Official Project Title
Enabling Extended-Term Simulation of Power Systems with High PV Penetration

Statement of Work 'Summary'
Significantly Improve extended-term power system simulation tools by implementing numerical algorithms that better simulate both fast and slow dynamics involved with systems that have high penetration of inverter based resources, low inertia, and variable solar irradiance.

- Focus on a 'mixed-mode' simulation framework.
- Implement fast time scale solvers.
- Conduct simulation studies of realistic grid models with high PV penetration and variable solar irradiance.
- Demonstrate performance improvements relative to prior state-of-the-art.

Deliverables and Due Dates

1. Develop mixed mode simulation framework and up to three different simulation test cases (models plus datasets) along with a matrix of numerical results comparing to the baseline solver method (RK-2 method). This is due no later than **6/30/2020**.
2. Implement the new mixed-mode simulation framework developed in Milestone 1 into PST/Matlab using variable irradiance PV models and data. This is due no later than **1/31/2021**.
3. Provide written contributions to a final report, covering framework development and simulation results. This is due no later than **2/28/2021**.

Technical Work Plan Interpretation
Advance the understanding of the grid impact of high penetration of photovoltaic generation by developing novel numerical methods to solve the differential algebraic equations that define a power system.

Tasks

1. Develop time step control, simultaneous-implicit and/or multi-rate algorithms within PST and PowerWorld. Update or develop dynamic models for slow system dynamics such as variable solar irradiance and automatic generation control.

2. Implement results from Task 1 into PowerWorld, engage stakeholders to show market readiness of project outcomes, and bring results to industry attention by demonstrating real-world relevance.

Objectives

1. Reduce limitations of current numerical methods for transient stability analysis by implementing time step control, simultaneous-implicit and/or multi-rate integration methods that are appropriate for realistic grid models with high levels of variable inverter based resources.

2. Develop variable time step algorithms for extended-term (15 minute +) dynamic simulations of power systems.