Paper 288-22

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PWM Inverter with 4-Phase Carrier for Grid Connection Via Combined LCL Filter

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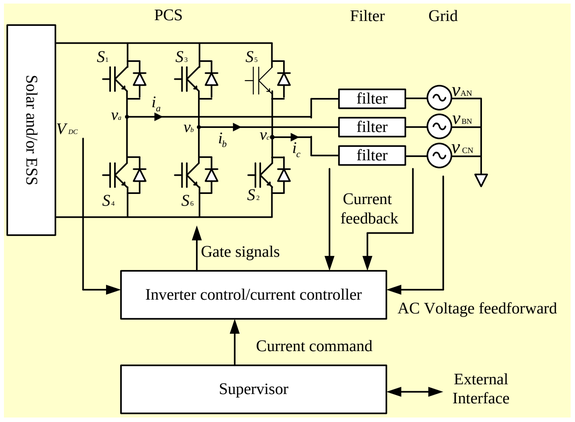
Objective

- **Inverter for grid connection**
- **Low Harmonic Injection to Grid**

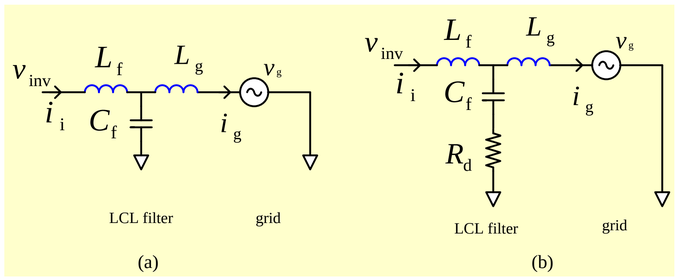
New features

- **PWM with 4-phase carrier (interleaved PWM)**
- **Combined LCL filter**
- **Excellent Harmonic elimination**

System Configuration for Grid Connection



Filters

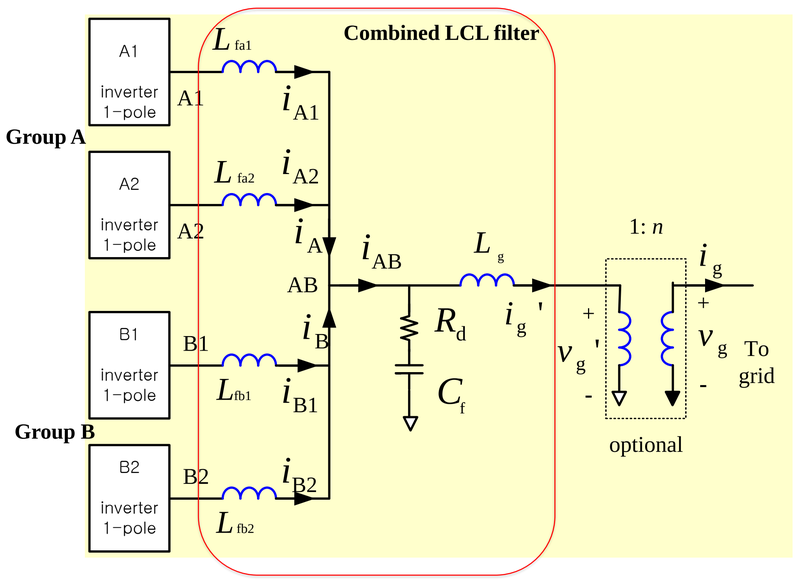


unstable

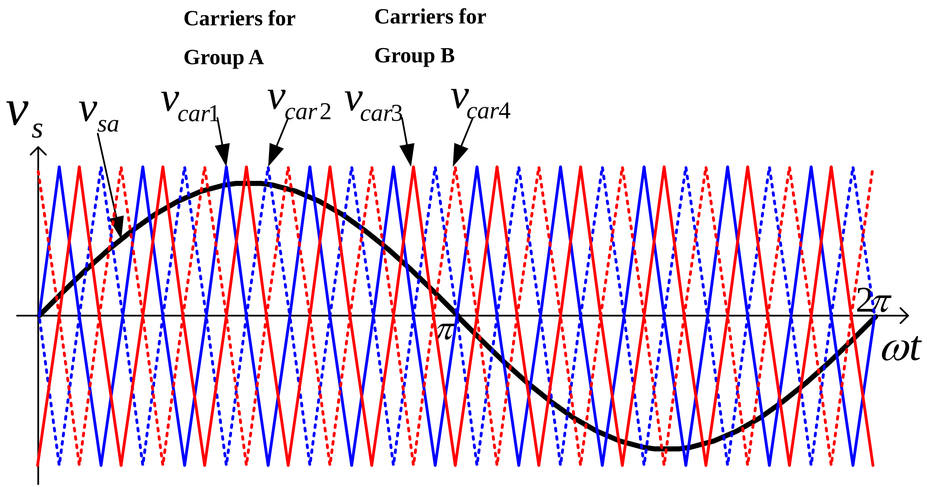
stable with damping resistor

stable operation can be also achieved with active damping

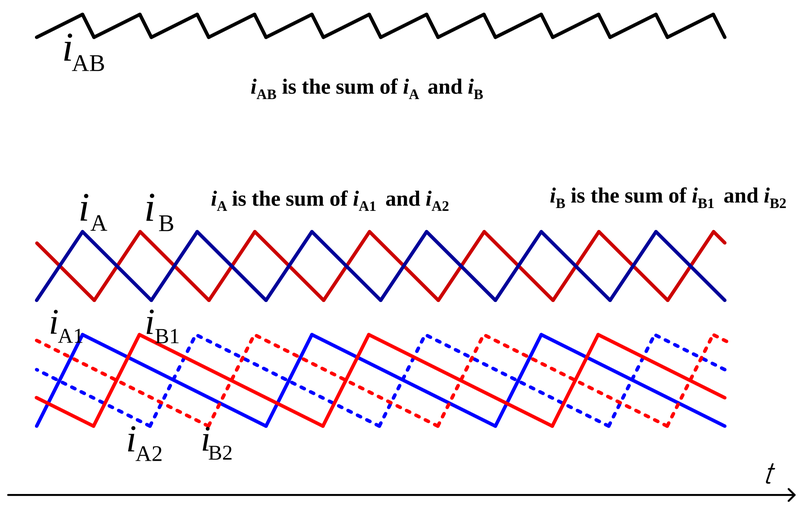
The Proposed System (based on single-phase half bridge)



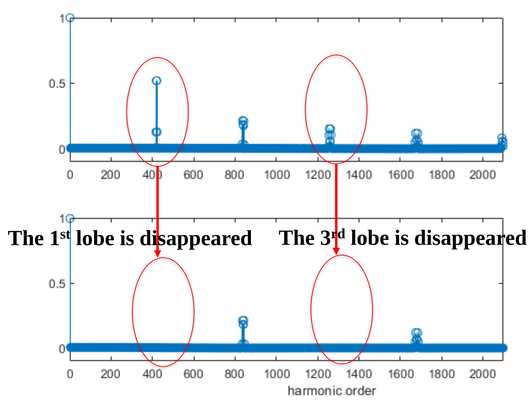
PWM with 4-Phase Carrier



Harmonic Reduction in Current (Constant average approximation)



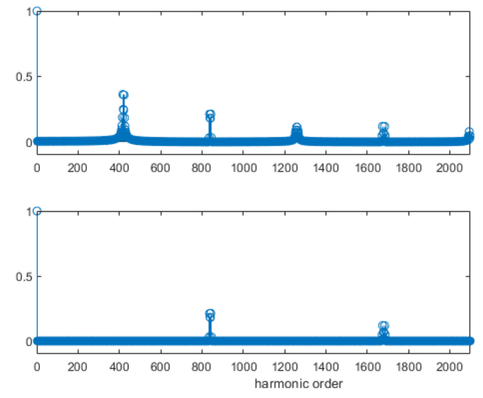
Harmonic Analysis (Voltage Harmonics)



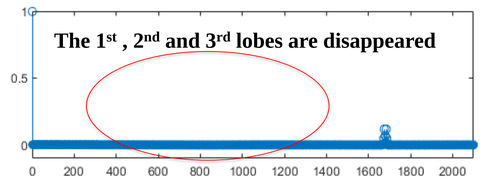
Group A

Individual harmonics

Common-mode harmonics



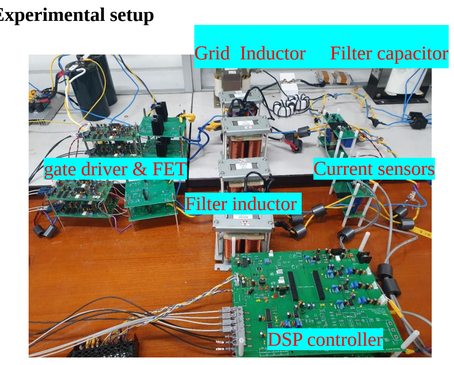
Group B



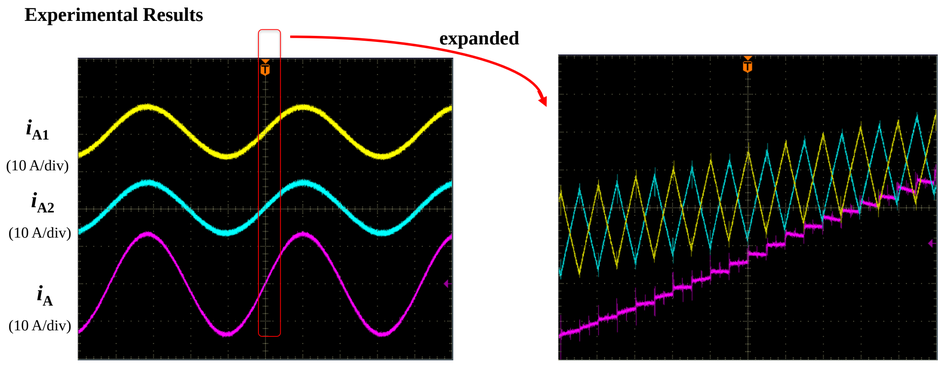
Over-all common-mode harmonics

Experimental Setup and Results

Experimental setup

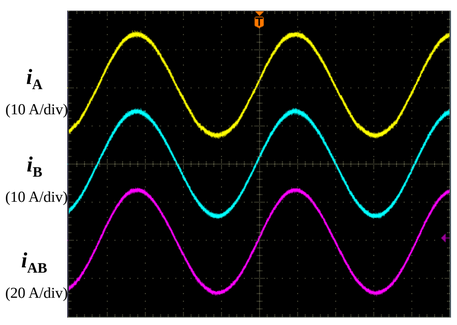


Experimental Results

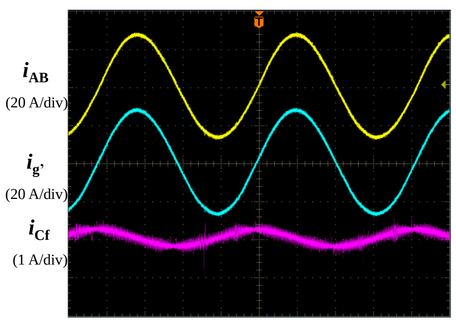


Currents in Group A (time: base 4msec/div)

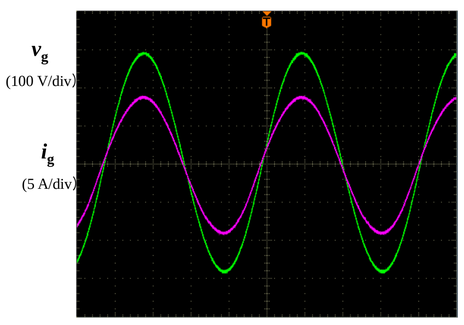
Time-expanded Currents (i_{A1} (0.5 A/div), i_{A2} (0.5 A/div), i_A (0.5 [A/div]), time base: 40 μsec/div



Combining Currents (time: base 4msec/div)



LCL filter operation (time base: 4msec/div)



Grid voltage and current (time base: 4msec/div)

Conclusion

- **The inverter system tied to a grid has been studied.**
- **Four-phase carrier-based interleaved PWM is applied to the inverter system.**
- **Harmonic currents into the filter capacitor and the grid are greatly reduced.**
- **Harmonics reduction is always possible as long as stable.**
- **The proposal is verified through prototype system.**

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