

Synchrophasor RAS at BPA

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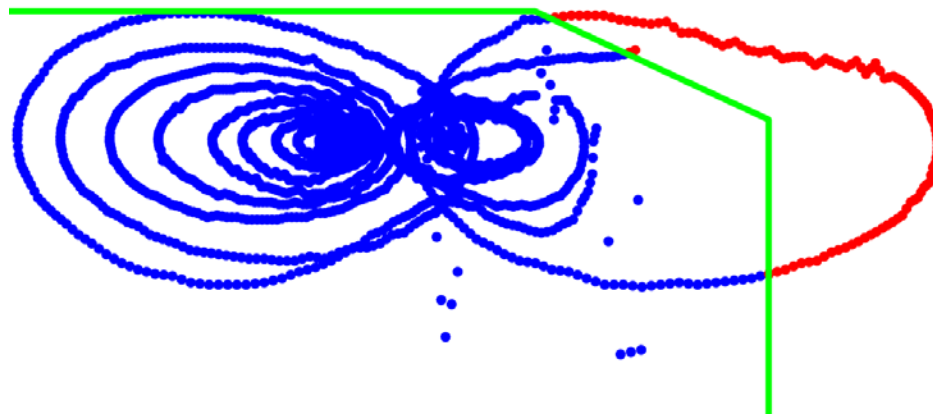


Introduction to BPA SP RAS

- BPA has investigated real-time wide-area control schemes for decades
- Implementation of a fast, secure, reliable PMU network through WECC WISP program made WACS more achievable
- First stage: reactive control
 - Relatively low consequence for false tripping
- Overall goal: *do no harm*

SP RAS Algorithm

- Multi-variable, phase plane methodology
 - Power flow, frequency, phase angle (and their corresponding rate-of-change)
- Sliding window triggering
 - If x out of y consecutive samples are outside the plane, trigger the RAS action



SP RAS Algorithm

- Pairs of PMUs, including primary, secondary, and tertiary devices
 - Sets of PMUs grouped by close electrical distance
 - RAS controller switches when bad/missing data is detected

Design Challenges and Solutions

- Minimize end-to-end latency
 - *No substation PDCs*
 - *UDP multicast over dedicated SONET channels*
- Data accuracy and availability – minimize quantity and effect of GPS loss, dropouts, etc.
 - *Full redundancy at substation, including GPS receivers, PMUs, PT/CTs, network equipment*
 - *Crosscheck values among PMUs for reasonability*
 - *RAS controller at each of BPA's two control centers*

Design Challenges and Solutions

- Integration with existing RAS system
 - *Synchrophasor-capable cards provided by vendor to read C37.118 data streams*
 - *PDC functionality programmed into RAS controller*
 - *Output of SP RAS is input contact to existing RAS*
- Vetting of algorithm functionality and error-handling
 - *Thorough online and offline testing*
 - *Multiple revisions of algorithm*

Testing

- Install test RAS unit in parallel with controller
- Simulate response to real event data in offline MATLAB environment
- Playback data sets as C37.118 data streams
 - Ambient data, “clean” event data, event data with dropouts/errors, etc.
 - Compare expected results with outputs generated by controller
- Real-time software implementation to compare results continuously

Current Status/Next Steps

- Scheme approved as WECC “safety net”
- Currently in final “test mode” phase
 - RAS controller receiving live data streams
 - Algorithms producing results
 - Actions disabled by dispatchers, pending outcome of long-term testing
- Begin assessing next generation algorithms

Contact

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