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0950 - STABILIZATION OF HARMONIC INSTABILITY IN AC DISTRIBUTION POWER SYSTEM WITH ACTIVE DAMPING

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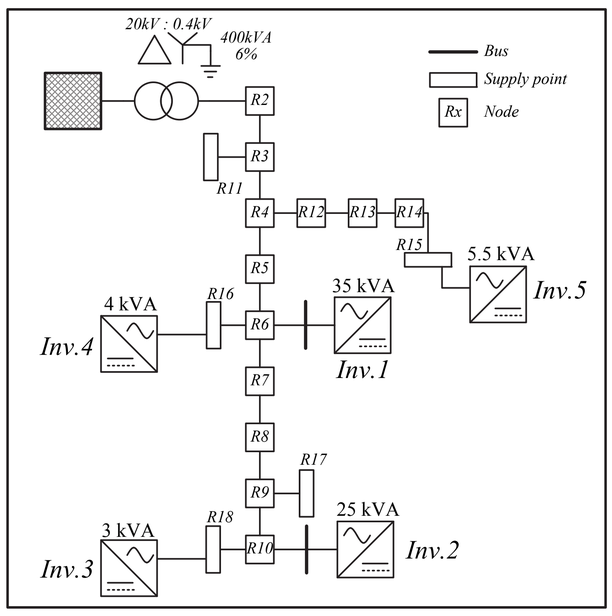
Introduction

Active damping control, as a stabilizing method of the harmonic interactions in the power electronics based power system, is discussed. The impedance based stability criterion is used to analyze the interaction as well as the effect of active damping functions. Cigré benchmark case (TF. 06.04) is used as a test system and the PSCAD/EMTDC simulations validate the result.

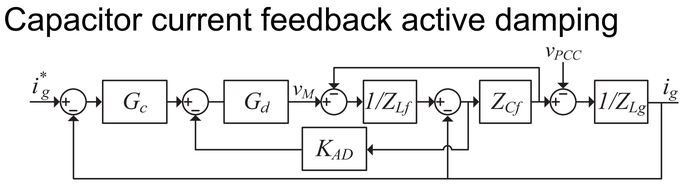
System Description

- Distributed Generation system with 5 inverters

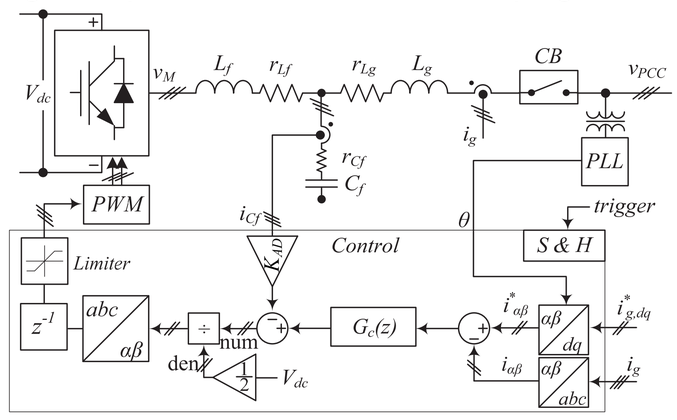


Active Damping method

- Capacitor current feedback active damping

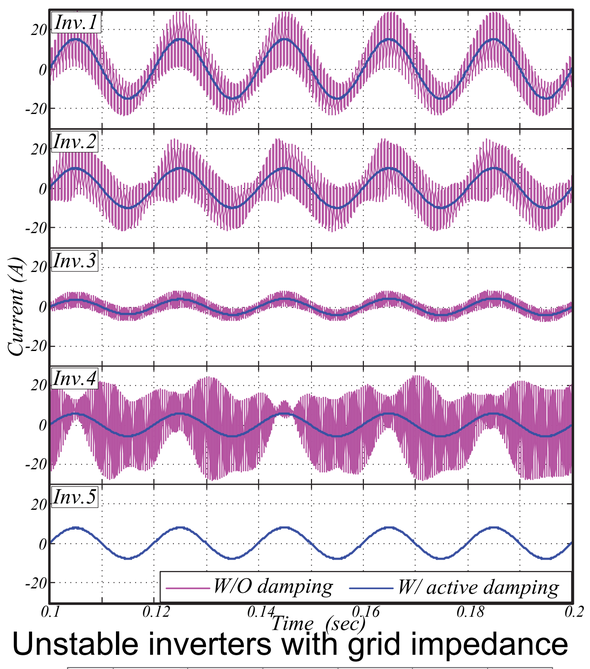


- Digital implementation of active damping in PSCAD

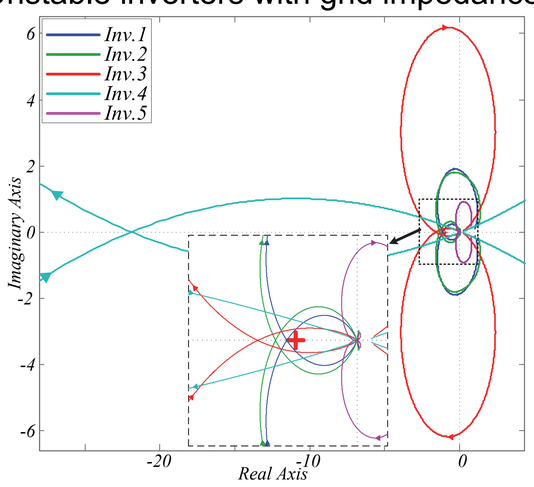


Necessity of damping

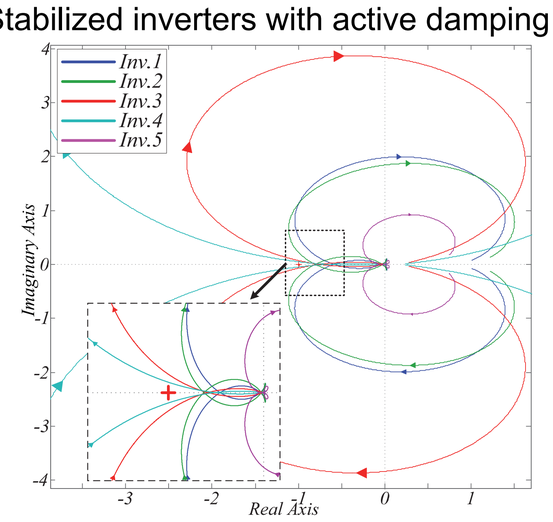
- Inverters can be unstable by grid impedance



- Unstable inverters with grid impedance

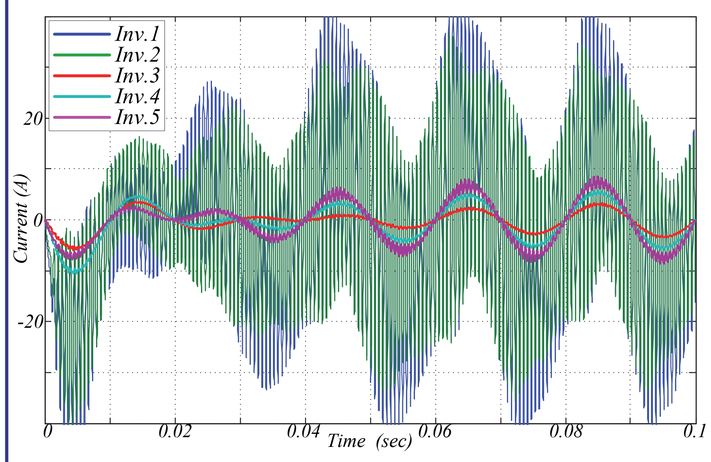


- Stabilized inverters with active damping

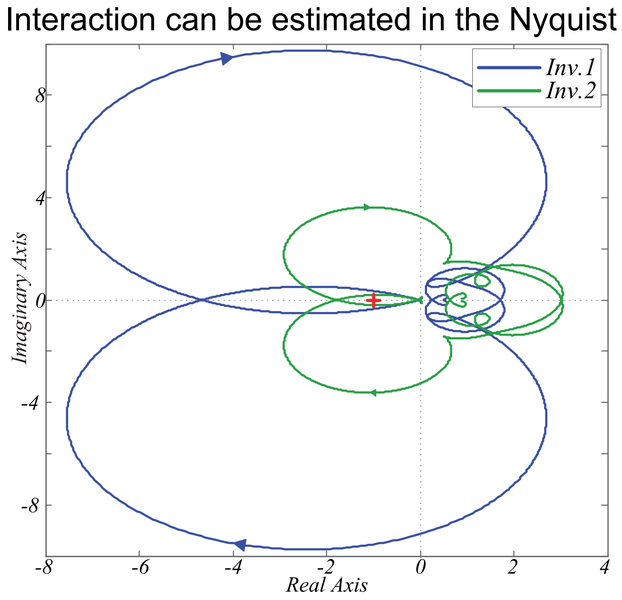


Needs more damping

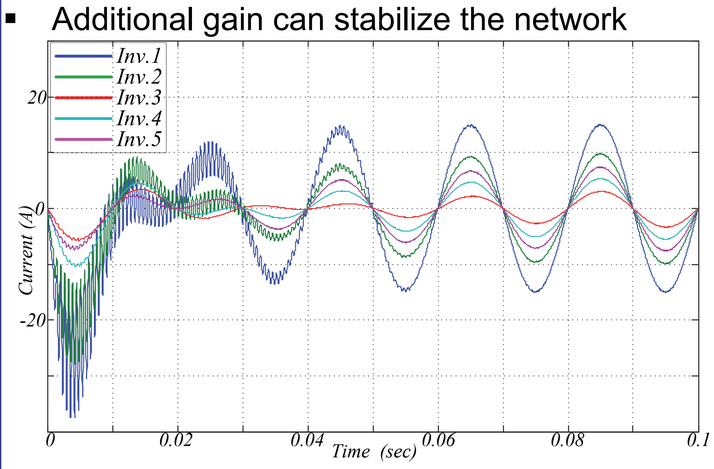
- Interaction happens when operating together even if the inverters have active damping function



- Interaction can be estimated in the Nyquist

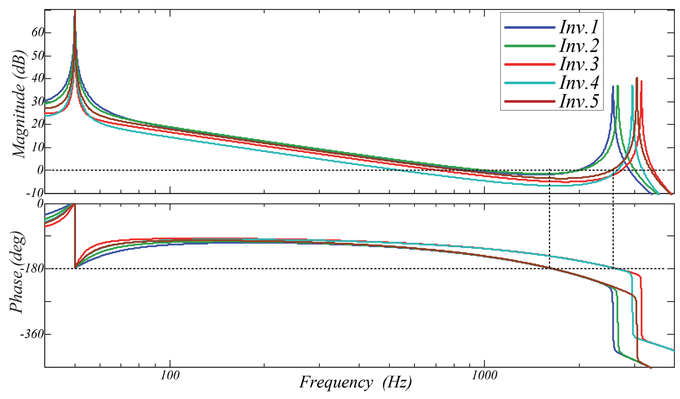


- Additional gain can stabilize the network

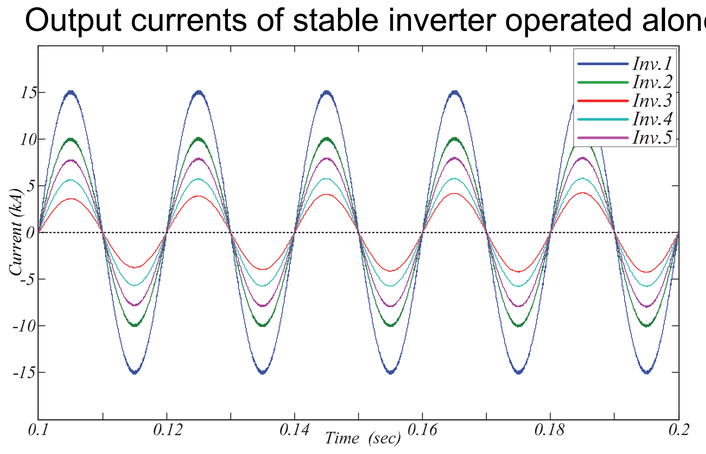


Individually stable inverters

- Bode diagram of stable inverters

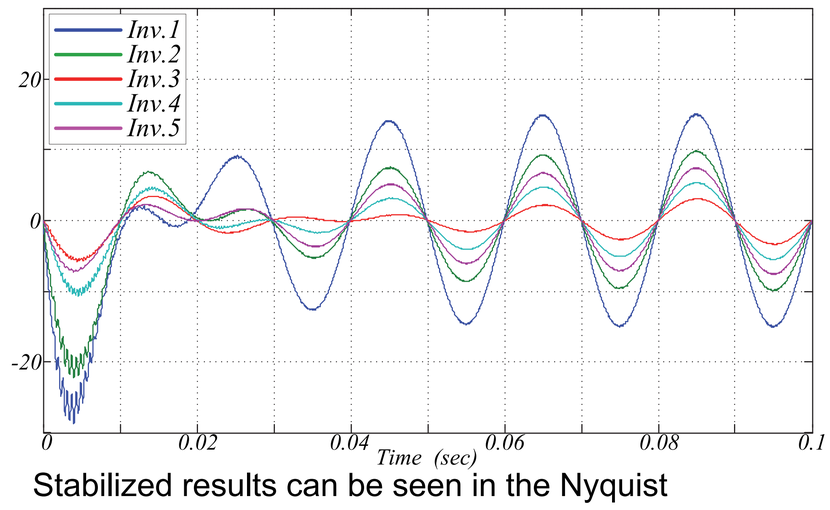


- Output currents of stable inverter operated alone

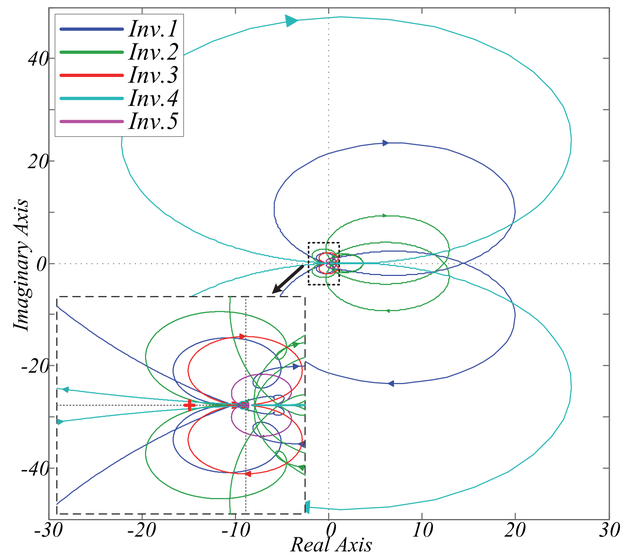


Alternative solution

- Only two inverters can stabilize the network



- Stabilized results can be seen in the Nyquist



Conclusion

The active damping function can stabilize the inverter itself as well as the unstable network suffering from the interactions among other inverters. The result shows that not all the inverters in the network are needed active damping functions if some of the inverters are designed properly. Therefore, the overall network is successfully stabilized.