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Implementation of Frequency Adaptive Damped SOGI Based Control for Power Quality Improvement in Wind-Solar-BES Based AC Microgrids

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Background

- The presented microgrid comprises of wind and solar photo-voltaic (PV) based energy generation, which is coupled to the single-phase AC grid. A BES is utilized to support the presented system when grid is not available. A non linear load is connected at the PCC which act as local load .
- This work presents a frequency adaptive damped second order generalized integrator (FA-DSOGI) for power quality (PQ) improvement in AC microgrids.
- The control of the microgrid involves the control of grid side converter, generator side converter and the bidirectional converter

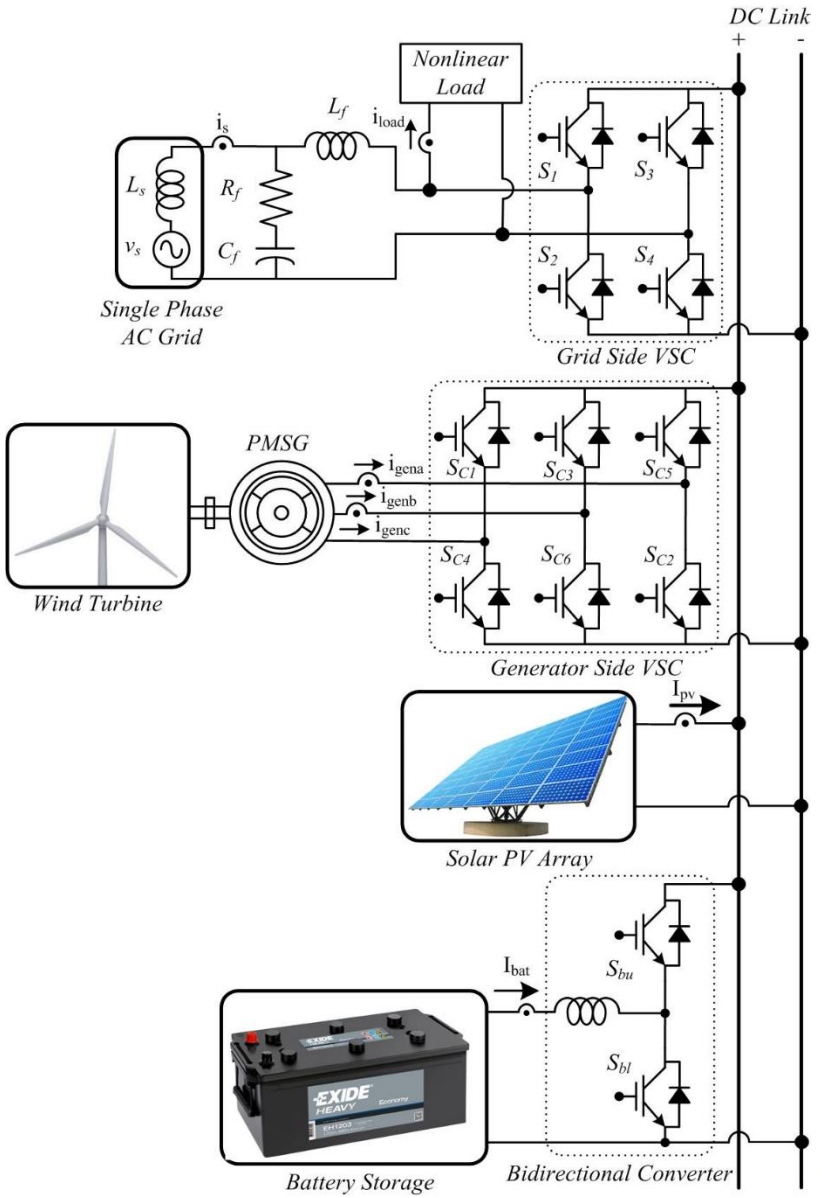


Fig. Structure of a presented microgrid

Control

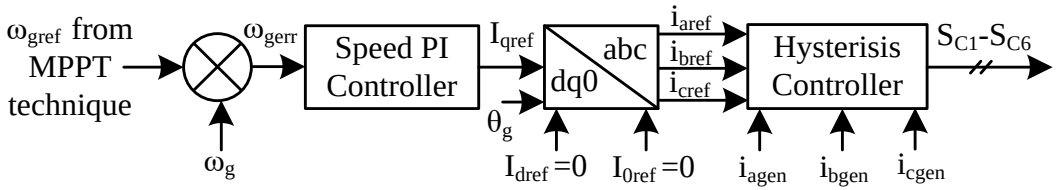


Fig. Control of generator side VSC

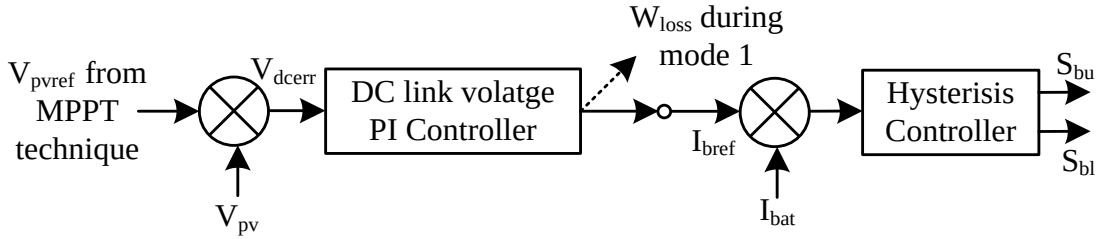


Fig. Control of DC link voltage and BDC

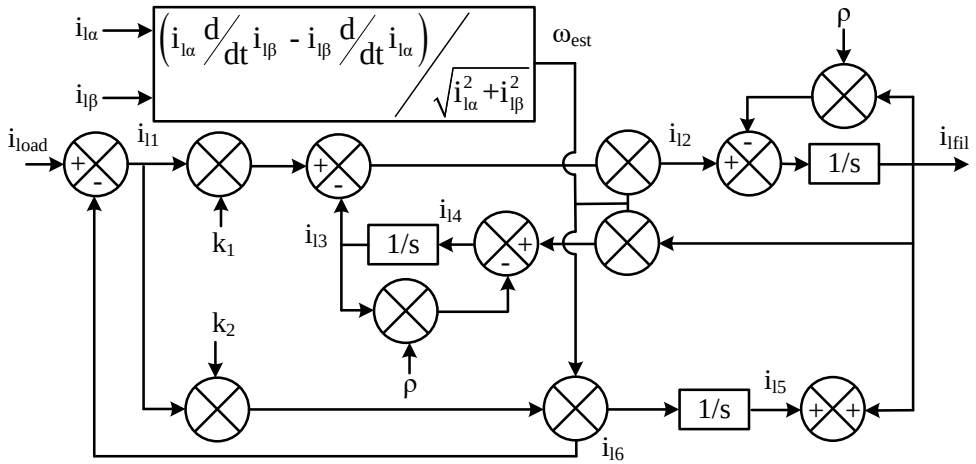


Fig. Control structure of FA-DSOGI

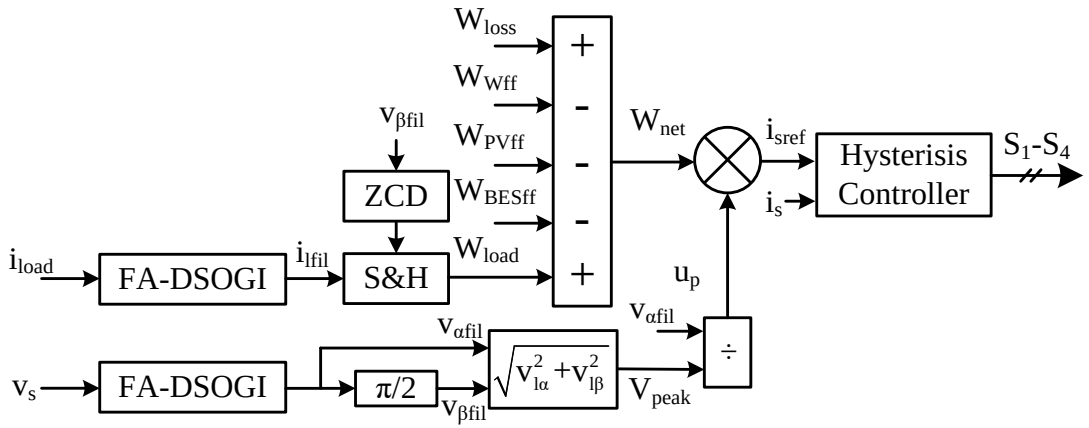
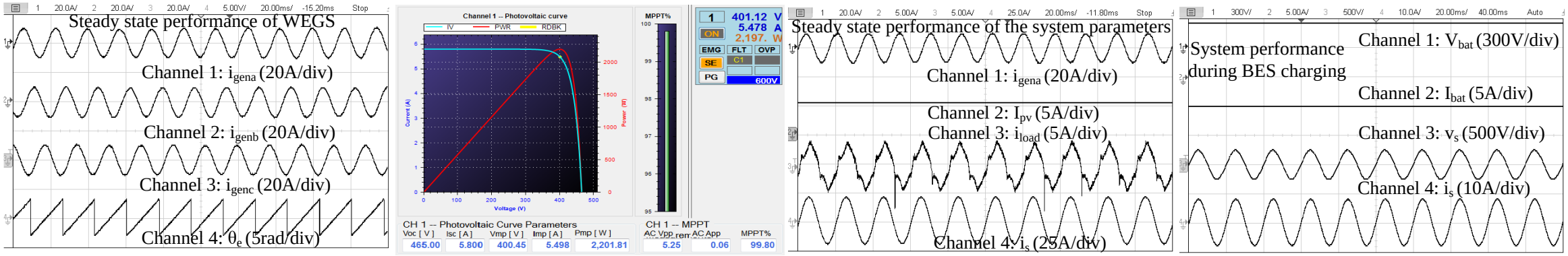


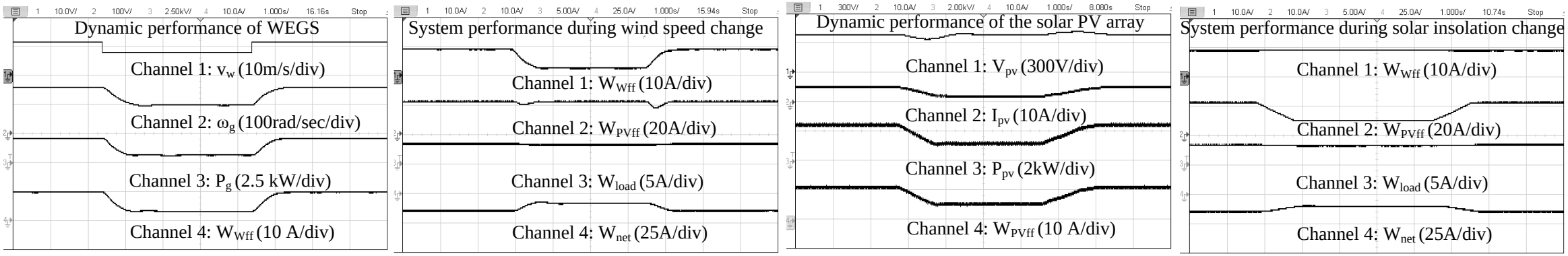
Fig. Control of grid side VSC

Results



(a) (b) (c) (d)

Fig. Steady-state performance of the presented system



(a) (b) (c) (d)

Fig. Dynamic performance (a-b) during wind speed change and (c-d) during insolation change

PQ Performance and Conclusions

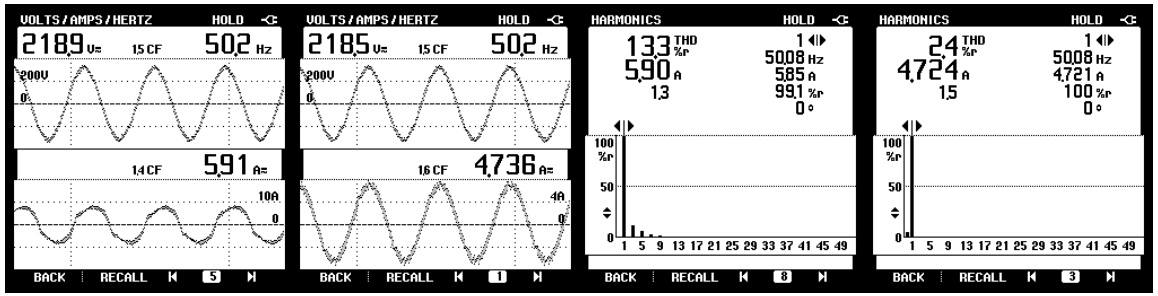


Fig. Power quality performance when grid is feeding the load

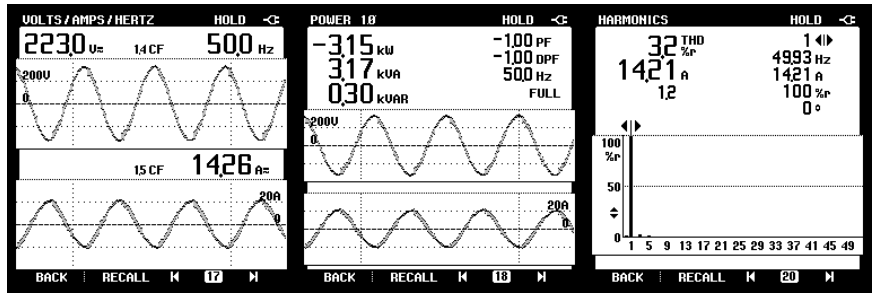


Fig. Power quality performance when wind and solar are feeding the grid and load

- A satisfactory operation of wind-solar-BES based AC microgrid under various operating scenarios has been exhibited.
- Owing to the implementation of FA-DSOGI structure, experimental results under steady-state and dynamic conditions are found to be satisfactory.
- The presented system follows the IEEE-1547 and IEEE-519 standards for grid connected system and therefore present a feasible solution for AC microgrid with non linear loads and distributed energy resources.