Project memo AN 02.12.72

Active damping of oscillations between grid reactance and filter capacitor of grid connected converters

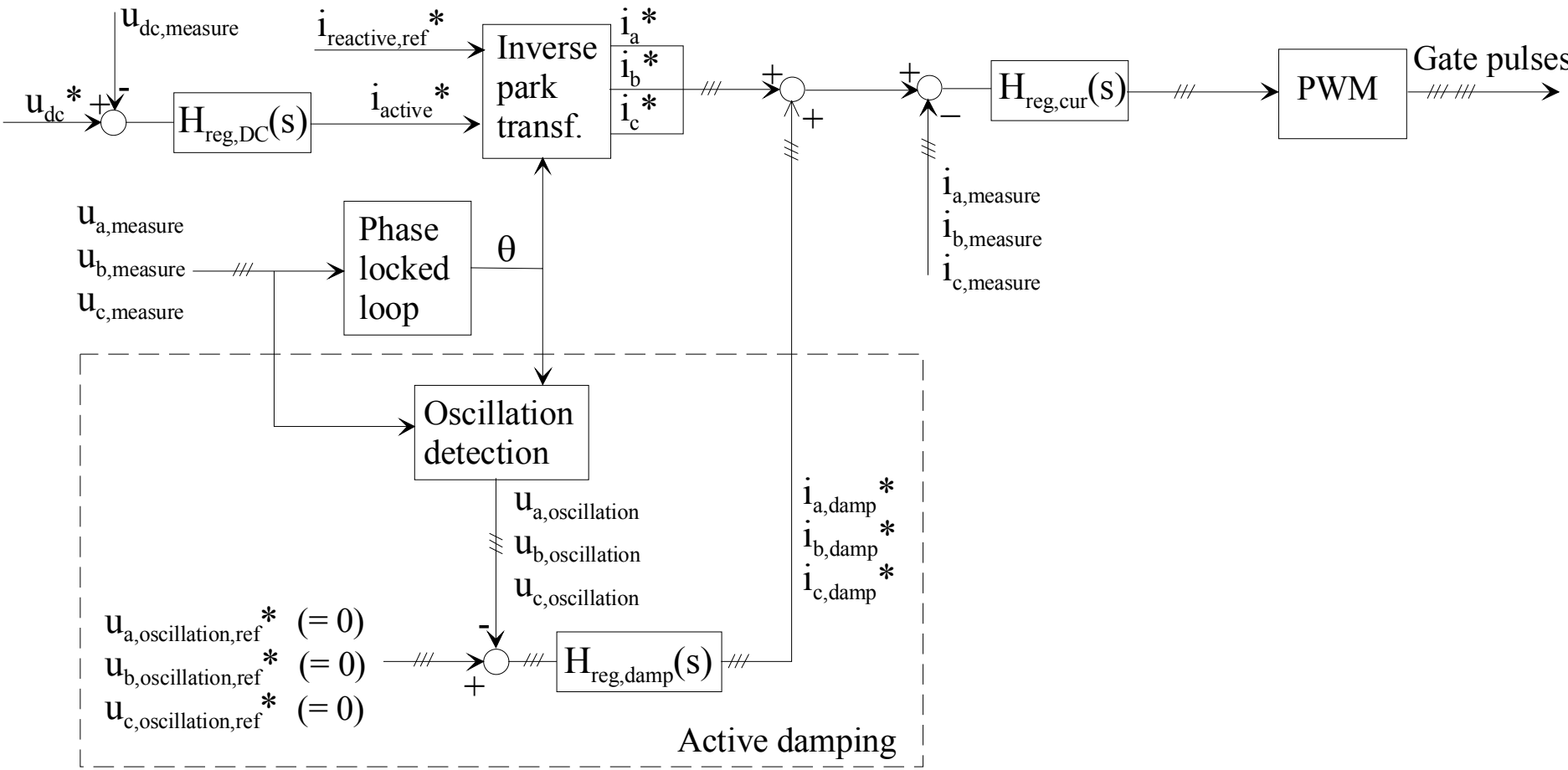
Objective

Verification of a method for active damping of oscillations between line reactance and filter capacitors in LC-filter for line connected PWM voltage source converters.

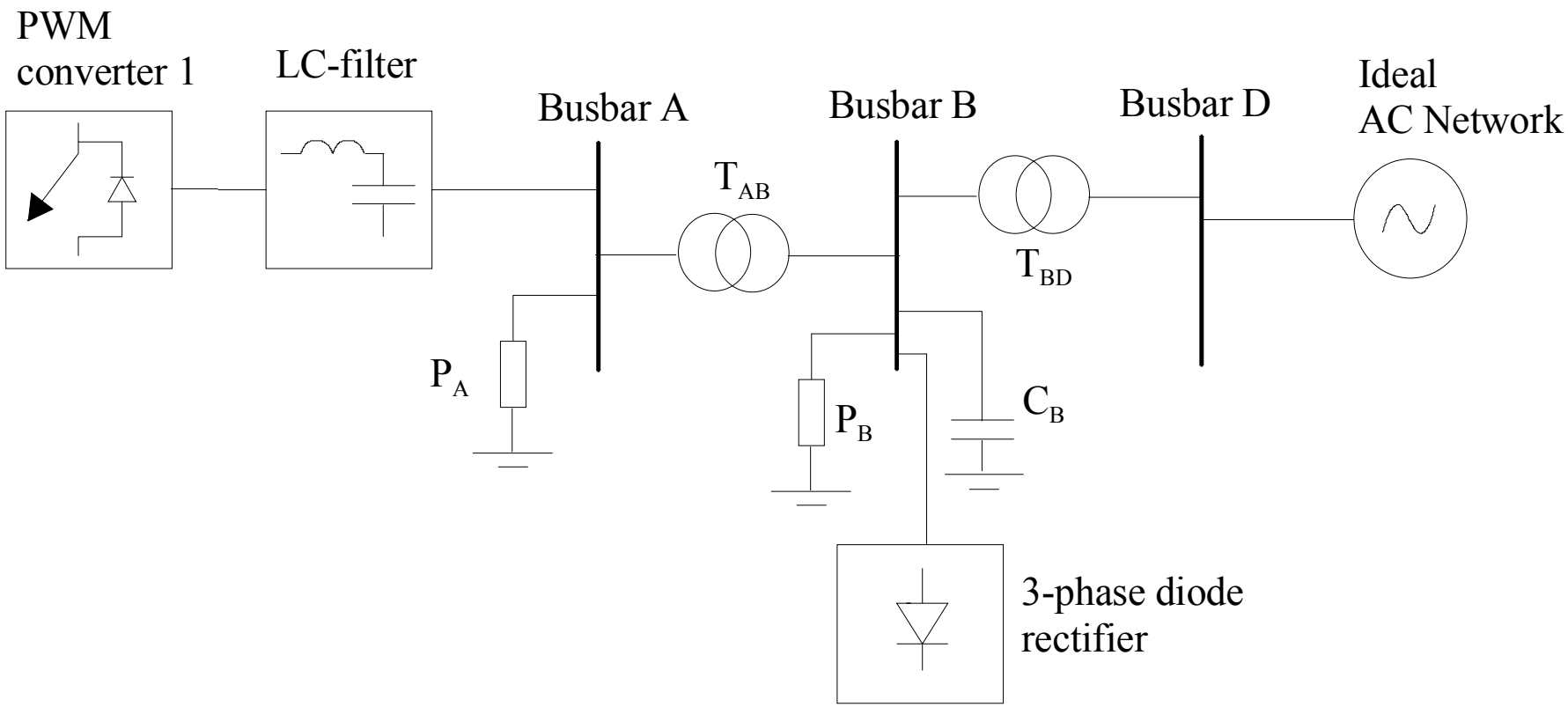
The purpose of the active damping is to avoid that the introduction of an active front-end converter with LC-filter on the AC-side reduces the voltage quality at the point of connection.

(verification by frequency domain analysis
and time domain simulation)

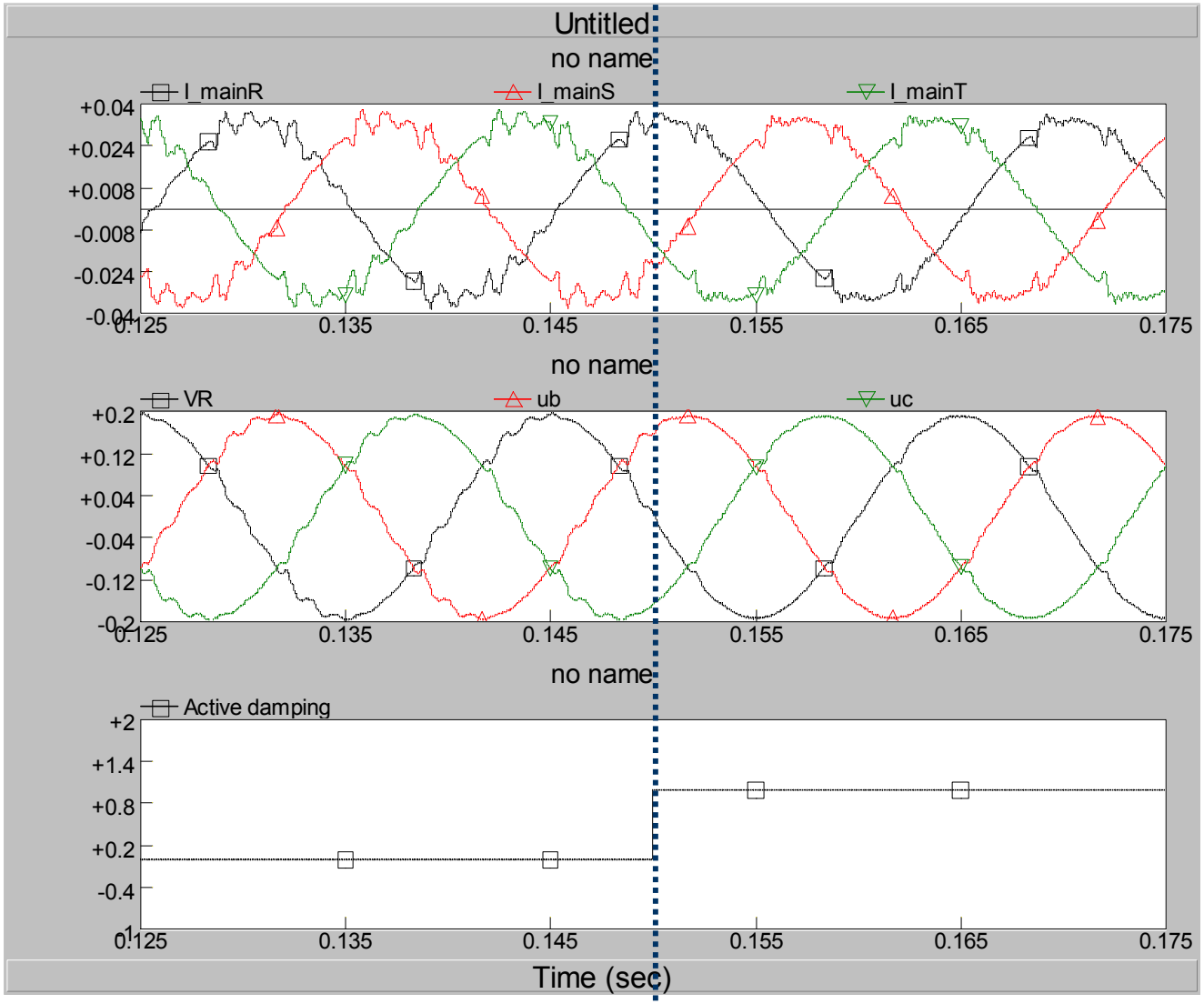
Block diagram of control system



Example: Harmonic injection upstream



Time domain simulation results

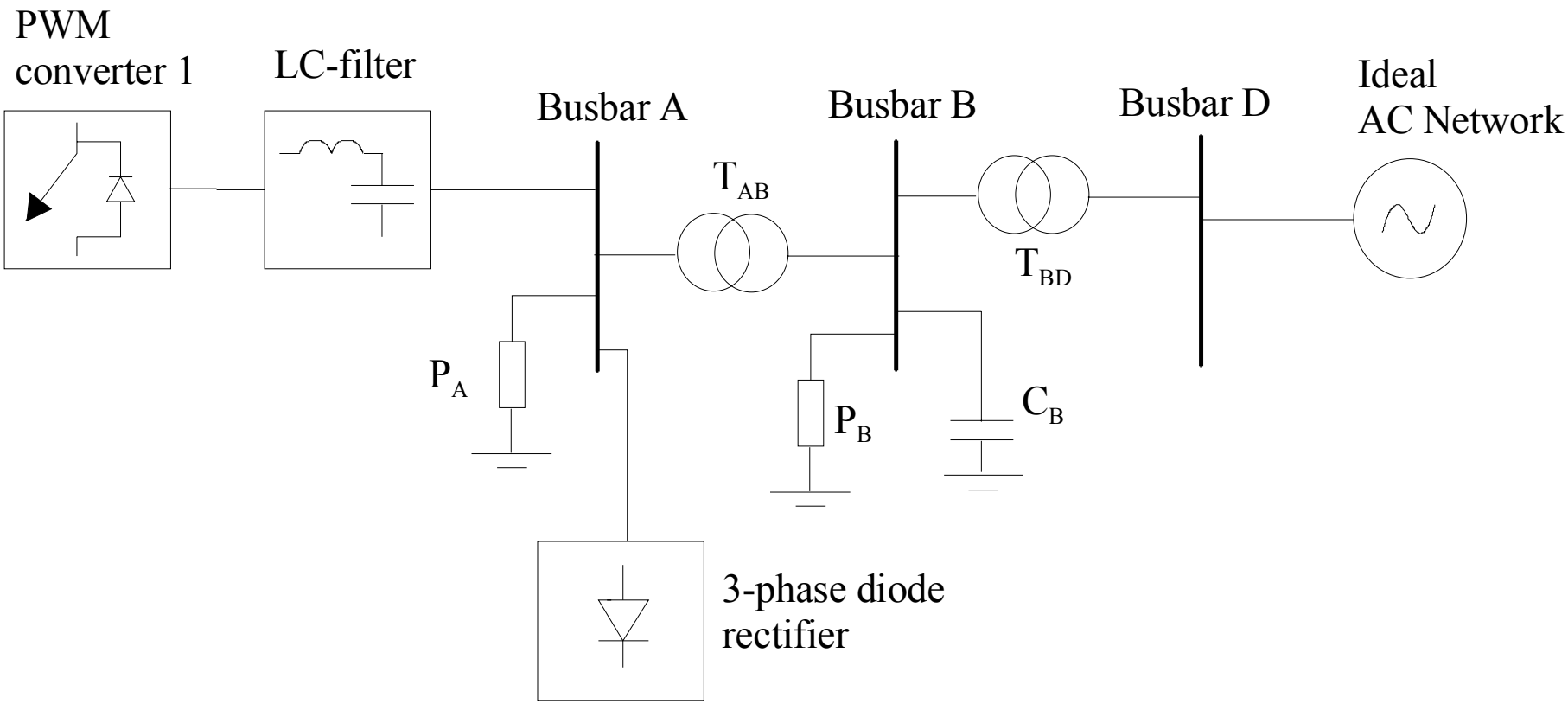


Current flowing between bus A and B (kA)

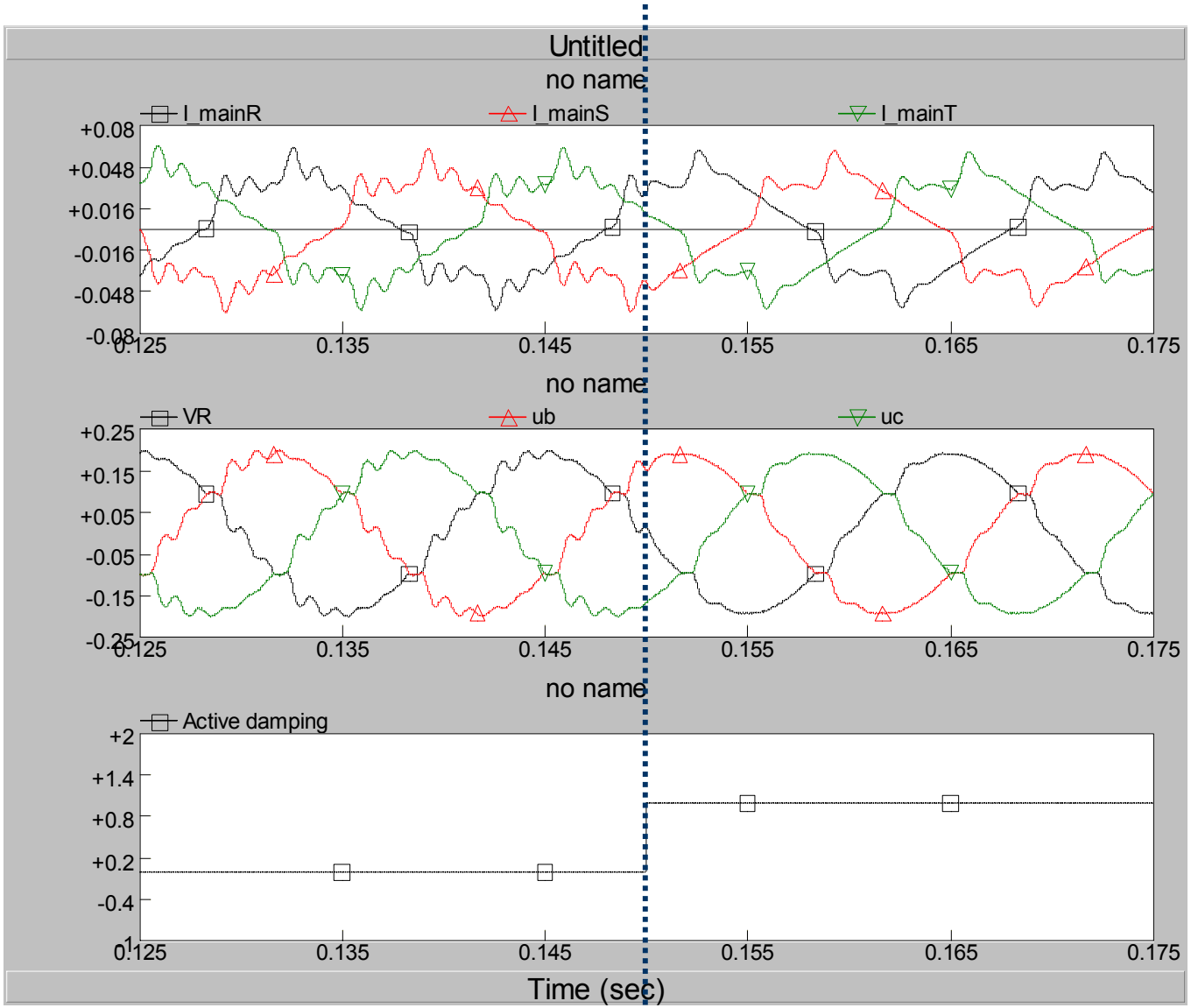
Voltage at bus bus A (kV)

Enable signal for active damping

Example:
Harmonic injection at the same busbar



Time domain simulation results



Current flowing between bus A and B (kA)

Voltage at bus bus A (kV)

Enable signal for active damping

Conclusion

- The proposed method works as intended
- The results shows that oscillations are damped effectively but that the voltage remains distorted. This complies to the expectations since the purpose of the implemented method is damping rather than filtering

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PROJECT MEMO

MEMO CONCERNS

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This memo present results of the Strategic Institute Programme (SIP) “Power electronics and energy storage technologies for cost- and energy efficient power systems” funded by The Research Council of Norway.

This memo presents a method for active damping of oscillations between line reactance and filter capacitors in LC-filter for line connected PWM voltage source converters.

The idea is to include closed loop feedback control that gives additional damping to the capacitor voltage oscillations by adding appropriate signals to the current references.

The results presented shows that the introduction of active damping is a possible measure to reduce oscillations due to active front-end LC-filters.

Further investigations are needed in order to:

- Clarify which grid topologies that will need additional damping when active front-end-converters with LC filters are connected.
- Clarify the situations were it will be appropriate to introduce active damping in the active front-end -converter controller
- Assess alternatives to the LC-filter
- Implement active damping in prototype and verify simulated results in the laboratory

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