



Design and Implementation of a Hybrid Solar–Grid Interface for Water Pump Systems

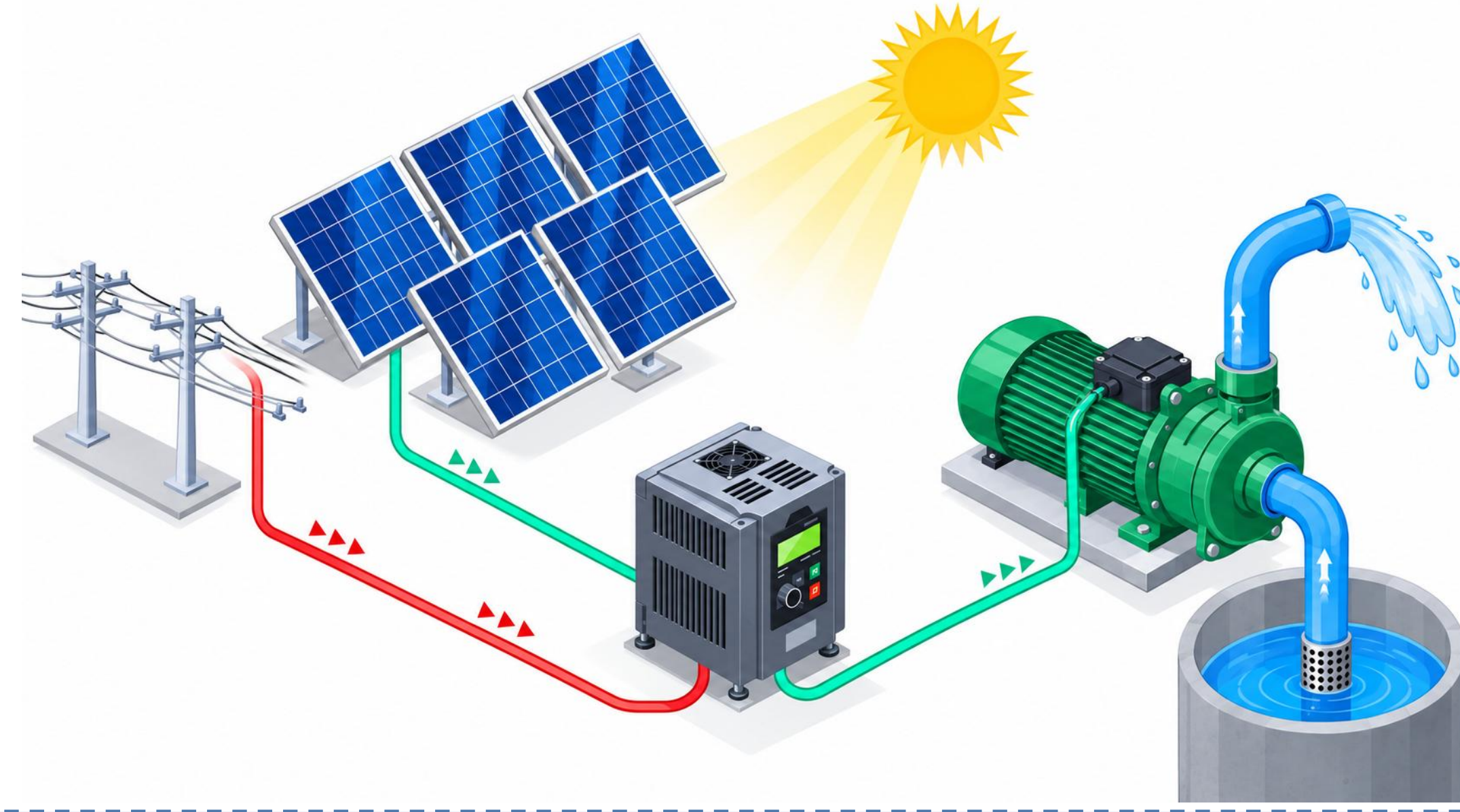


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1 Background

- Existing solar water pumps typically rely on either grid supply or PV power (by switching between the two sources) to drive the pump.
- This project focuses on developing a control algorithm that enables power sharing between the grid and PV source, with priority given to extracting maximum power from the PV system.
- The work involves system modelling, control design and hardware implementation of the system.

2 System Block Diagram and Specifications



- System rating : 3kW
- DC bus voltage : 380V
- MCU : TMS320F28069
- Input AC: Single phase, 240V
- PV input: 200V, Voc
- Switching frequency :
- PV side converter : 50kHz
- Grid side converter : 50kHz

3 Prototype

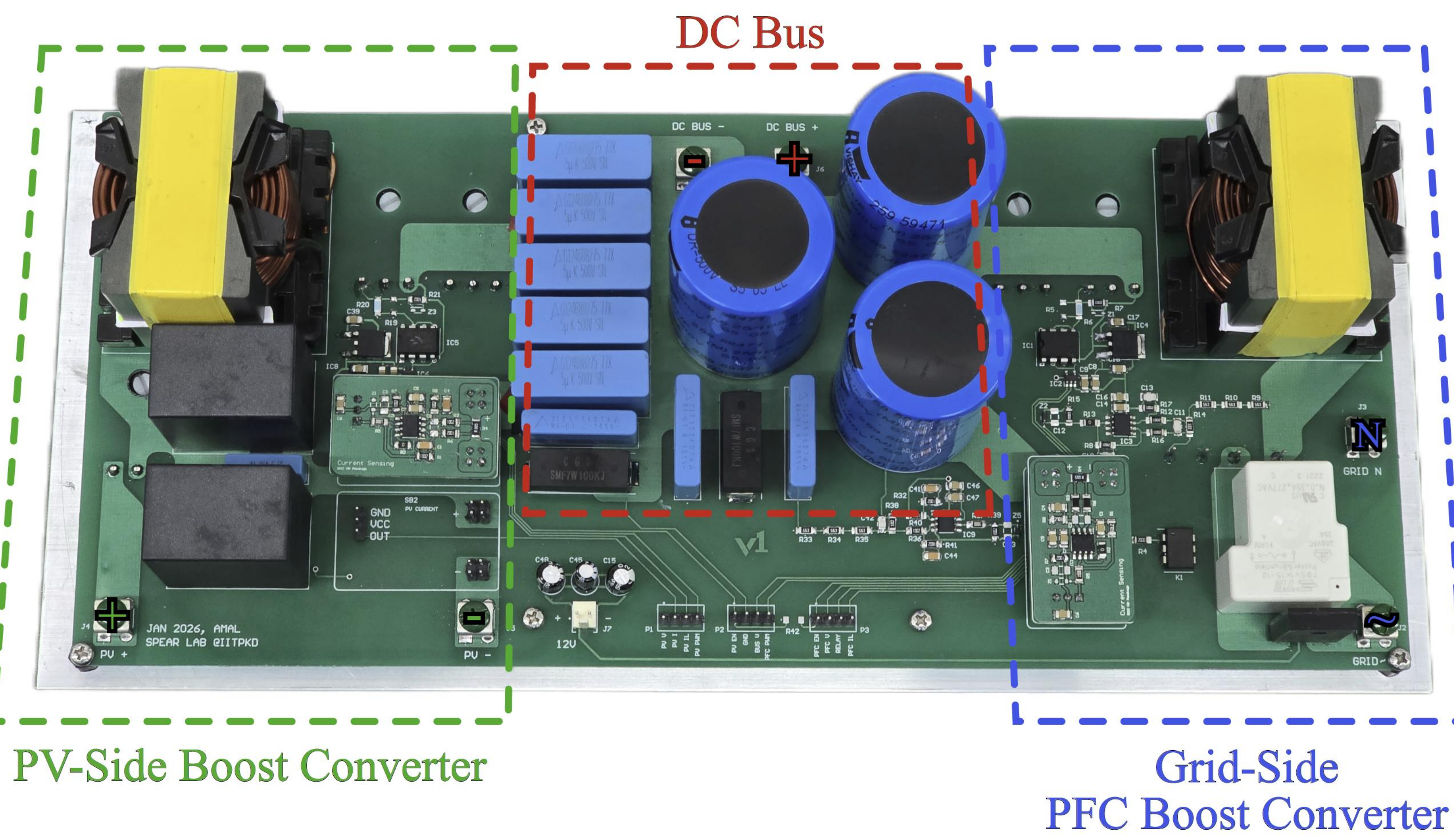


Fig: PCB prototype of the system

4 Working Principle

- The grid-side circuit is realized using a **PFC boost converter**, while a **boost converter** is used to realize the MPPT controller.
- Maximum power is extracted from the PV and supplied to the DC bus, which then powers the load. The grid is also connected in parallel to the DC bus through the PFC boost converter.
- The grid-side converter maintains the DC bus voltage at its reference level and supplies the additional power required by the load.

$$P_{\text{Grid}} + P_{\text{PV}} = P_{\text{Load}}$$

- The developed algorithm effectively controls the power drawn from both the PV and grid, ensuring that the load always receives the rated power, while giving priority to extracting the maximum available power from the PV.

5 Proof of Concept

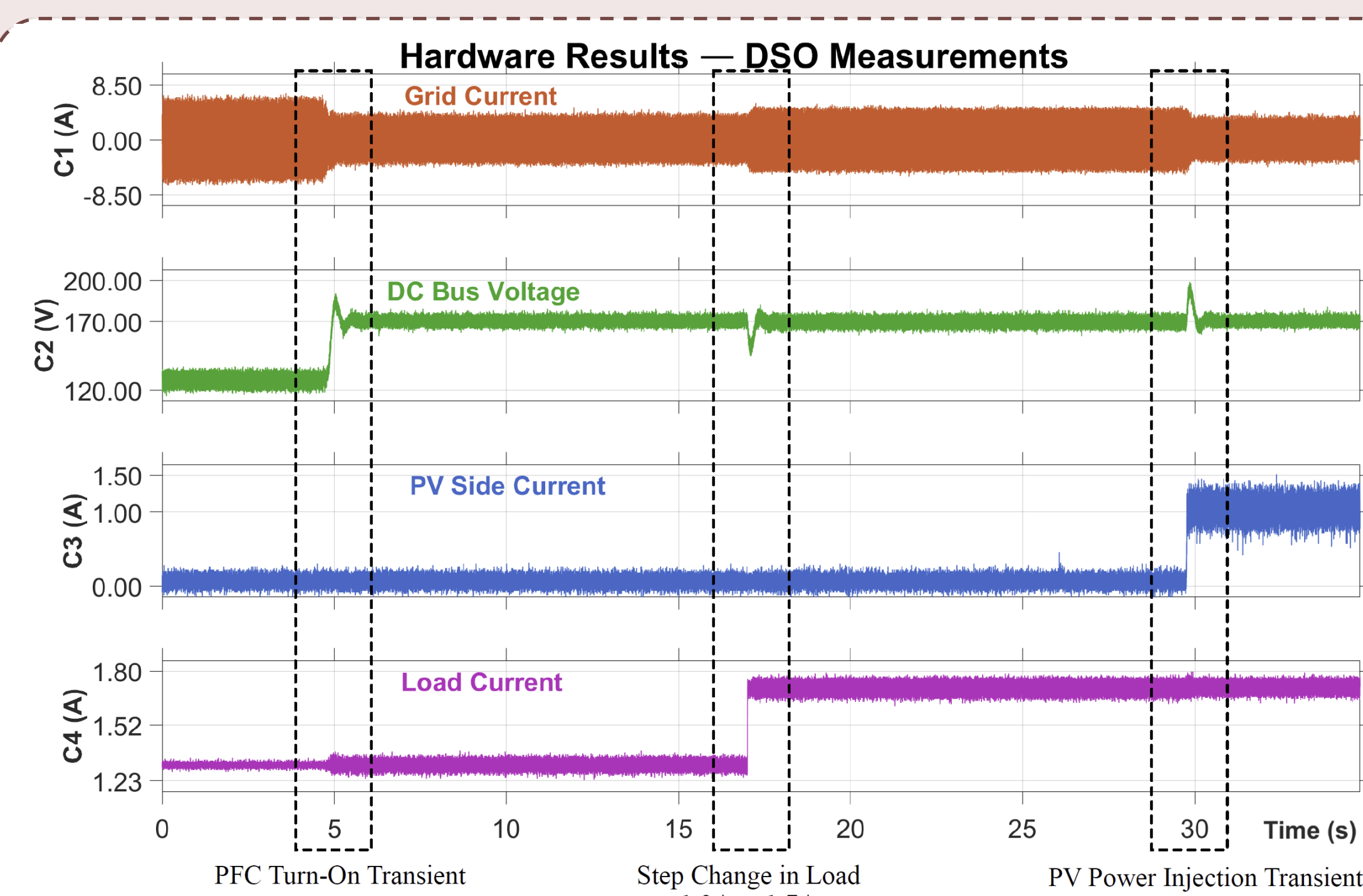


Fig: Experimental measurements of various waveforms under varying PV power and load power

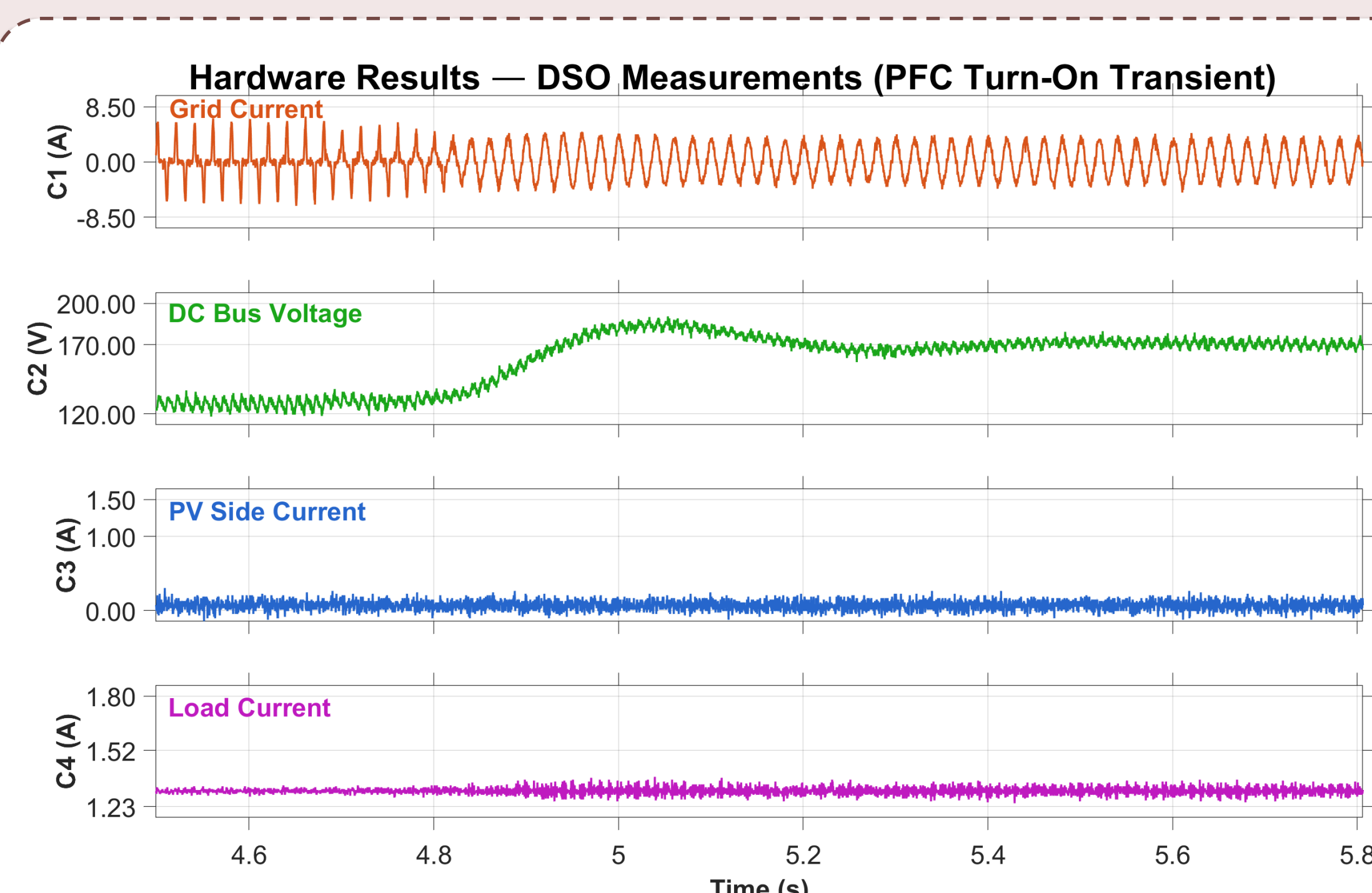


Fig: PFC turn-on transient

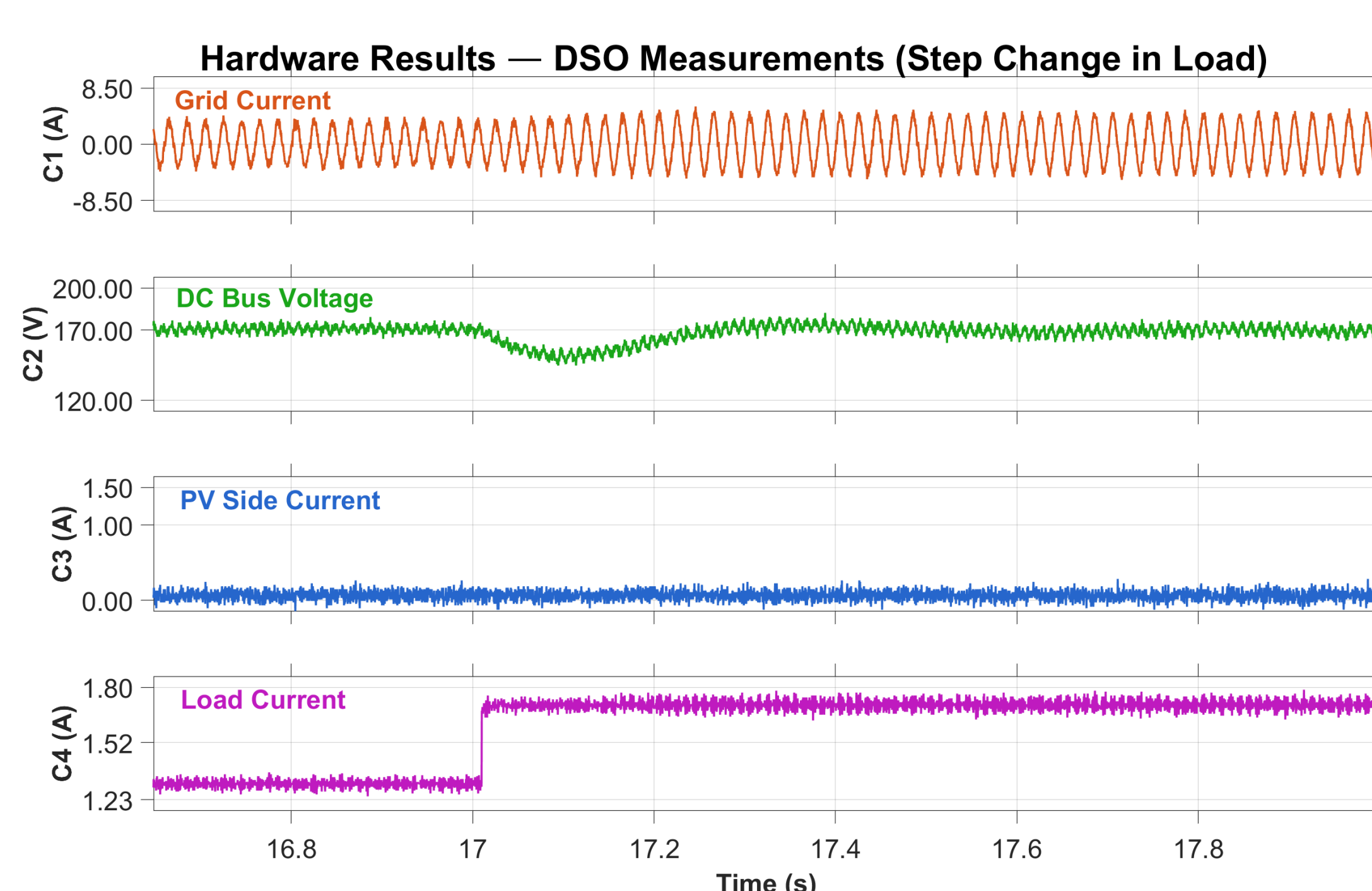


Fig: Load current step change transient

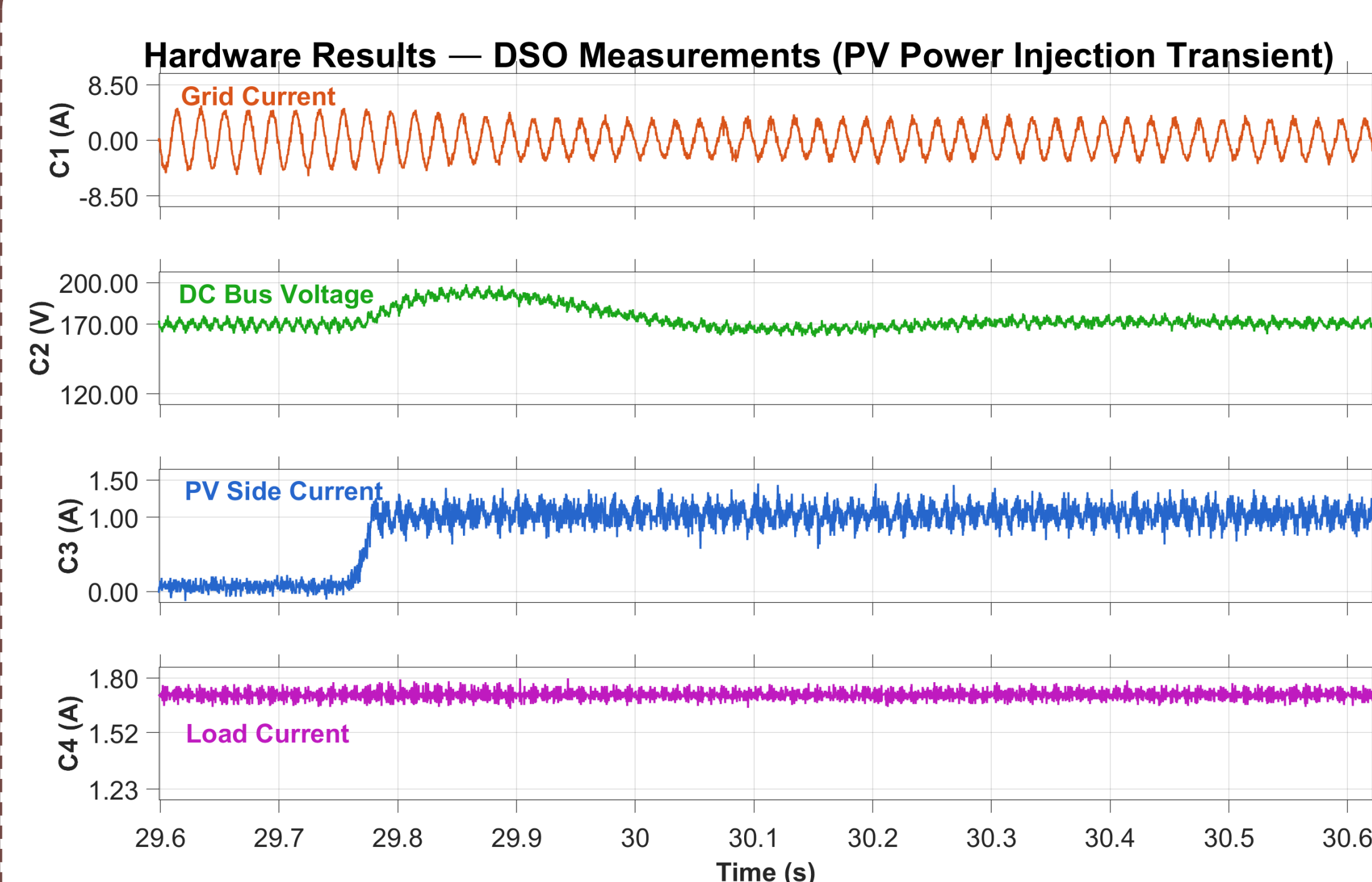
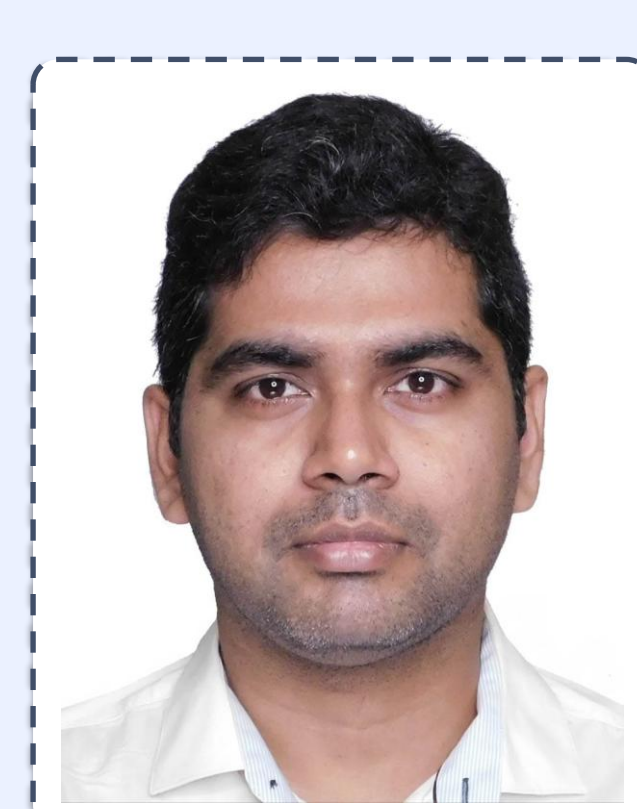


Fig: PV side power injection transient

6 Team Members



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