



Benchmark of PWS Transient Stability with Current Industry Tools

Tracy Rolstad
Avista System Planning

Introduction

- Tracy Rolstad
 - Senior Power System Consultant
 - tracy.rolstad@avistacorp.com
 - 509-495-4538

Transient Stability in the West

- Programs Used
 - BPA IPF → WSCC IPS
 - IPF is used in China
 - GXED is a PWS partner involved in T.S. work
 - GE PSLF/PSDS is WECC “standard”
 - Supported by WECC, CAISO, BPA, etc
 - Numerous epcls exist to aid Engineers
 - PTI PSS/E & PSSDS4
 - Less use and local support in WECC

The New Guy (Powerworld)

- Why use it?
 - GE and PTI have substantial elements of their code written by one person
 - J. Undrill—He has stated that having IPF around was a good thing, i.e. a second check on GE/PTI
 - Note that IPF is not maintained by BPA anymore
 - Presumably PWS is the substitute
 - PWS is modern and represents a “fresh” start
 - Reasonably young staff—the original developers
 - Modern coding tools used throughout its development
 - You can influence its features!!!

What is Avista's Role?

- Testing against test results and standard tools
 - AVA licenses both GE and PTI
 - We aren't particularly happy with either product
 - PWS is our “go to” power flow tool
 - We would like it to “do it all”
 - We test machines yearly
 - Reality is the ultimate “ground truth”

WECC PTI *.dyr Results

Model Explorer: MEX_FLD::TSMModelSummary
Transient Stability Model Summary Form

Filter Find... Remove

	Model Class	Object Type	Active Model Count	Inactive Model Count	Fully Supported
1	Machine Model	CIMTR4	94	0	NO
2	Load Relay	LDS3	1713	0	NO
3	Machine Model	GENROU	1831	0	YES
4	Machine Model	CSVGN5	11	0	YES
5	Machine Model	CSVGN6	5	0	YES
6	Gen Other Model	IEEEVC	555	0	YES
7	Exciter	IEEET1	50	0	YES
8	Exciter	EXPIC1	1	0	YES
9	Exciter	IEEET4	79	0	YES
10	Exciter	IEEEX1	320	0	YES
11	Exciter	EXAC1	163	0	YES
12	Exciter	EXAC1A	5	0	YES
13	Exciter	EXAC2	65	0	YES
14	Exciter	EXAC4	18	0	YES
15	Governor	TGOV1	17	0	YES
16	Governor	IEEEG3_PT1	388	0	YES
17	Exciter	EXST1	867	0	YES
18	Exciter	EXST2	19	0	YES
19	Exciter	EXST3	22	0	YES
20	Exciter	ESST2A	53	0	YES
21	Exciter	ESST3A	41	0	YES
22	Exciter	ESST4B	338	0	YES
23	Exciter	EXDC2_PT1	112	0	YES
24	Exciter	REXSYS	203	0	YES
25	Exciter	REXSY1	4	0	YES
26	Exciter	ESAC3A	4	0	YES
27	Exciter	ESAC8B_PT1	135	0	YES
28	Governor	GGOV1	812	0	YES
29	Governor	HYGOV	208	0	YES
30	Governor	PIDGOV	30	0	YES
31	Exciter	EXELI	2	0	YES
32	Exciter	SCRX	10	0	YES
33	Governor	WSIEG1	289	0	YES
34	Governor	URGS3T	65	0	YES
35	Governor	WSHYDD	52	0	YES
36	Governor	WSHYGP	178	0	YES

Search Search Now Options

Two model types

WECC GE *.dyd Results

Model Explorer: MEX_FLD::TSMModelSummary

Transient Stability Model Summary Form

Records Set Columns

Filter Find... Remove

	Model Class	Object Type	Active Model Count	Inactive Model Count	Fully Supported
1	Gen Other Model	OEL1	381	0	NO
2	Machine Model	GENWRI	3	0	NO
3	Machine Model	GEWTG	18	0	NO
4	Machine Model	MOTOR1	73	0	NO
5	Gen Other Model	LCFB1	81	0	NO
6	Exciter	EXWTGE	18	0	NO
7	Load Relay	LSDT1	48	0	NO
8	Exciter	EXWTG1	3	0	NO
9	Machine Model	GENTPF	1065	0	NO
10	Exciter	TEX5	10	0	NO
11	Machine Model	SVCWSC	15	0	NO
12	Exciter	ESAC7B	2	0	NO
13	Governor	WNDTGE	18	0	NO
14	Governor	IEEEG3_GE	354	0	NO
15	Load Relay	LSDT9	1677	0	NO
16	Load Relay	LSDT2	13	0	NO
17	Exciter	EXAC2	65	0	YES
18	Exciter	EXST4B	338	0	YES
19	Exciter	EXAC1A	5	0	YES
20	Exciter	EXAC1	163	0	YES
21	Governor	GAST_GE	65	0	YES
22	Governor	WNDTRB	2	0	YES
23	Exciter	EXST2	19	0	YES
24	Exciter	EXST2A	53	0	YES
25	Exciter	EXST3	22	0	YES
26	Exciter	EXST3A	41	0	YES
27	Exciter	IEEET1	50	0	YES
28	Exciter	EXDC1	320	0	YES
29	Exciter	EXDC2A	63	0	YES
30	Exciter	EXDC2_GE	49	0	YES
31	Exciter	EXST1	869	0	YES
32	Governor	IFFFG1	290	0	YES

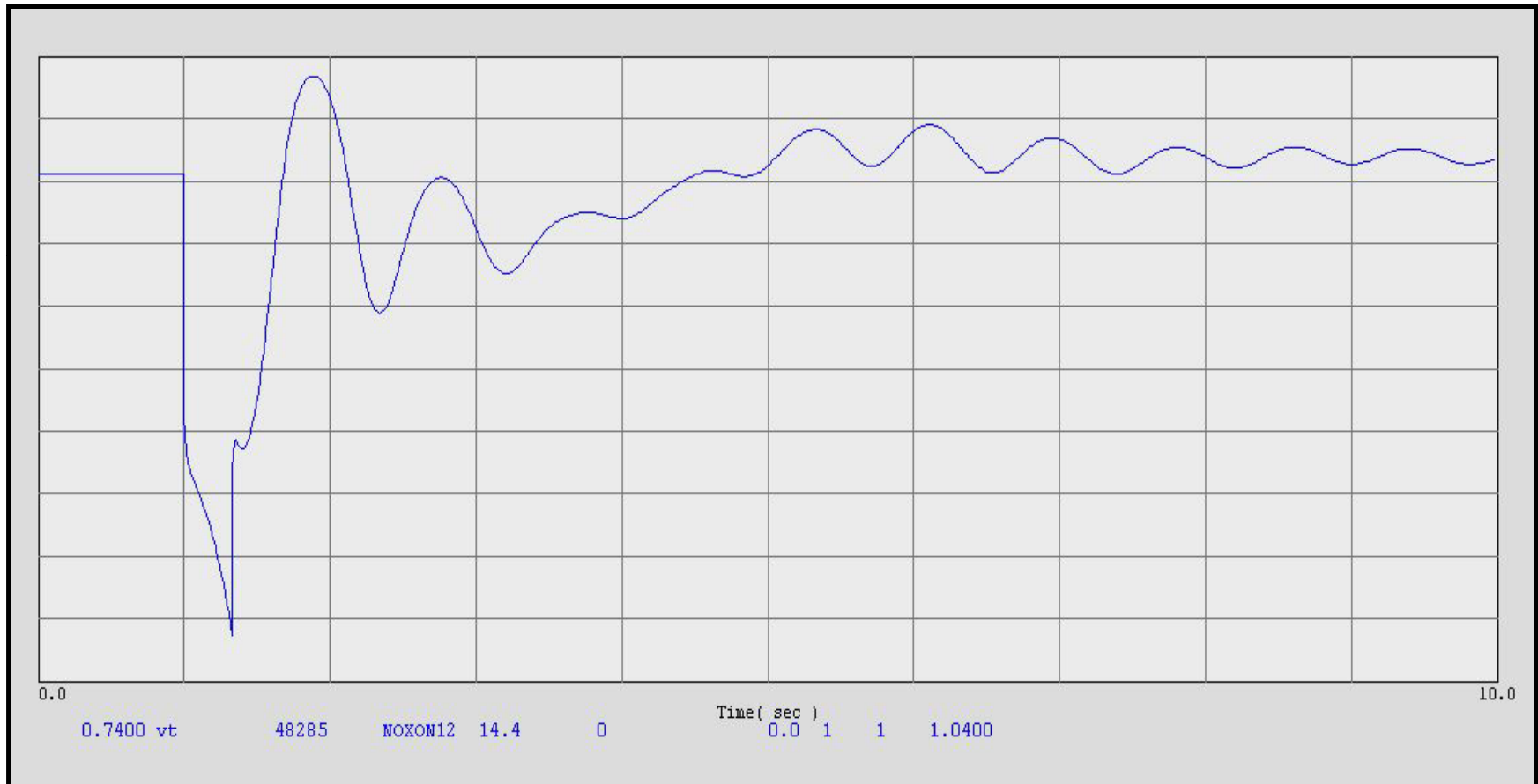
Search Search Now Options

16 model types, plus ATR, PDCI, etc

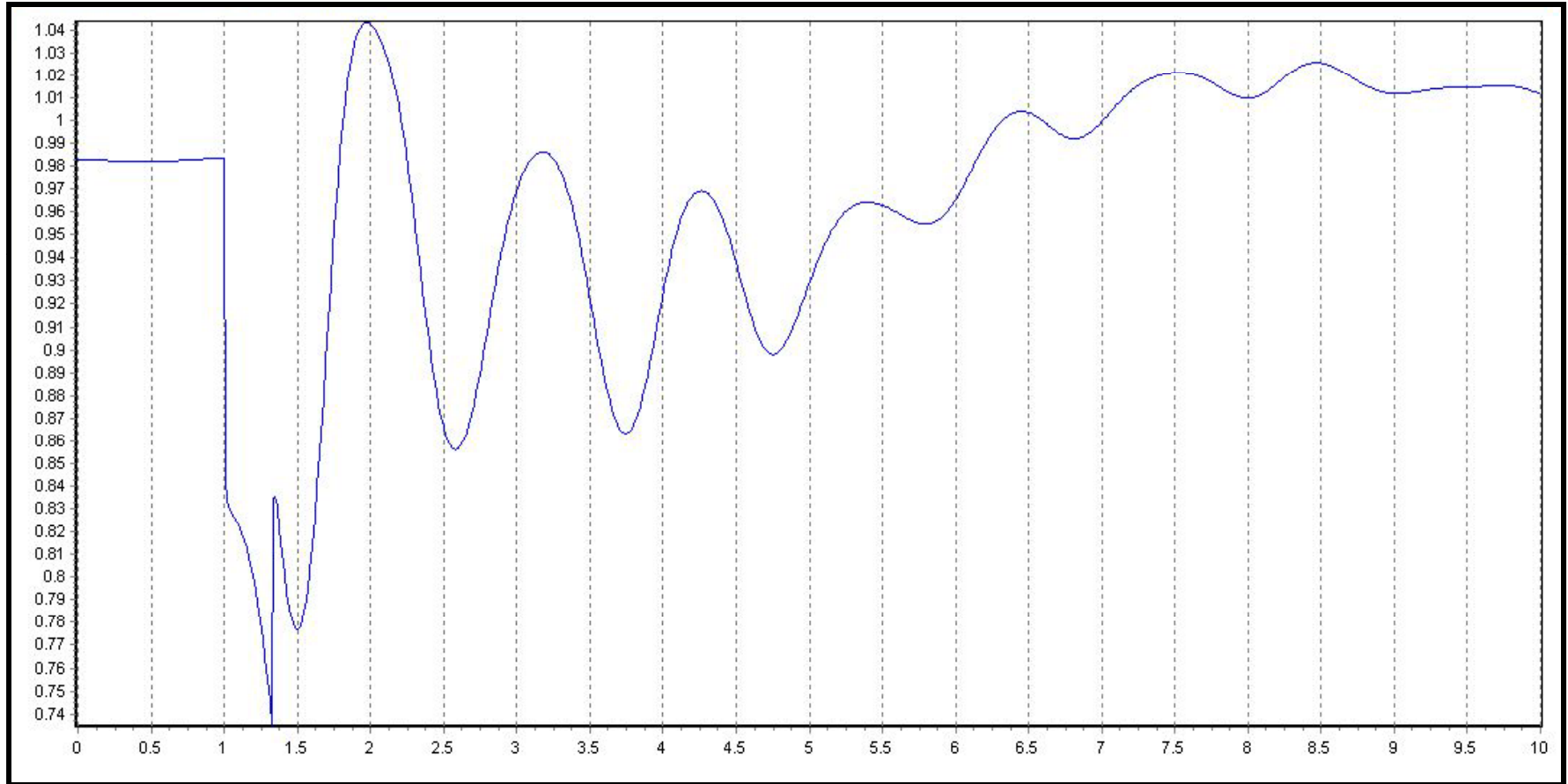
Test 1 (GE Results vs. PWS *.dyr)

- Worst case from data perspective
 - PTI based input to PWS
 - GE tool has more advanced models than PTI
 - At least as far as WECC is concerned...
 - Results are favorable
 - In spite of numerous models not yet implemented in PWS
 - Based on a known “rattling” event for Avista
 - Delayed clearing on Boulder—Otis 115 kV line
 - Used default settings for all tools

GE PSDS Results



PWS Results



Observations

- Model implementation...
 - PWC has done an admirable job slogging through these...still more to do
- “Tuning” is needed
 - Present release requires very small time step in order to actually function
 - i.e. we have used 0.002 second time steps
 - Suggestions to user
 - Auto size time steps, etc

Future Capabilities Needed

- SPEED!
- Automation, automation, automation
 - Need to be able to read in multiple cases
 - Need to be able to apply numerous events
 - Need to screen ALL events and write table of violations
 - Need to automatically save plots out
 - In “PWS format”
 - As a pdf document, etc
 - Raw plot data as CSV, Excel, etc
 - All of the above needs to be “hands free”
 - And non-cryptic as far as building a “script”