

Smart Solar Microgrid Inverter

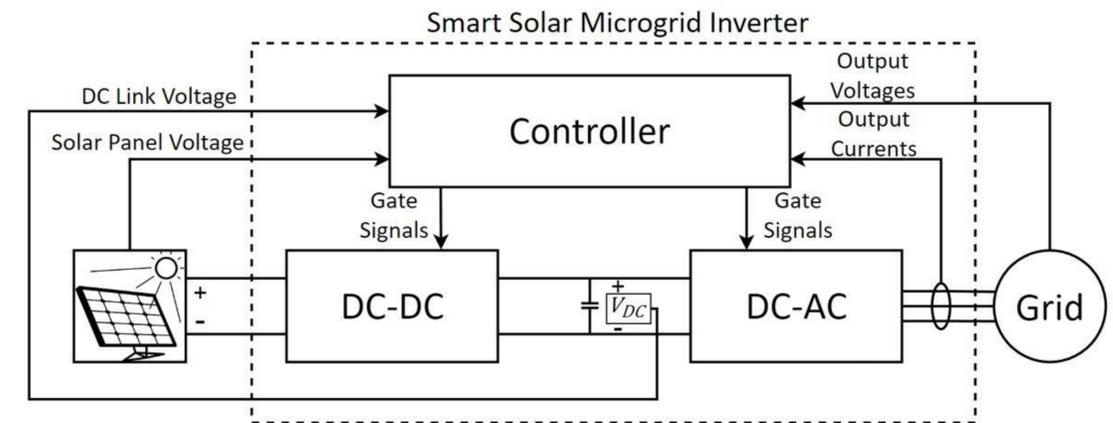
Project

Renewable energy integration is becoming more relevant and popular. During strenuous conditions, state-of-the-art, grid-following solar inverters become a burden to the grid, rather than a resource. A smart solar inverter can help solve this problem. This was the topic of the 2022 IEEE International Future Energy Challenge (IFEC).

- Objectives:
 - Develop 1 kVA solar inverter with efficiency >95%
 - Provide frequency and voltage support during strenuous grid conditions
 - Integrate new technology wide band-gap GaN devices

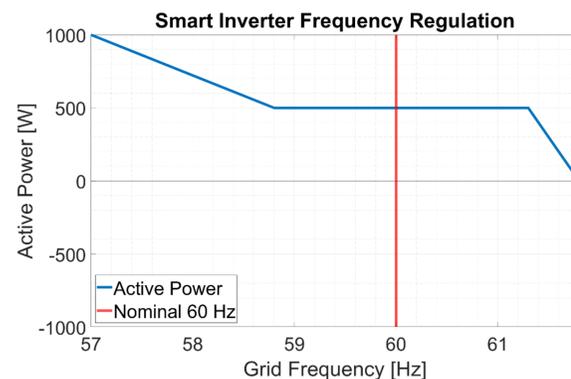
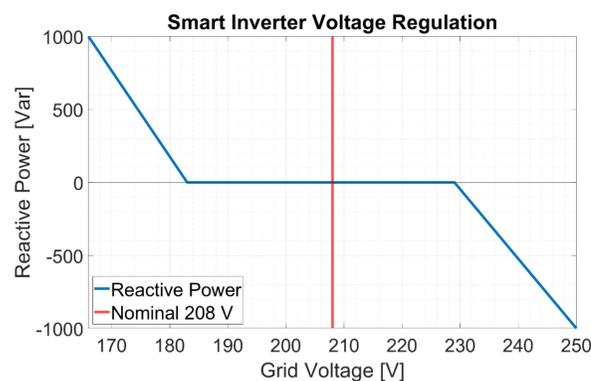


System



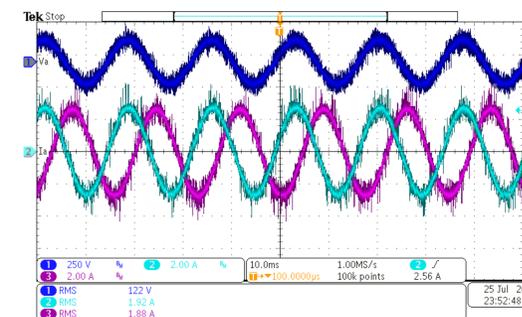
Methods

- Designed LLC resonant dc-dc converter for 1st stage of system, including a custom transformer, and a three-leg inverter for 2nd stage of system
- Utilized TI Launchpad microcontroller (TMS320F28379D) to control the system
- Used California Instruments MX-30 as grid emulator to test grid servicing functionality based on the following curves:

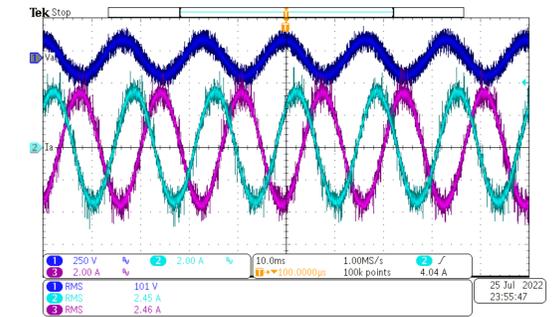


Conclusion

- Tested both frequency and voltage support capabilities of solar inverter
- System successfully provided grid services during strenuous conditions
- Future development includes increasing power level and adding battery storage
- Won the 2022 IEEE IFEC Worldwide Grand Prize



Low frequency, high current



Low voltage, high current, phase shift