Grid tied inverter control

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A grid-tied inverter is a power electronics device that converts direct current (DC) to alternating current (AC) so that electricity from an external power source (such as a solar plant) can be injected into a power grid. At the heart of the grid-tied inverter is a digital controller that regulates power electronics to perform power conversion and drive power output.

Engineers developing grid-tied inverters design and implement digital control to ensure the safety and efficiency of power conversion and injection. Some of the most important design objectives of the digital controller are:

Simulink(R) and Simscape Electrical(TM) help accelerate the design process of digital controllers for grid-tied inverters.

The controller design process can be broken down into three main stages: designing and optimizing controls using electrical systems simulation, generating code for the plant and the controller, and testing the control hardware using hardware-in-the-loop (HIL) simulation.

Workflow for designing, simulating, and testing controllers for grid-tied inverters.

With Simulink and Simscape Electrical, you can create a schematic model for the grid-tied inverter and perform power electronics simulation. You can design and tune the inverter''s control algorithm, such as PID control, for regulating output voltages. The maximum power point tracking (MPPT) algorithm can be used to maximize the power output of the inverter under different conditions. You can design a fault ride-through (FRT) algorithm for the controller to provide reactive power support during low-voltage grid faults.

The digital control strategy of the grid-tied inverter can be tested against different grid codes, such as IEEE(R) 1547-2018, to ensure full compliance with the grid code. Simulink and Simscape Electrical provide capabilities for performing power system simulation and optimization. The entire power system that includes the power plant, the inverter, and the power grid can be modeled and simulated by connecting the inverter model to the external power source model (such as a photovoltaic plant) and a power grid model.

Schematic-based modeling of a photovoltaic (PV) plant, grid-tied inverter, and grid system with common power electronics topology in Simulink and Simscape Electrical.

Simulation results from the model, such as the inverter''s output characteristics, can be easily visualized using

Simscape(TM) logging.

Simulation outputs of phase voltages and phase currents from a three-phase solar inverter model.

After modeling and simulating the controller, you can generate defect-free, optimized C code for the controller using Embedded Coder(R). The hardware support packages for Embedded Coder make it easy for you to deploy the code to supported microcontrollers. You can also generate C and HDL code for the plant by using Simulink Coder(TM) and HDL Coder(TM). The code can then be deployed to a Speedgoat(R) real-time target machine with a multi-core CPU and FPGA running Simulink Real-Time(TM).

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