Real-time modeling and simulation of synchrophasor systems at the New York Power Authority: Use cases and applications

IEEE Smart Grid Synchronized Measurements and Analytics (SGSMA) conference May 25-27, 2021

Panel Session: Role and Use Cases of Real Time Simulators (RTS) Towards Advancing and Deploying Synchrophasor Based Wide Area Monitoring Protection and Control (WAMPAC) Systems May 25, 2021



A Program of the New York Power Authority

NYPA Overview – Generation/Transmission Assets



- Established by the NY State Legislature in 1931.
- Largest state public electric utility in the United States.
- Wholesale power supplier throughout New York State and neighboring states as required by law.
- Provides, with generation and power purchases, about 25% of New York State's electricity. No Distribution System
- 2019 Net Generation: 30.2 million MWh; 80% hydro; 20% gas/oil
- Transmission lines: 1,400+ circuit miles; 115kV, 230kV, 345kV & 765kV
- Non-profit energy corporation, does not use tax revenues or state credits, finances projects through bond sales and cash from operations



The Advanced Grid Innovation Laboratory for Energy (AGILe) Collaboratively enabling an affordable, reliable, low-carbon future

Bringing together **industry stakeholders** to evaluate integrated grid solutions for a clean energy future and **accelerate development and adoption of new technologies**



Advanced T&D Applications



Cybersecurity



Advanced Modeling and Simulation with Real-Time Hardware/Software-in-the-loop Capabilities



Power Electronic Controls



Grid Automation



Advanced Sensors



End-to-end grid modeling and real-time simulation



Hardware/software-in-the-loop equipment testing for digital substation automation and control



Simulation of communication systems and cyber security events



Economic analysis and evaluation of technical solutions



Development of a RTS-Based Testbed for Synchrophasor Applications



Development of a RTS-Based Testbed for Synchrophasor Applications



openPDC Manager	E7003		Same bird	Parlant.		-		o op	enPDC Ma	nager			Farmer Banker Calut		
Home Inputs Outputs Actions Me	stadate Mor	vitoring Reporting Sy	vices				0	Home	Imports Outports a	Actions Met	tedate Mo	extoring Reporting 1	lystem		0
Graph Real time Measurements								Graph R.	al-time Measurements	-					
Mattern University Care Last Cheffering, Control 202 Order, Care Last Cheffering, Control 202 Order, Care Last Care Care Care Care Care Care Care Care	Biological Antonia Cardina and Santa Santa Cardina Cardina Cardina and Santa Santa Cardina Car						INVEST. CAREAR LIKE REFERENCE NOOTSCHEIN OCCUMANAL SITUATIONSCHEINE UND OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE OCCUMANAL SITUATIONSCHEINE NAMERICH ANTRODUCTIONSCHEINE MANNERSCHEINERSCHEINE MANNERSCHEINERSCHEINE MANNERSCHEINERSCHEINE MANNERSCHEINERSCHEINERSCHEINE MANNERSCHEINERSCHEINERSCHEINE MANNERSCHEINERSCHEINERSCHEINE MANNERSCHEINERSCHEINERSCHEINE MANNERSCHEINERSCH	00.535399 M Gas " RC.1 645 RC.1 645 RC.2 645 216120724 20651.2 G 26651.2 G 26651.2 G 47736.2 G 47736.2 G 47736.2 G 468 bas t Gas t Gas t Gas t	School up References		1 Danke Lettinger Lann Danker find	The second s	In Class Davide, Software Read Lower Income Jan		
 International and the second state of the second stat	PPA 1082	BURCHANANA, B1262628124	15-09-45-093	80.001	164	36	-		WARCY #1478330140059 E	C LOB	PPA.2645	PORTER, 81372108137730	16:02:07.523 BOODE	114 26	
CARRAGUT \$1206448126642 Lan	PPA-1211	PARAGOUT_B12004481282	15-09-45,350	24,958	344	24			MARCY #1480608110750 E	Los					
# FANRAGUE #120545#126272 Edit	PPA308	STL.PSANT_B14782081477.	15:09:23.360	80.001	2492	24			VILLWOOD 812629181262	263.3 Eule					
ASEAGUT #1266458126274 6484							-		VILLWOOD E12629181262	10.1 2 1.01					1.00
TARRACUT E1200458126277 Edit	Ram, Since Start	MARY BUILDARAMAN BUILDARA	wine sectors	h testorical 2 and			<u> </u>		VILLWOOD #12629181262	258 608	Rase store Stat	NAMES BUILDINGS BUILDING	126267 Betret Mercury 2 and		
#1A88AGA/T.#3266438126278 Edd	00	Statistic	Value		Tana	TimeTap			MILLWOOD, #12629181282	209 8.08	eD.	Statistic	Value	TimeTag	
EAMEAGAJI, 81258458126599 Lott	5167-016	Data Chailing Tonics		0		10-10-02 625			NITT MOICID # 150540181585	270 6,08	STATETS	Cana Chairing Second		100244210	1
ANRAGATI B1255458126642 Las	STAT NO.	Last Report Yang	44100-2010		15-1907-035				VILLWOOD 812629181262	663 MCS	STAT 683	Cant Report Vires	0.00,000 5.0	96:02:44.210	121
ARRAGAT & LOTINORI 20279 LOR	\$1A1-919	Tanie Quality Errors	0		15(19(02-895				MILLWOOD \$1262F181253	106 Eulit	53A1876	Time Guality Drons 12.	10	16/02/44/210	121
GOKTHALS 81262838326265 1 Edit	STATINGS	Yorket Printee				19/19/02/695			KU.WOOD 812629181288	129 Lut	STATERS:	Total Harrens	1.000	9603A4210	4
B CONTINUE STOCKEDUTIONS 2 Date	STAT 920	Device Errors		0		15/19/02/895			VILLWOOD B12628181282	100 Eule	STATETT	Device Balors	.0.	10/02/44/210	
	STATISTY.	Minung Franks	0		15(1002.635				CONTRA DEVELOPMENTERS -	5.640	STATION	Relicionary Enternies	0	36/02/46/210	4
CONTRACT REPORTED AND A DATE	\$1A1928	Measurements Received			15(19)	15/10/02/835			DORTON OLIVE		STATION	Measurements Received	0.012	160248,210	
CONTINUES RELEASED BELOWING & DAR	53AT/942	Milleng Data			15/10/03/095				POSTER OLDO DITE		5.1AT 000	Meerig Data		1802/44210	1. III
CONTRACT BILLEN BILLEN BILLEN BILLEN	31/41/302	Measurements Capeched	_		15(194	12.833		100	100000 (0.1.00)		210-879	Incencements Copected	.0.	180244210	1.1

Capability for detailed modeling of NYPA and NYS grid to simulate a large variety of phenomena

٠

.

- Ability to model and cosimulate communication systems and cyber-security events evaluating their impact on grid applications
- Capability testing equipment and schemes in close-to-field conditions prior to field deployment
- De-risking synchrophasorbased wide-area monitoring, protection, and control systems



Use Case: Implementation and Testing of Wide Area Oscillation Damping Controller

- Collaborators
 - EPRI, NYPA, TERNA, UTK
- Issue under study
 - Design and implement an adaptive, wide-area oscillations damping controller utilizing phasor measurement unit data and is capable of damping interarea low-frequency oscillations observed after disturbance events.
 - Performance demonstration both in the New York state and the Italian transmission grids.









Discussion



George Stefopoulos

Director, Advanced Grid Innovation Lab for Energy (AGILe)

New York Power Authority

914-287-3857

george.stefopoulos@nypa.gov

www.nypa.gov

