ONS Real-Time Dynamic Simulator

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Brazilian ISO Challenges

Fifth largest country by area
• 8.5 million km$^2$

Sixtieth most populous
• 213 million people
Country Size Comparison

https://thetruesize.com/
Brazilian ISO

≥ 30 MW

≥ 230 kV

Source: www.epa.gov
Brazilian ISO

99% Brazilian Load

Isolated Systems
≈ 300 cities
Small thermal power plants
Transmission System

2022
179 311 km

2027
270 558 km
Energy Matrix

Total: 181.511 MW

- Hydro: 109.288 MW (60.21%)
- Thermal: 39.436 MW (21.73%)
- Solar: 7.159 MW (3.94%)
- Nuclear: 23.637 MW (13.02%)
- Wind: 1.990 MW (1.10%)
PMU Deployment

- 350 PMUs in OP
- Data Quality ~ 80 % good
- Data Availability ~ 85 %

1000 PMUs
6000 phasors
10000 Digitals

at 60 fps
CC-PMS - Layout

Real Time
- Alarm Management
- Composite Alarms
- Oscillation Monitoring
- F, V&I, Power Flow Monitoring
- System Disturbance
- Islanding & Restoration
- Dynamic Stability Assessment

Offline
- User Calculations
- Spectral, Modal & Event Analysis
- Reporting capability
- Training Environment
- Historical Event Storage

SCS - Supervision & Control System (4 sites)
CNOS - National Control Center
COSR-NCO - North Central-West Regional Control Center
COSR-NE - Northeast Regional Control Center
COSR-SE - Southeast Regional Control Center
COSR-S - South Regional Control Center

OP - Operation Production
CORPUS - Corporate User System
SSH - System Staging & Homologation
ADOT - Application Development & Operator Training
CC-PMS – Simulator Characteristics

Special characteristics:

- Simulator – generates current and voltage phasors based on fully electromechanical models. These phasors are sent to PDCs at a rate of 60 ftp using the IEEE C37.118 protocol and then sent to be consumed by applications in real time and offline. The simulator allows you to do:
  - Start / stop the simulation
  - Changing generation & load
  - Open & close equipment's (LT / TR / SC / EC / RE / CA )
  - Separate & reconnect bus bars
  - Generate errors in loads and phasor measurements

- The dynamic models are the same as those used by the planning and engineering teams and benefit from the evolutions made in the database of dynamic models by these teams.

- Supported models: hydraulic generators, wind generators, thermal units, HVDC, different load models, protection schemes. All lines and transformers receive standard protection automatically (zone protection, bus protection, etc.)
Simulator
Simulator Output
Simulator Output
Simple to use - get a pre-fault base case from State Estimator, start a simulation, and reproduce the disturbance.

Real-time Environment – What was observed by a PMU near the problem

Simulator – What was observed by the same PMU
Team

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Thank You!

Questions?