

Testbed for Mitigation of Power Fluctuation on Micro-grid [★]

Xin Zhao^{*} Raymond A. de Callafon^{*}
Maurice L. J. van de Ven^{**} William Torre^{***}
Charles H. Wells^{****}

^{*} *Department of Mechanical and Aerospace Engineering, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA
(e-mail: xiz028@ucsd.edu; callafon@ucsd.edu)*

^{**} *Department of Mechanical Engineering, Eindhoven University of Technology, 5600 MB Eindhoven, The Netherlands
(e-mail: m.l.j.v.d.ven@student.tue.nl)*

^{***} *Center for Energy Research, University of California, San Diego, 9500 Gilman Drive, La Jolla, CA 92093, USA
(e-mail: wtorre@ucsd.edu)*

^{****} *Center of Excellence, OSIsoft
(e-mail: cwells@osisoft.com)*

Abstract: Power fluctuation occurs intermittently on micro-grid when there exists a difference between generated and consumed power. Conventional generation tends to stabilize and maintain synchronous operation of the system by the inertia in the form of spinning rotational mass. As more renewable energy generation is added to the utility grid, less and less conventional generation will be required to meet the power demand. It could result in instability and poorly damped oscillations in AC frequency and power on micro-grid. A testbed composed by a photovoltaic (PV) system, a four-quadrant grid-tied inverter, and a real-time controller is developed. A resonant load circuit is integrated into the system to act as a disturbance and generate power fluctuation. By modeling the dynamics of the system and applying proper real-time control, the power fluctuation can be mitigated. The testbed can benchmark a real-time power control technology. The developed control system is scalable to the integration of renewable energy generation with advanced control features into micro-grids. (The diagram of the testbed and two photos are included in the next page.)

Keywords: Micro-grid; Grid-tied inverter; Real-time control.

[★] This work was sponsored by the California Energy Commission.

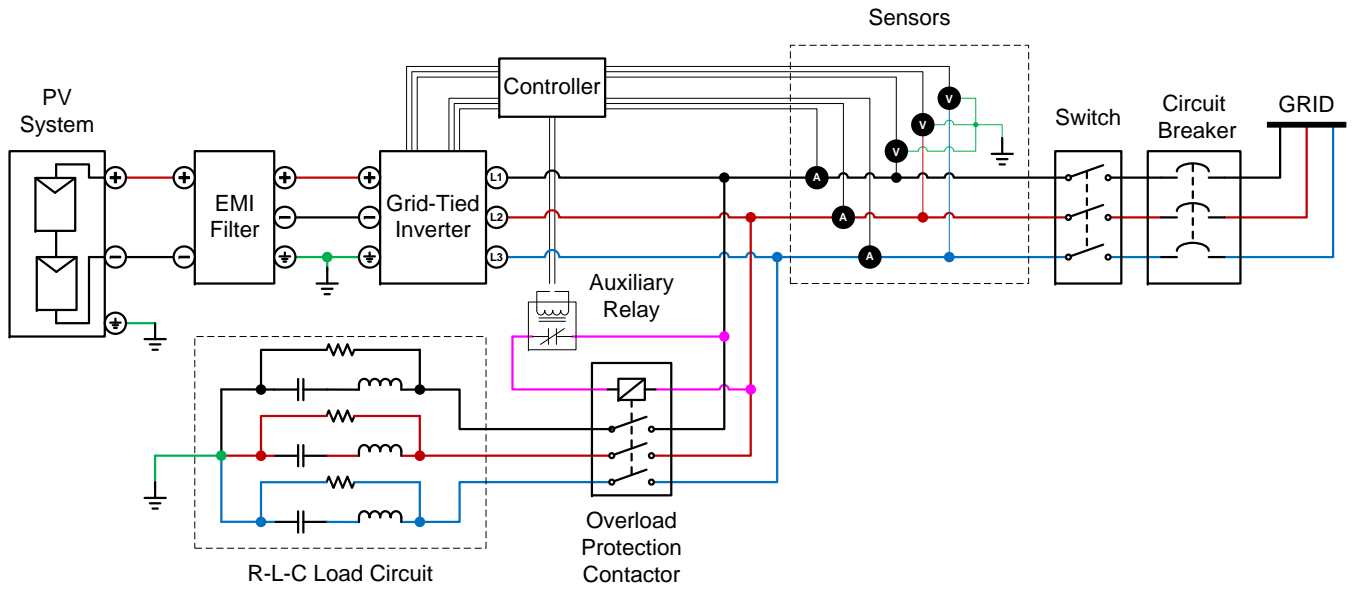


Fig. 1. Diagram of the Testbed

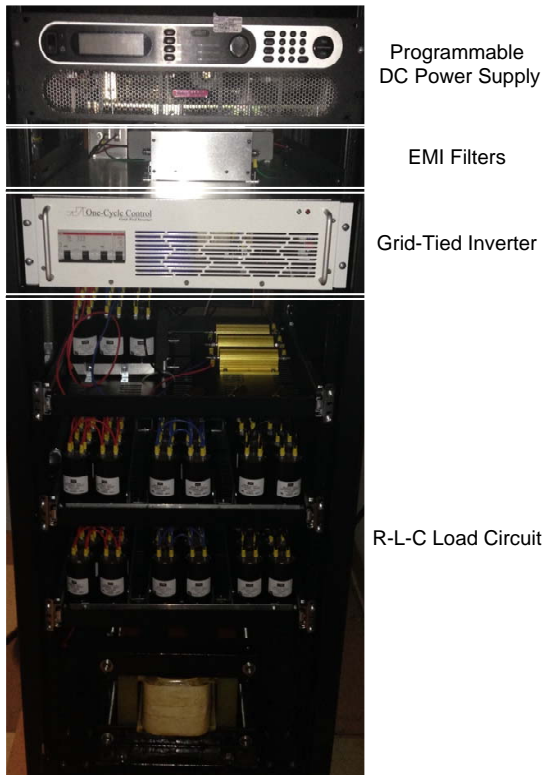


Fig. 2. Front of the Testbed

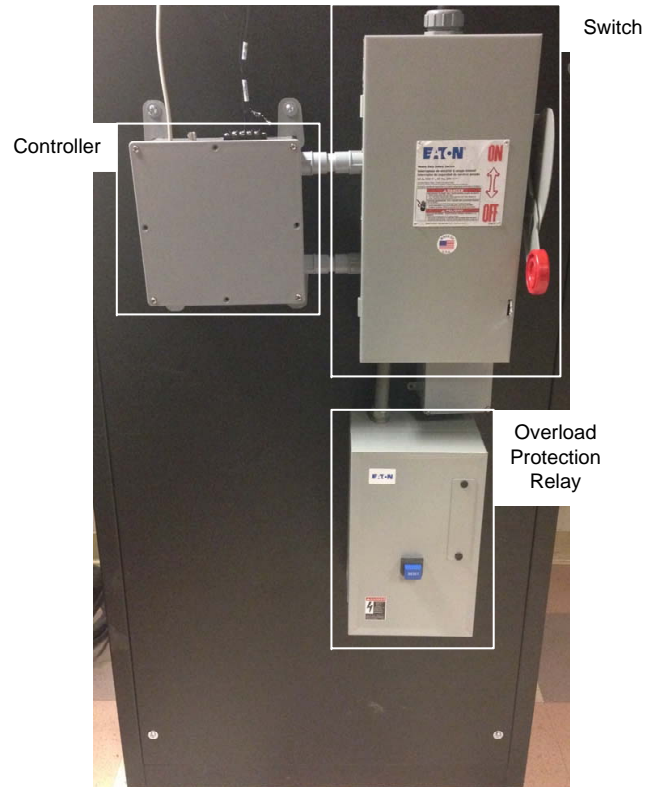


Fig. 3. Side of the Testbed