**PhD Topic**

**Advanced Control Strategies for Renewable Energy Generators to Provide Grid Ancillary Services**

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**Keywords:** Renewable energy, grid ancillary services, power systems with high penetration of power electronics,

**Research background:** Renewable energy sources are integrated into the grid using the power electronic converters. The conventional grid-following control schemes of these converters pose serious challenges to the stable operation of the electrical grids with high penetration of renewable energy. Many new control schemes are being reported recently to provide ancillary services using renewable energy generators. Each control scheme comes with certain benefits and some limitations. The commercial integration of these new control schemes will only happen if the limitations and concerns of the grid operators are properly addressed. This research work proposes to conduct a comprehensive review of the existing control schemes for providing ancillary services to the grid using renewable energy sources. The focus shall be on the solar and wind energy generators. The grid ancillary services such as frequency support, voltage control and fault-ride through capabilities shall be explored. The limitations of the existing control schemes shall be studied and new control schemes shall be proposed to enable the successful integration of renewable energy generators with grid ancillary services. The new control schemes need to be validated using extensive off-line simulations and real-time simulations with power-hardware-in-the loop.

**Tasks:**

* Investigate the existing control schemes to provide ancillary services using renewable energy generators
* Propose new control schemes and validation using off-line, real-time simulations and power-hardware-in-the loop.

**Competencies:**

 Working knowledge on MATLAB/Simulink/Simpowersystems, Theoretical background of renewable energy integration with the grid and control systems.