

Paper No: 20PESGM1136



# Design of a Non-PLL Grid-Forming Inverter for Smooth Microgrid Transition Operation

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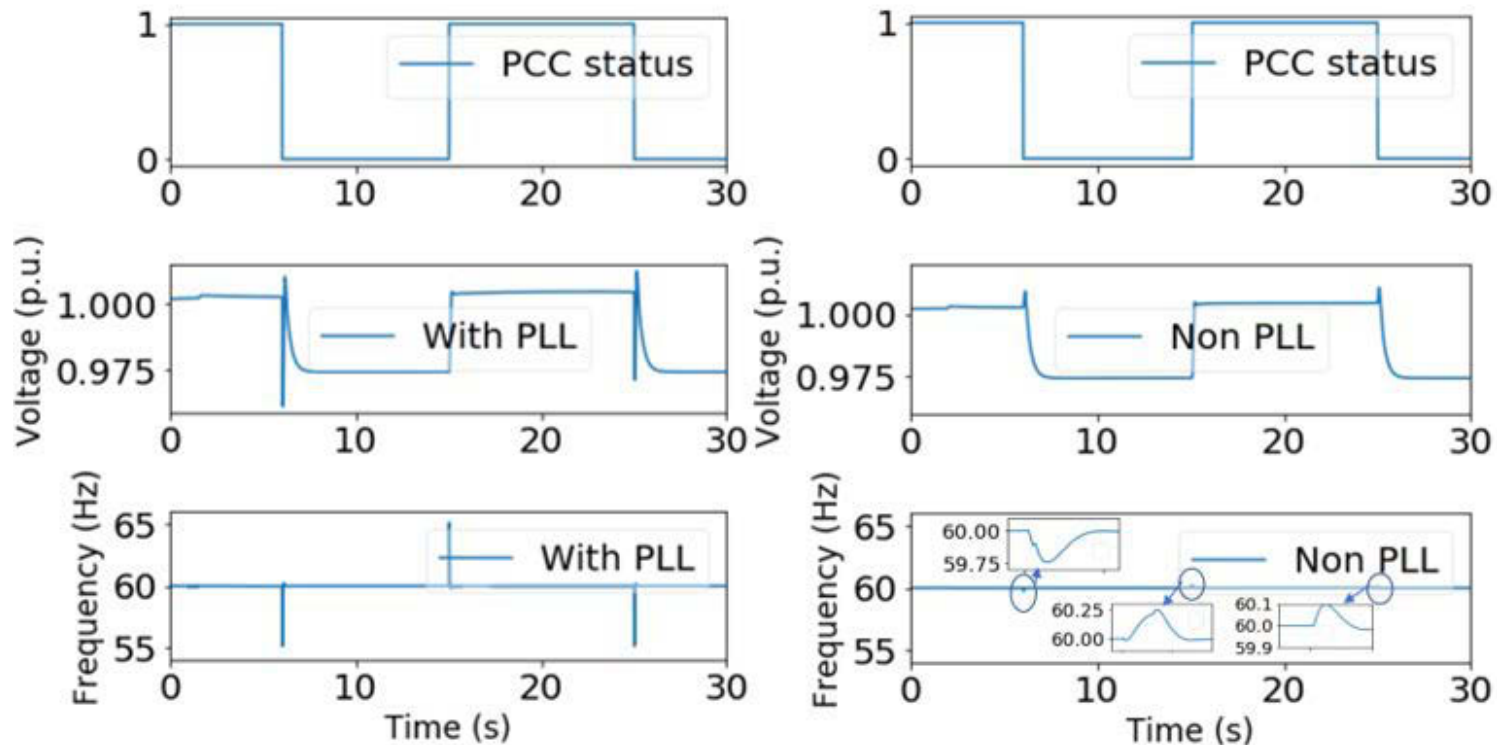
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August 3-6, 2020



# Results

- Multiple transition operation: unplanned islanding ( $t=6s$ ), reconnection ( $t=15s$ ) and unplanned islanding ( $t=25s$ ).

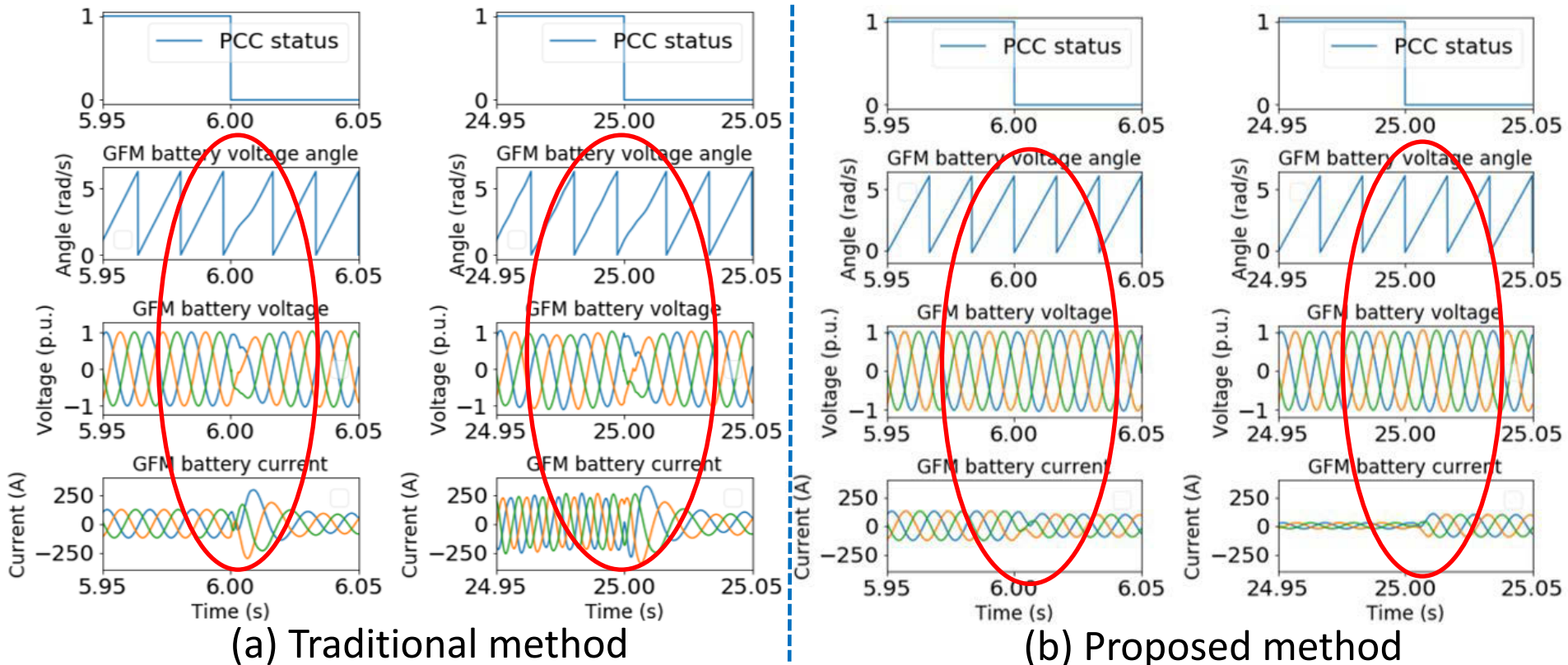


(a) Traditional method

(b) Proposed method

Results of full microgrid simulation scenario

# Unintentional islanding



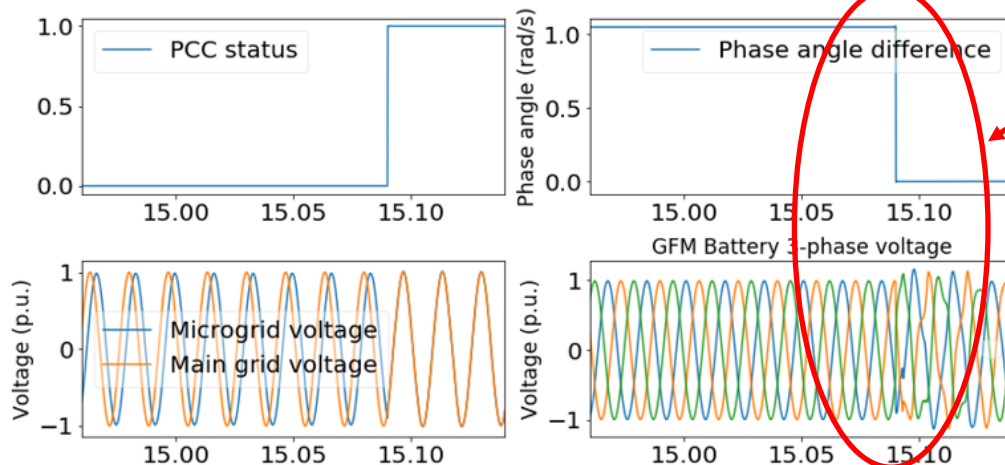
(a) Traditional method

(b) Proposed method

Switch from the phase angle following the grid voltage to the self-generated phase after disconnection, **abrupt change in phase angle.**

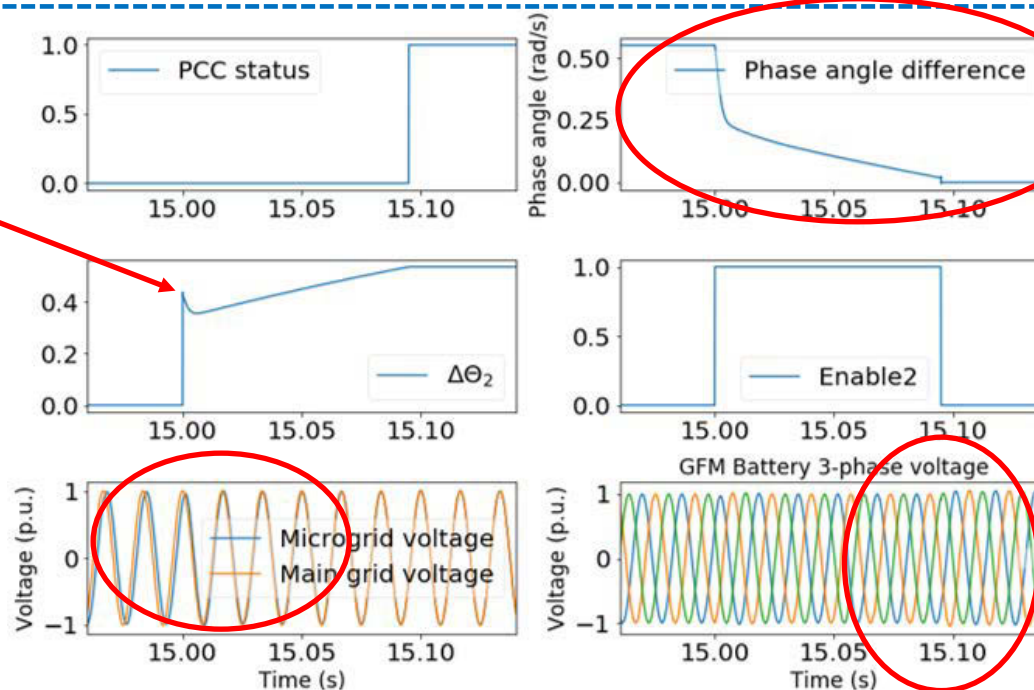
Use self-generated phase before and after disconnection, no change in phase angle. **Keep the same phase without need for compensation.**

# Reconnection



No phase angle sync control

(a) Traditional method



With phase angle sync control

(b) Proposed method

# Conclusions

- A synchronization scheme of a non-PLL GFM inverter is developed based on **emulating the synchronous generator operation** to achieve seamless microgrid transition operation.
- The effectiveness of the proposed control scheme to synchronize the phase angle of GFM inverter under microgrid transition operation is validated, **especially for unplanned islanding**.

NREL/PR-5D00-77338

This work was authored by the National Renewable Energy Laboratory, operated by Alliance for Sustainable Energy, LLC, for the U.S. Department of Energy (DOE) under Contract No. DE-AC36-08GO28308. Funding provided by the U.S. DOE's Advanced Research Project Agency-Energy (APRA-E) NODES program. The views expressed in the article do not necessarily represent the views of the DOE or the U.S. Government. The U.S. Government retains and the publisher, by accepting the article for publication, acknowledges that the U.S. Government retains a nonexclusive, paid-up, irrevocable, worldwide license to publish or reproduce the published form of this work, or allow others to do so, for U.S. Government purposes.