TCIPG PMU Integration into Power Flow Software

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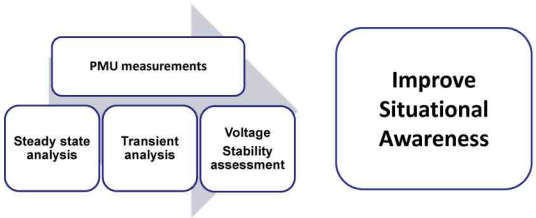
Goals

- Develop a framework to allow PMU measurements to be directly incorporated into existing power flow algorithms in order to improve situational awareness.
- Develop power flow algorithms for solving part of a power network using the standard ac model and other parts using the more approximate dc model.
- Develop voltage stability assessment method with PMU values in order to prevent voltage collapse.



Fundamental Questions/Challenges

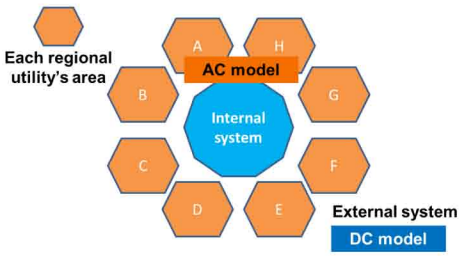
- What kinds of function are required to improve situational awareness with PMU measurements?
  - ➢ Steady-state and transient analysis and voltage stability assessment.
- How can we include PMU measurements in power flow software?
  - ➢ New power flow algorithm is required, and the approach combines the standard ac model with the approximate dc model.
- How can we predict voltage collapse margin?
  - ➢ New voltage stability index should be developed to utilize PMU values

Research Plan

- Fast steady-state and transient analysis.
  - Define how to interface PMU data into power flow software.
  - Develop new power flow algorithm.
  - Integrate the developed algorithm into actual power system code.
- Voltage stability assessment.
  - Research the cause and effect of voltage instability.
  - Define possible voltage assessment methods, incorporating PMU data.
  - Obtain PMU measurements from practical power system.
  - Test the developed voltage stability index with past or simulated voltage instability case.

Research Results

- Advanced power flow algorithm was implemented with Matlab.
- Paper was submitted to *IEEE Transactions on Power Systems* and is now under review.



Broader Impact

- State estimator (SE) results are not available in a variety of situations.
  - Smaller utility control systems may not have an SE.
  - SE may have failed to converge during rapidly changing system conditions.
  - SE results are not public information.
- In above situations, new software incorporated with PMU can be utilized.

Future Efforts

- The availability of actual power system PMU data, and associated power flow models.
- Integration of the developed algorithm into actual power system code.
- Testing of the developed voltage stability assessment method with past or simulated cases.
- Identification of technology transfer targets through industry interactions; work to meet the possible targets' requirements.