

# Introduction of Power Electronics (PE) Laboratory

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# Research Areas of Power Electronics Lab

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## + 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

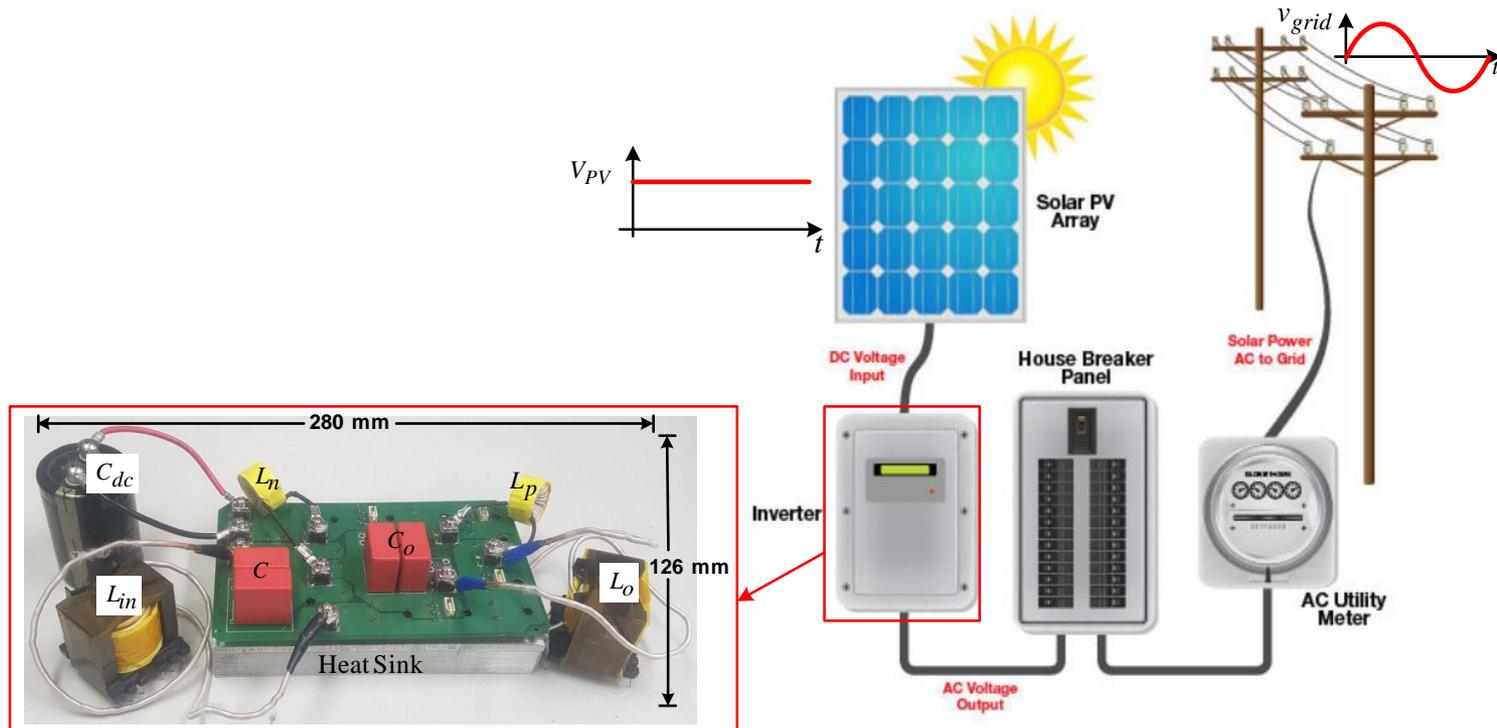
### ❖ DC-DC Converters

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

Switch mode power  
supplies

Electric Vehicles

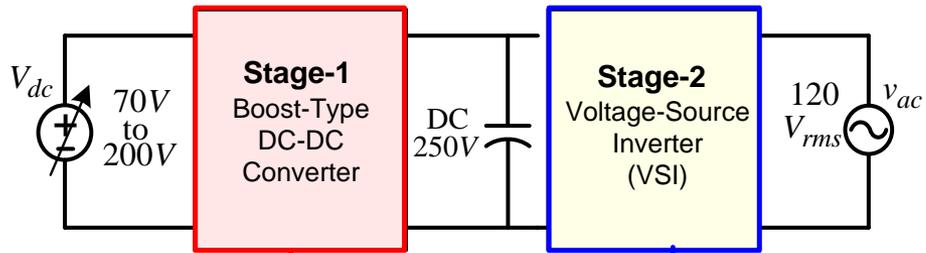
# I. Development of Single-Phase Buck-Boost PV Inverters



# Limitations of the Conventional Voltage Source Inverter for PV Applications

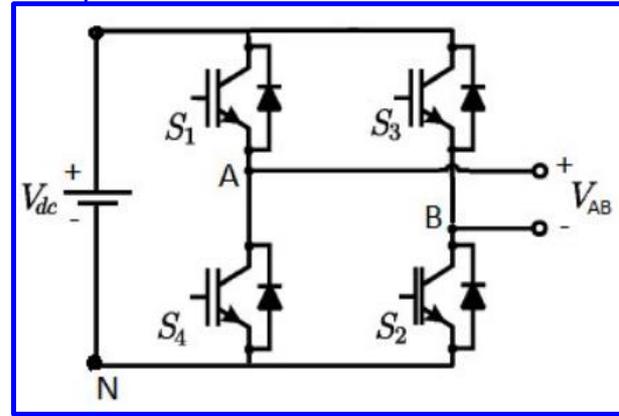
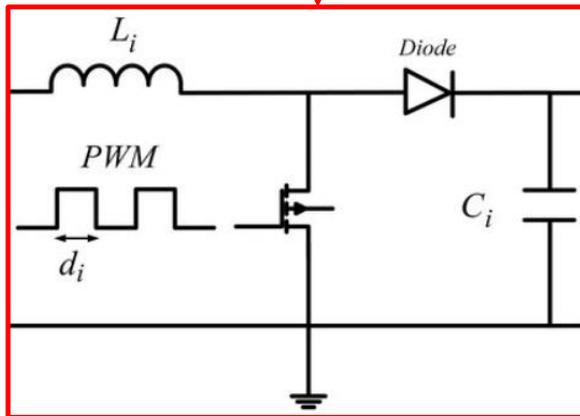
✚ A buck-boost inverter system is required for PV applications

Conventional two-stage buck-boost inverter



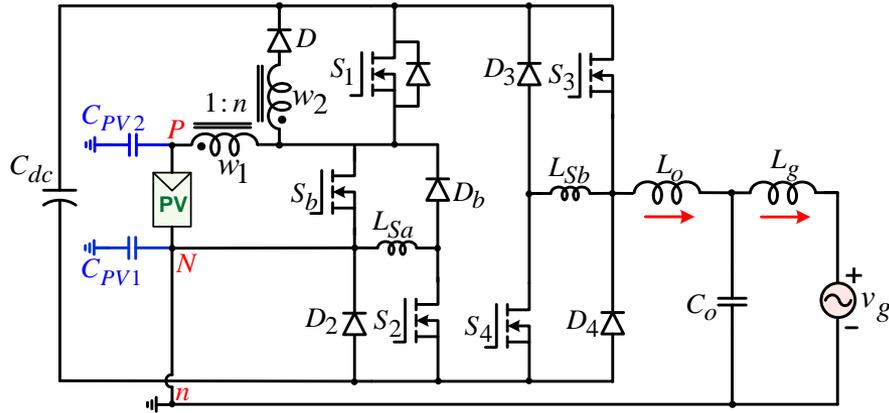
Drawbacks

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



# Proposed Single-Stage Buck-Boost Inverter

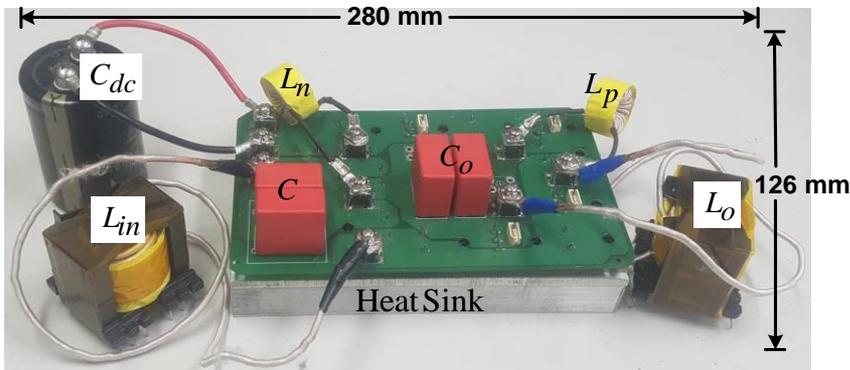
## Proposed buck-boost inverter



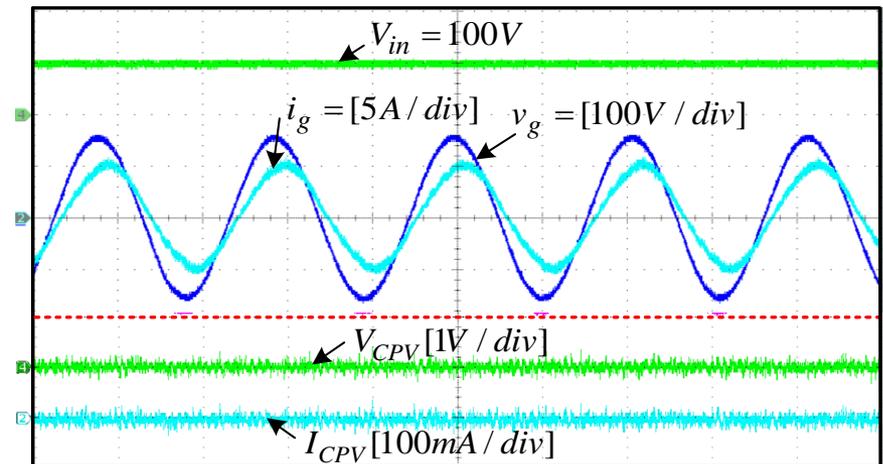
## Features

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

## Hardware prototype



## Experimental waveforms



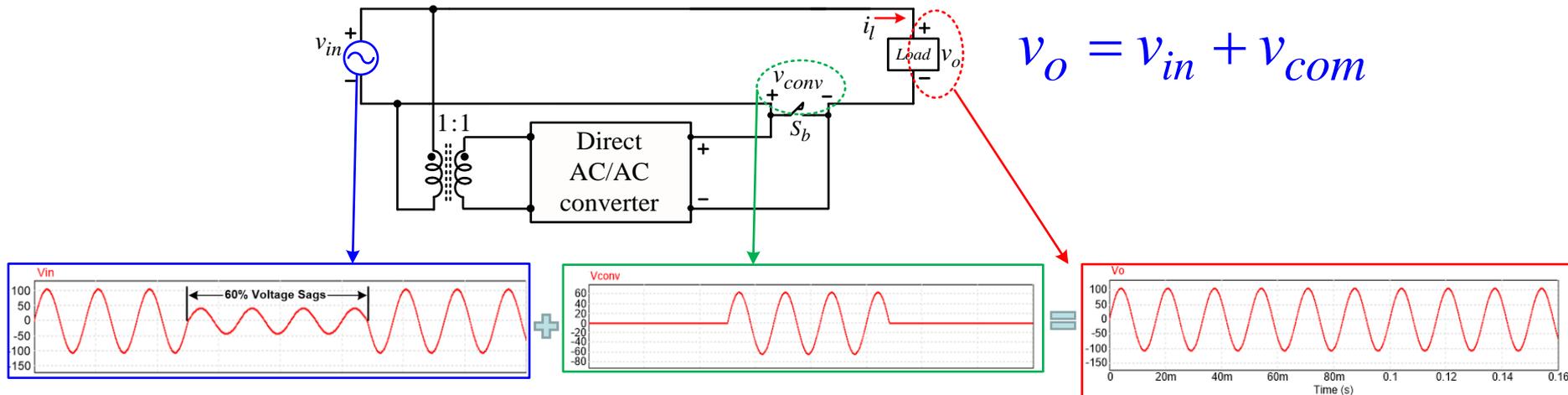
## **II. Development of AC-AC Converters for Grid Voltage Regulation**

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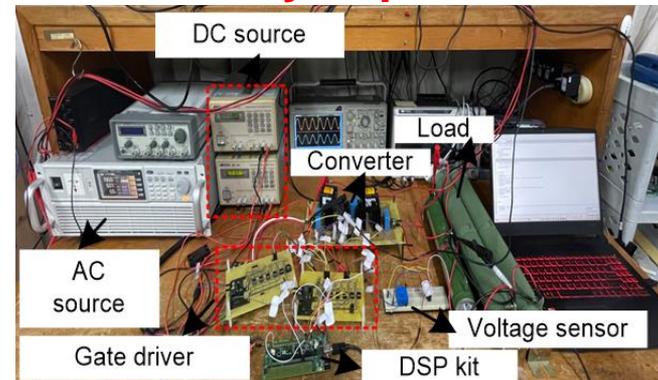
# Direct AC-AC Converter Based Dynamic Voltage Restorer (DVR)

- Stabilize the grid voltage through series voltage injection

## ➤ Direct AC/AC converter based DVR



## ➤ Laboratory implementation



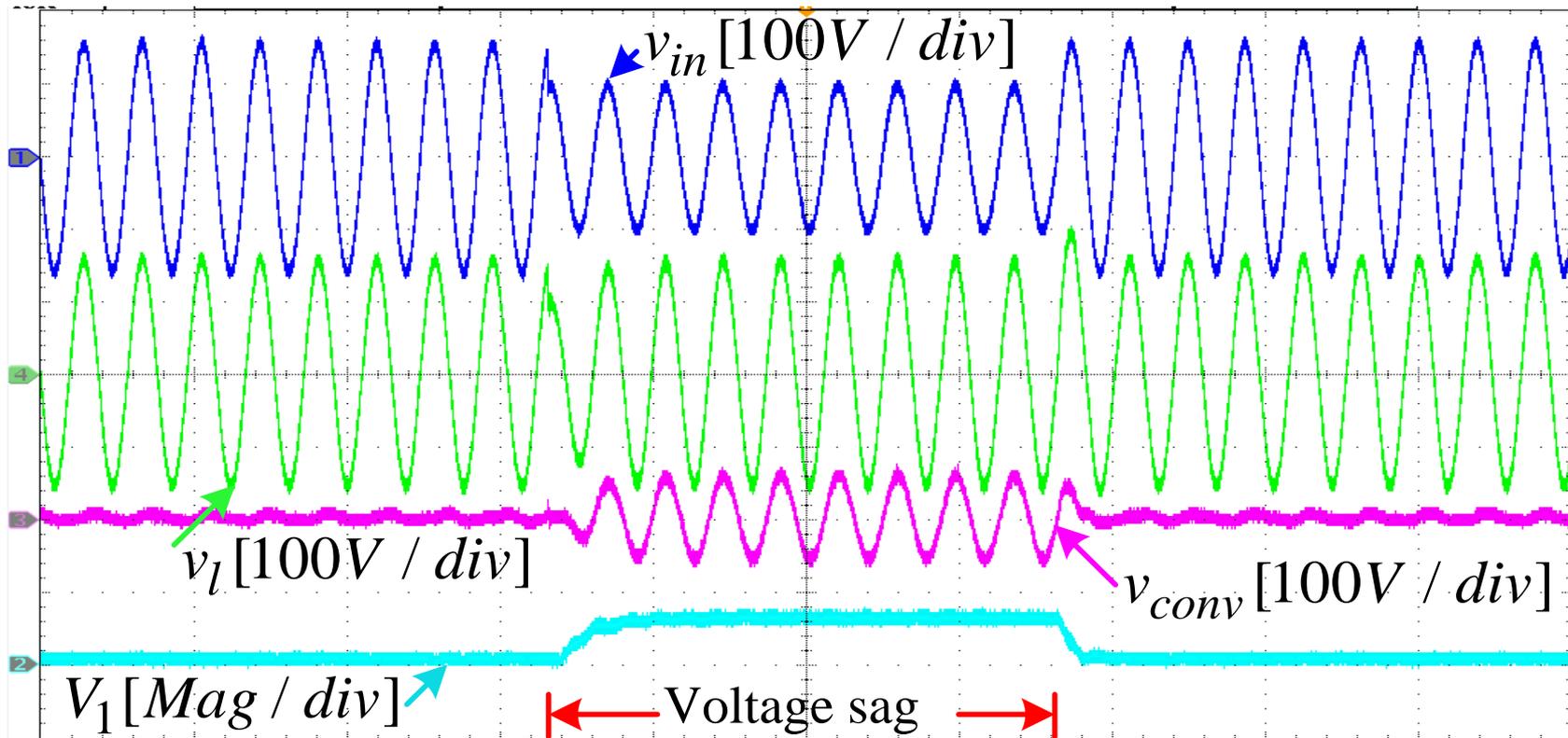
## □ Key features

- 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 !**

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