violation

Choose Filter for which devices to monitor
Filter decision is based on the power flow solution (initial steady state)

Maximum number of violations to store

Transient Limit Monitoring Dialog



Define what is considered a limit violation

Specify Limit Value and Duration

Is this an Upper or Lower Limit?

Specify how the Limit Value and special triggers are interpreted

Absolute Value

Comma Delimited String Categories

Transient Limit Monitors: Monitor Violations



- As a transient stability run is processed, any violations of the Transient Limit Monitors will be shown in the Monitor Violations table
 - Shows which Limit Monitor was violated
 - Shows contingency under which violation occurs
 - Shows violated device
- If violations are found, you can revisit the run and store appropriate results
- Option to “Make a New Plot” on the Records Menu and right-click menu, will automatically generate a new Plot Definition

Transient Limit Monitors

Monitor Violations

	Limit Monitor Name	Contingency Name	Violated Device	Limit Monitor Variable	Initial Value	Actual Value	Converted Value	Time of Value	Actual Value Start	Converted Value Start	Time of Value Start	Actual Value Extreme
1	WECC Category B Frequency	My Transient Contingency	Bus '3'	TSFrequency	60.000000	59.597542	59.597542	4.7000	59.599819	59.599819	4.5917	59.592346
2	WECC Category B Frequency	My Transient Contingency	Bus '5'	TSFrequency	60.000000	59.597454	59.597454	4.7000	59.599785	59.599785	4.5917	59.592316
3	WECC Category B Frequency	My Transient Contingency	Bus '10'	TSFrequency	60.000000	59.597546	59.597546	4.7000	59.599815	59.599815	4.5917	59.592327
4	WECC Category B Frequency	My Transient Contingency	Bus '12'	TSFrequency	60.000000	59.597523	59.597523	4.7000	59.599804	59.599804	4.5917	59.592323
5	WECC Category B Frequency	My Transient Contingency	Bus '13'	TSFrequency	60.000000	59.597511	59.597511	4.7000	59.599785	59.599785	4.5917	59.592316

When running multiple contingencies, you can see which one caused the violation

Transient Limit Monitors: Monitor Violations



- There are two other places where the Monitor Violations can be seen:

Simulation Control and Violation Tab

Transient Stability Analysis

Simulation Status: Finished at 20.000000

Run Transient Stability | Pause | Abort | Restore Reference | For Contingency: Find My Transient Contingency

Select Step: Simulation

Control | Definitions | Violations | Options | Result Storage | Plots | Results from RAM | Transient Limit Monitors | Monitor Violations | States/Manual Control | Validation | SMIB Eigenvalues | Model Analysis | Dynamic Simulator Options

Simulation Time Values: Start Time (seconds): 0.0000, End Time (seconds): 20.0000, Time Step (cycles): 0.5000

Summary Results: Tripped: 0.00, Islanded: 0.00

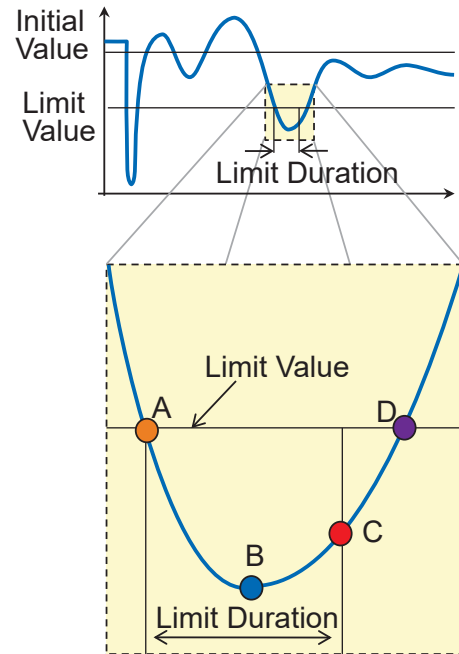
Transient Contingency Monitor Violations

Limit Monitor Name	Contingency Name	Violated Device	Limit Monitor Variable	Initial Value	Actual Value	Converted Value
1 WECC Category B Frequency	My Transient Contingency	Bus '3'	TSFrequency	60.000000	59.597542	59.597542
2 WECC Category B Frequency	My Transient Contingency	Bus '5'	TSFrequency	60.000000	59.597454	59.597454
3 WECC Category B Frequency	My Transient Contingency	Bus '10'	TSFrequency	60.000000	59.597546	59.597546
4 WECC Category B Frequency	My Transient Contingency	Bus '12'	TSFrequency	60.000000	59.597523	59.597523
5 WECC Category B Frequency	My Transient Contingency	Bus '13'	TSFrequency	60.000000	59.597511	59.597511

Transient Limit Monitors: Monitor Violations



- Values reported by Monitor Violations
 - Violation (Point C)
 - Value
 - Time of Value
 - Extreme (Point B)
 - Extreme Value
 - Time of Extreme Value
 - Note: could be after point C also
 - Start of Violation (Point A)
 - Value Start
 - Time of Value Start
 - Value no longer violating (Point D)
 - Value No Violation
 - Time of Value No Violation
 - Note: Point may not exist



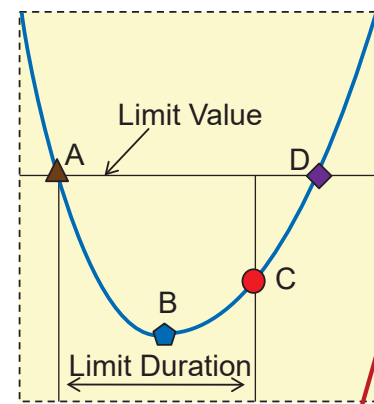
Monitor Violations: Example



- Run the simulation
- Open the Transient Limit Monitors page and view the violations
- The “Generator Out-of-Step” limit monitor has several violations

Monitor Violations Tab- View the violations

For this example, points A and C are the same because the Limit Duration is 0



Limit Monitor Name	Contingency Name	Violated Device	Limit Monitor Variable	Initial Value	Actual Value	Time of Value	Actual Value Start	Time of Value Start	Actual Value Extreme	Time of Value Extreme	Actual Value No Longer	Time of No Longer
1 WECC Category B Frequency	My Transient Contingency	Bus '3'	TSFrequency	60.000000	59.597542	4.7000	59.599819	4.5917	59.592346	5.4500	59.600174	6.3667
2 WECC Category B Frequency	My Transient Contingency	Bus '5'	TSFrequency	60.000000	59.597454	4.7000	59.599785	4.5917	59.592316	5.4500	59.600231	6.3667
3 WECC Category B Frequency	My Transient Contingency	Bus '10'	TSFrequency	60.000000	59.597546	4.7000	59.599815	4.5917	59.592327	5.4500	59.600128	6.3667
4 WECC Category B Frequency	My Transient Contingency	Bus '12'	TSFrequency	60.000000	59.597523	4.7000	59.599804	4.5917	59.592323	5.4500	59.600159	6.3667
5 WECC Category B Frequency	My Transient Contingency	Bus '13'	TSFrequency	60.000000	59.597511	4.7000	59.599785	4.5917	59.592316	5.4500	59.600155	6.3667
6 WECC Category B Frequency	My Transient Contingency	Bus '14'	TSFrequency	60.000000	59.597466	4.7000	59.599907	4.5917	59.592388	5.4500	59.600105	6.3500
7 WECC Category B Frequency	My Transient Contingency	Bus '15'	TSFrequency	60.000000	59.597431	4.7000	59.599770	4.5917	59.592281	5.4500	59.600182	6.3667
8 WECC Category B Frequency	My Transient Contingency	Bus '16'	TSFrequency	60.000000	59.597446	4.7000	59.599773	4.5917	59.592289	5.4500	59.600182	6.3667

Monitor Violations: Example



- You can add Plot Definitions for variables which are violating the limit monitors
- Select all the violations, right click, choose “Make New Plot”

Create Plot Definitions for violating fields

The screenshot shows the 'Transient Limit Monitors' window with a table of violations. A context menu is open over the table, and the 'Make New Plot...' option is highlighted. The table contains the following data:

Limit Monitor Name	Contingency Name	Violated Device	Limit Monitor Variable	Initial Value	Actual Value	Time of Value	Actual Value Start	Time of Value Start	Actual Value Extreme	Time of Value Extreme	Actual Value No Longer	Time of Value No Longer
1 Generator Out-of-Step	Multi-Transient Contingency - Gen		TSRotorAngleNoShift	17.725307	-163.116440	3.3500	-163.116440	3.3500	-2043.581909	20.0000		
2 Generator Out-of-Step			TSRotorAngleNoShift	22.623854	-158.104141	3.3583	-158.104141	3.3583	-2036.634033	20.0000		
3 Generator Out-of-Step			TSRotorAngleNoShift	2.574129	-178.452438	3.3583	-178.452438	3.3583	-2057.231445	20.0000		
4 Generator Out-of-Step			TSRotorAngleNoShift	24.365929	-156.317825	3.3667	-156.317825	3.3667	-2033.889648	20.0000		
5 Generator Out-of-Step			TSRotorAngleNoShift	24.365929	-156.317825	3.3667	-156.317825	3.3667	-2033.889648	20.0000		
6 Generator Out-of-Step			TSRotorAngleNoShift	3.176225	-177.747818	3.3750	-177.747818	3.3750	-2054.341309	20.0000		
7 Generator Out-of-Step			TSRotorAngleNoShift	10.092613	-170.475906	3.3750	-170.475906	3.3750	-2047.109131	20.0000		
8 Generator Out-of-Step			TSRotorAngleNoShift	7.365517	-173.130798	3.3917	-173.130798	3.3917	-2050.162842	20.0000		

Monitor Violations: Example



The screenshot shows the 'Plots' window in the software. The 'Plot Designer' tab is active, showing a list of plot definitions. The 'Object' column lists various generator speed and rotor angle variables, and the 'Variable' column lists the corresponding plot series. The 'Plot Series List' table is as follows:

Object	Variable	Value Type	Style	Visible	Color	Thickness	Dashed	St
1 Gen '53' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Blue	1	Solid	N
2 Gen '44' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Red	1	Solid	N
3 Gen '48' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Green	1	Solid	N
4 Gen '28' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Grey	1	Solid	N
5 Gen '28' '2'	TSRotorAngleNoShift	Actual Line	YES	YES	Black	1	Solid	N
6 Gen '14' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Dark Blue	1	Solid	N
7 Gen '50' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Purple	1	Solid	N
8 Gen '31' '1'	TSRotorAngleNoShift	Actual Line	YES	YES	Teal	1	Solid	N

New Plot Definitions created from Monitor Violations

Blank Page