

Introduction of Power Electronics (PE) Laboratory

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Research Areas of Power Electronics Lab

✚ Development of Power Electronics Converters and Their Control

❖ DC-AC Inverters

1. Single-phase buck-boost inverters
2. High-efficient and high-gain dc-ac inverters
3. Impedance-source (Z-source) Inverters

Photovoltaic (PV)
Power Generation

❖ AC-AC Converters

4. Single-phase AC-AC converters
5. Three-phase AC-AC converters
6. High-frequency isolated AC-AC converters.

Grid Power quality
improvement

Solid-state
transformers

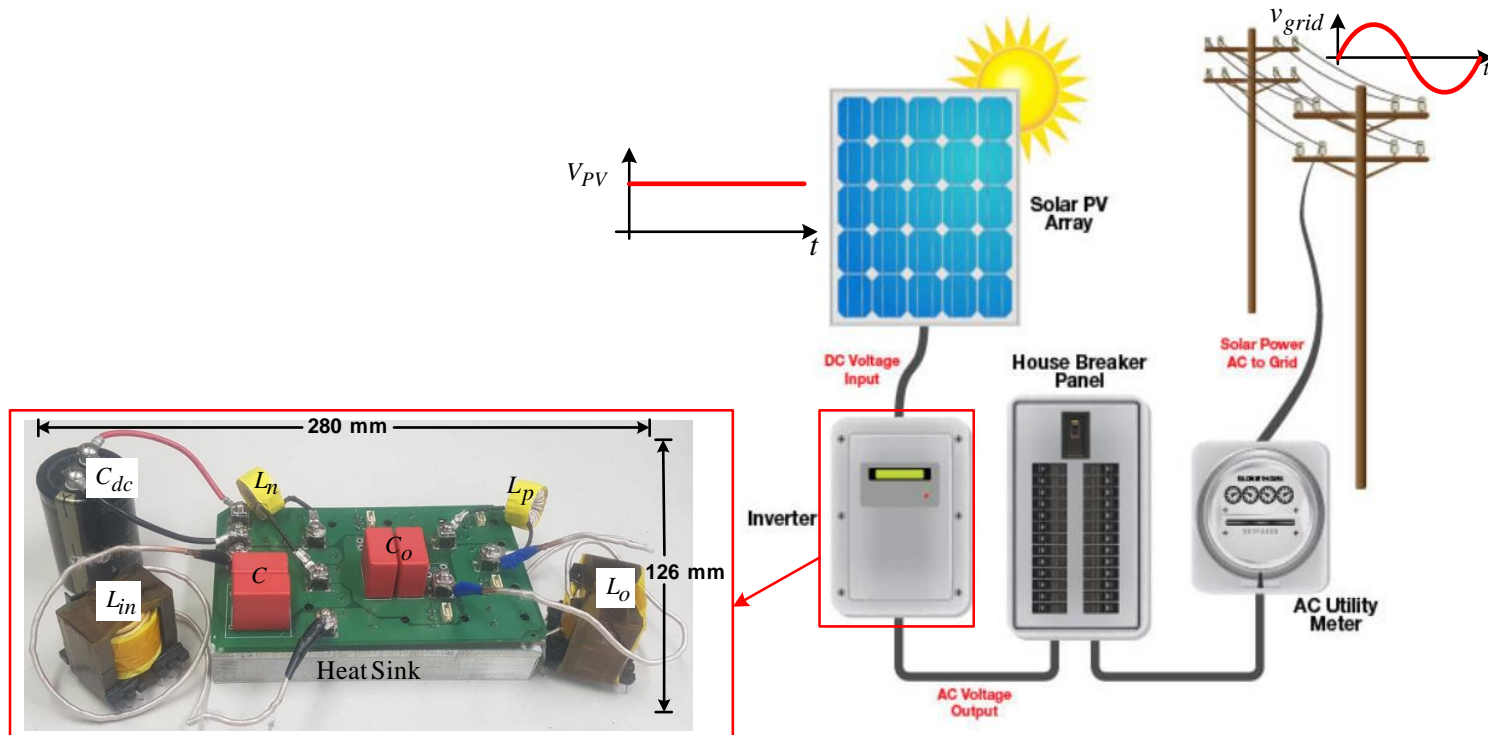
❖ DC-DC Converters

8. High-efficiency hard-switching DC-DC converters
9. High-efficiency soft-switching DC-DC converters

Switch mode power
supplies

Electric Vehicles

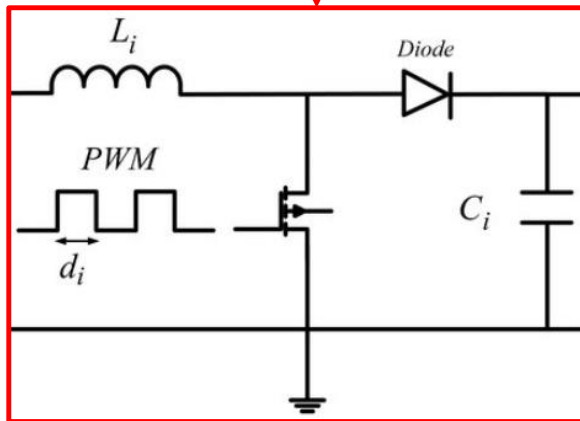
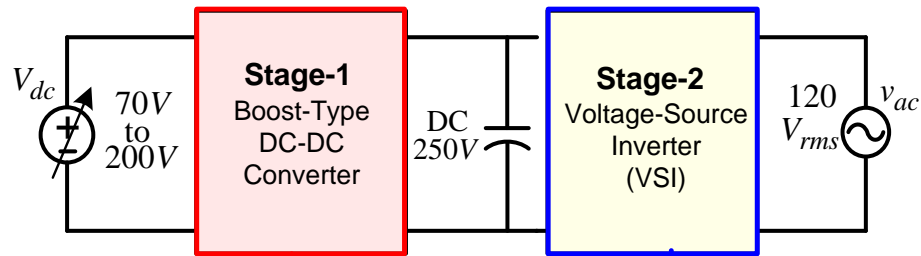
I. Development of Single-Phase Buck-Boost PV Inverters



Limitations of the Conventional Voltage Source Inverter for PV Applications

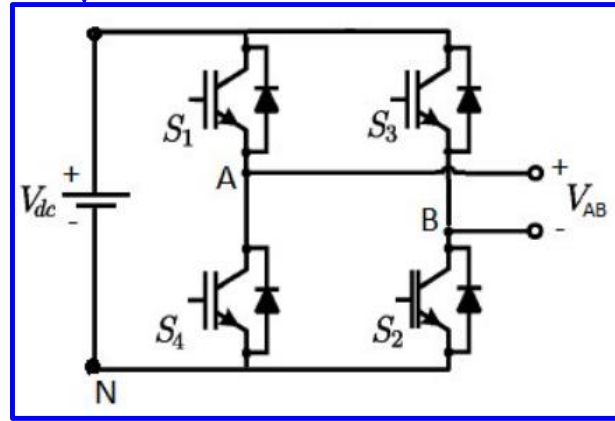
✚ A buck-boost inverter system is required for PV applications

Conventional two-stage buck-boost inverter



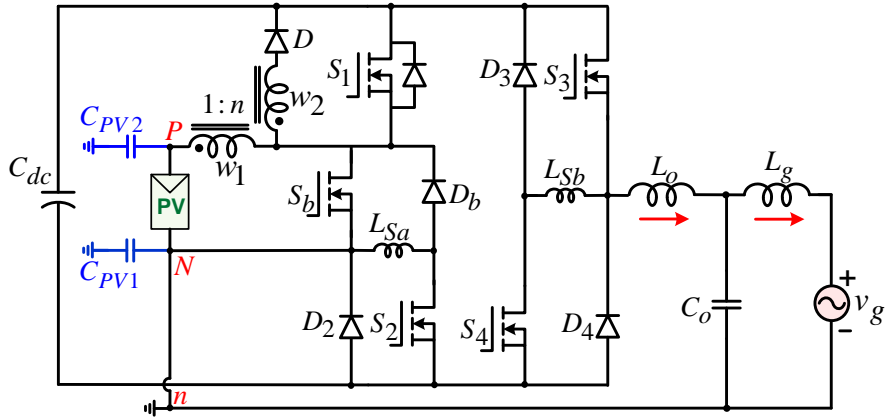
Drawbacks

- ❑ Two stage power conversion (dc-dc-ac)
- ❑ Generation of PV to grid leakage current



Proposed Single-Stage Buck-Boost Inverter

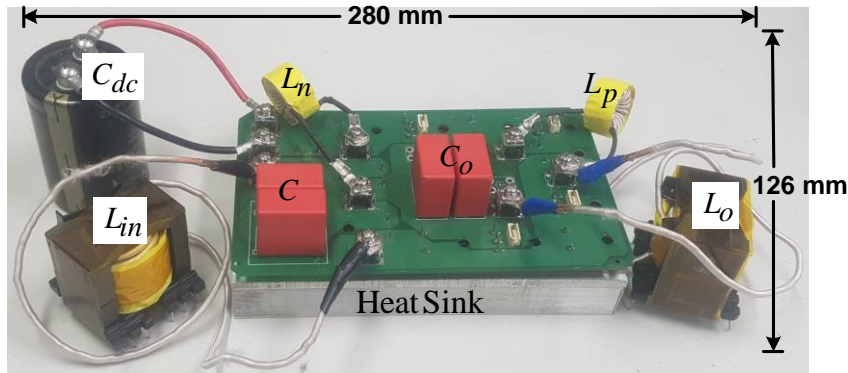
Proposed buck-boost inverter



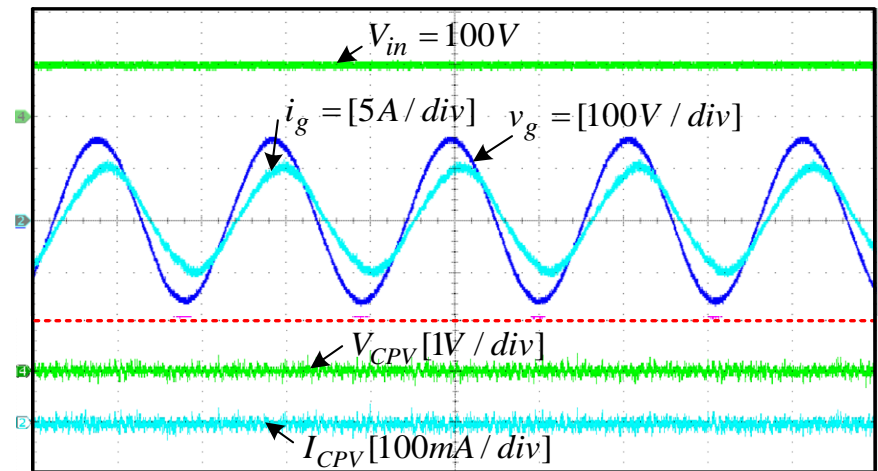
Features

- Single-stage buck-boost voltage inversion
- Common-ground point between PV panel and Grid
- Elimination of PV leakage current

Hardware prototype



Experimental waveforms

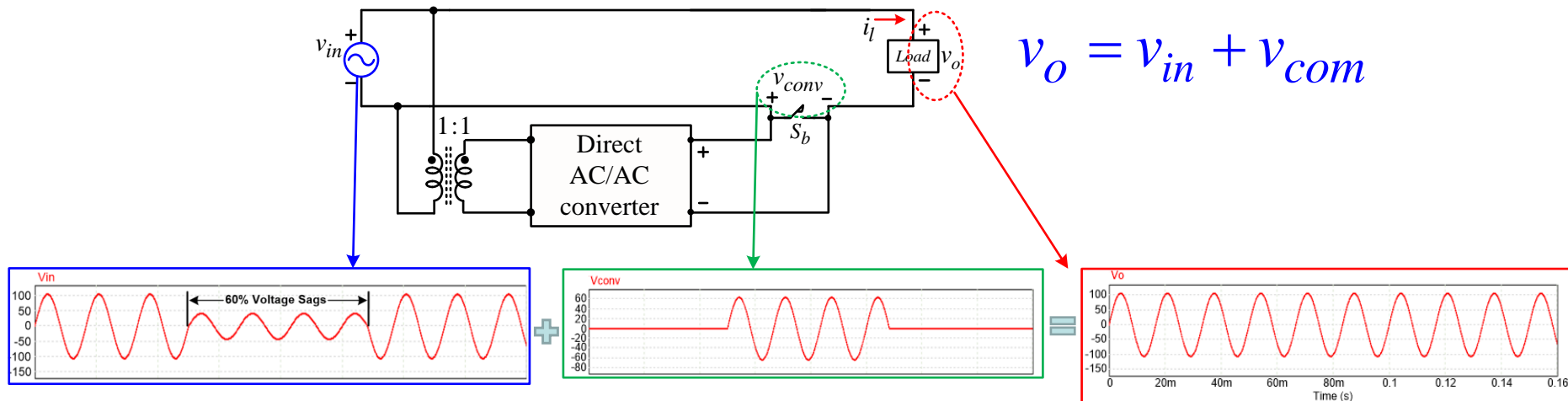


II. Development of AC-AC Converters for Grid Voltage Regulation

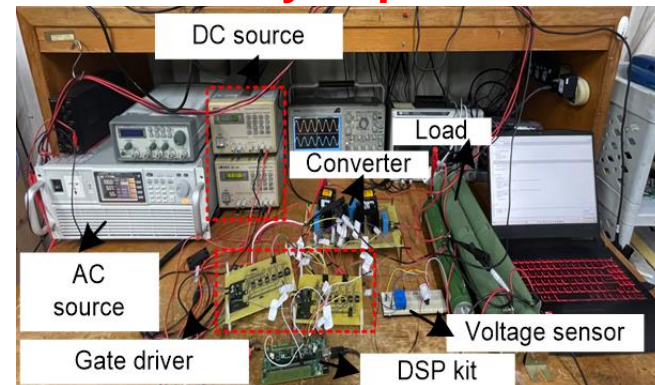
Direct AC-AC Converter Based Dynamic Voltage Restorer (DVR)

- ❑ Stabilize the grid voltage through series voltage injection

➤ Direct AC/AC converter based DVR



➤ Laboratory implementation



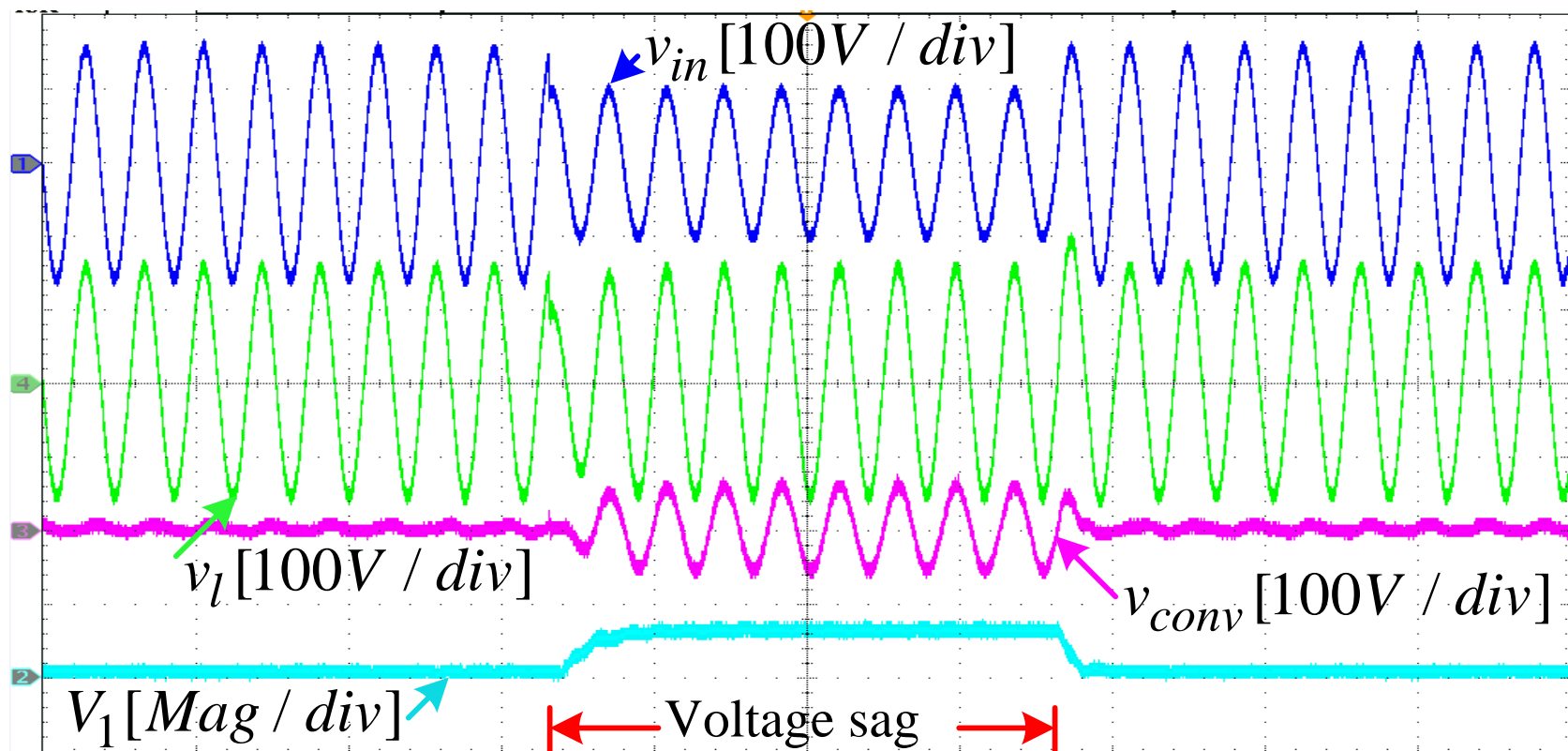
❑ Key features

- Single-stage power conversion
- No external dc-source

Experimental Results for Voltage Sag

❖ Voltage sag- depth of 36%

- ❑ v_{in} drops from 110 V_{rms} to 70 V_{rms}
- ❑ v_o is regulated to 110 V_{rms}



Thank you for your attention !
