Paris Session 2022

Grid forming control for various IBRs

Study Committee C4

Power System Technical Performance

Preferential Subject 3, Q17

How are various generation technologies including the BESS, wind turbines, solar inverters, VSC HVDC and STATCOMs are compared with regard to the ease of implementation and system stability impact when equipped with grid-forming capability, and what is the impact various grid-forming controls including but not limited to the so-called virtual synchronous generator or virtual synchronous machine?

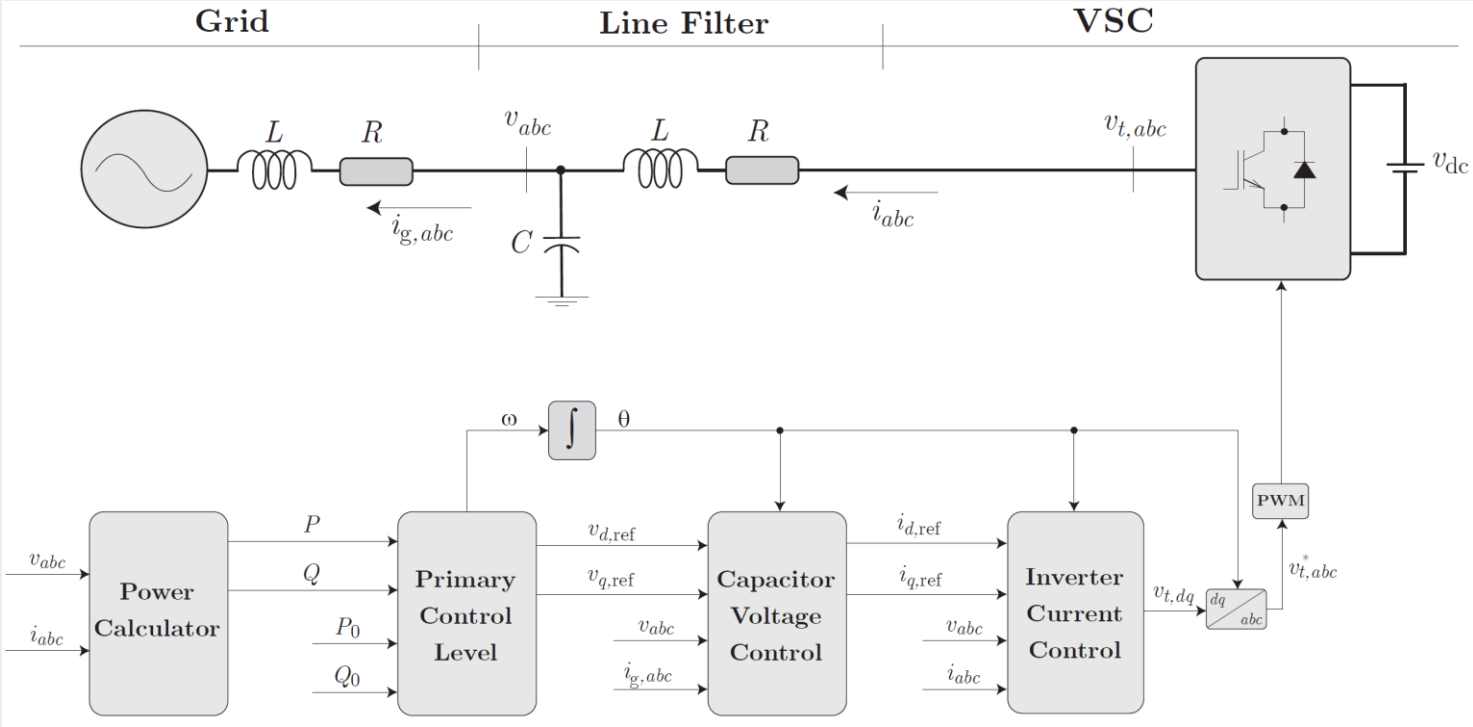
Behrooz Bahrani, Australia

A Typical BESS-based Grid-forming Inverter

A typical BESS-based GFMI does not require to control its DC-side voltage as the battery takes care of this task.

The control blocks are:

- Inverter current control loop
- Point of Connection voltage control loop
- Primary control loop
- Governor and AVR loops if needed



Grid-forming for Other Inverter-based Resources

Contrary to BESS-based IBRs, other types need to regulate extra variables and maintain them within their permissible limits upon disturbances to which the GFM responds to:

- Wind: DC link voltage, turbine torque/speed
- Solar: DC link voltage
- STATCOM: DC-link voltage

Additionally, in the presence of an event:

- transferrable **energy and its rate of change** to the grid is **limited** and is **a function of the wind/solar farm operating point**
- STATCOMs are unable to provide real power for frequency control unless they use **oversized DC-link capacitors**.

Moreover, other than BESS-based GFMIs, the **black-start capability** in other IBRs equipped with GFM control is challenging.