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BESS Testbed for Standardizing DERMS Interface

Keywords: Battery Energy Storage System, BESS, Distributed Energy Resource Management System, DERMS, Hardware-in-the-Loop, HIL, Real-Time Digital Simulator, RTDS, DNP3, Relays, Testbed, EMT, Power Systems Dynamics, Renewable Energy, Islanding

Abstract:

Battery Energy Storage System (BESS) is becoming a prominent component of renewable energy strategy for utilities worldwide. However, faster adoption of BESS is hampered by the lack of standardization [1], including its communication and protection interfaces [2]. A real-time testbed based on RTDS™ simulator lets BESS suppliers and utilities test their controls, DERMS interface, and protection system under the full range of grid conditions and BESS operating modes. Utilities can use this facility to develop and test interface standards as well as specify and verify compliance prior to installation and commissioning. It is also useful as an operator training facility. The architecture presented here can be readily extended to include other utility assets. The full report includes in-depth details of the BESS model, testbed configuration and a full set of use case results.

Salient Features:

- DERMS interface with standard DNP3 map
- HIL with protective relays and controllers
- Full range of BESS P, Q control modes
- Open and customizable BESS controls
- Fully scalable BESS MW rating
- Supports islanded operation
- Multiple, distributed BESS on the grid
- Test coordination of multiple systems
- Full-function non-HIL development-mode
- Detailed utility network at the POI
- Requires minimum RTDS hardware

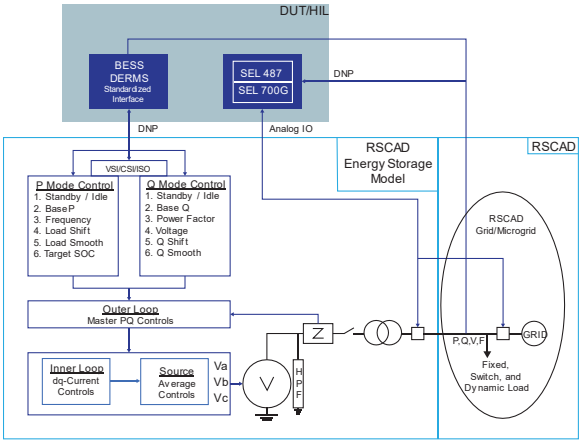

Fig. 2. BESS-DERMS testbed architecture

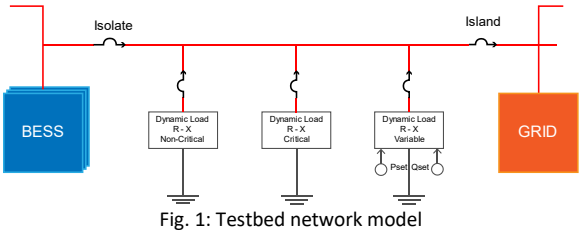

Fig. 1: Testbed network model

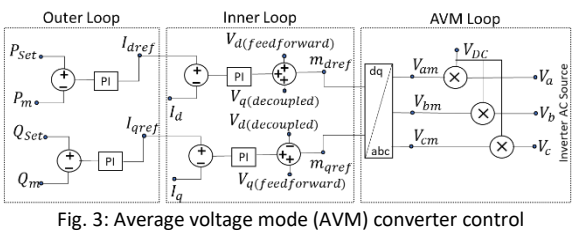

Fig. 3: Average voltage mode (AVM) converter control

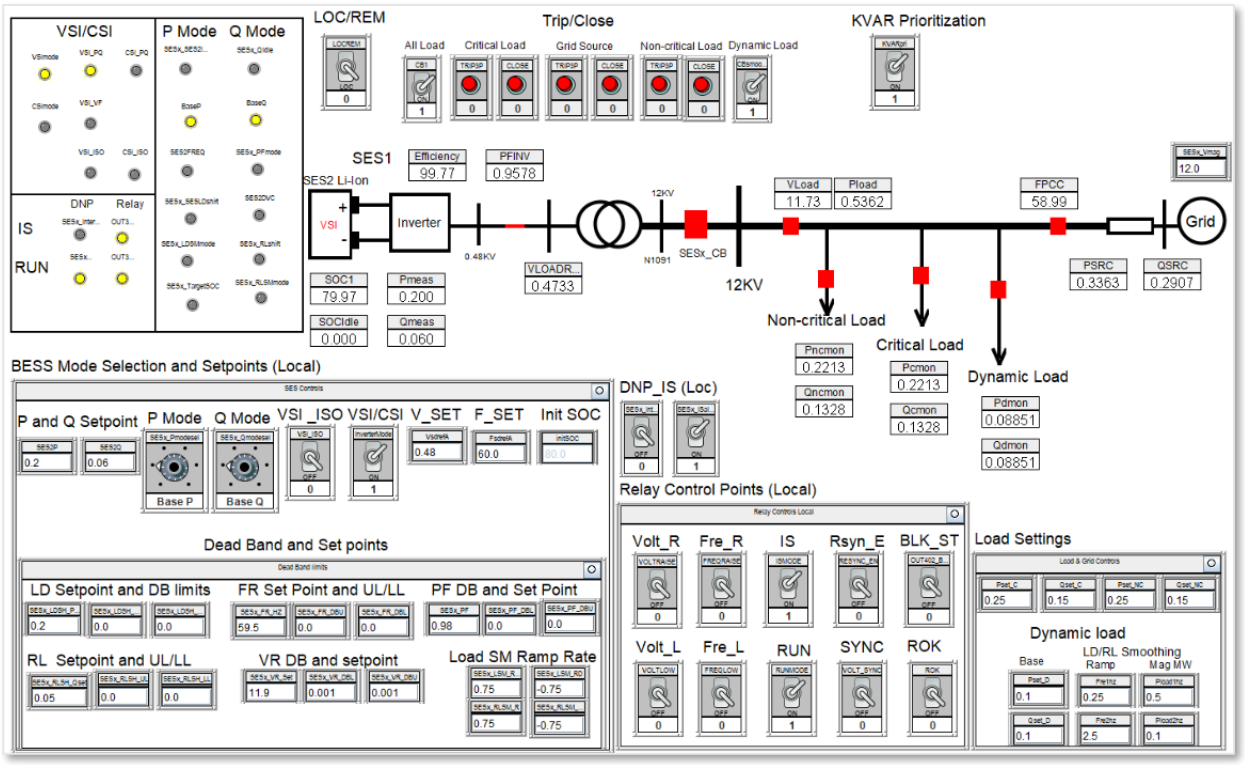

Fig. 4: BESS testbed control panel in RTDS/RSCAD

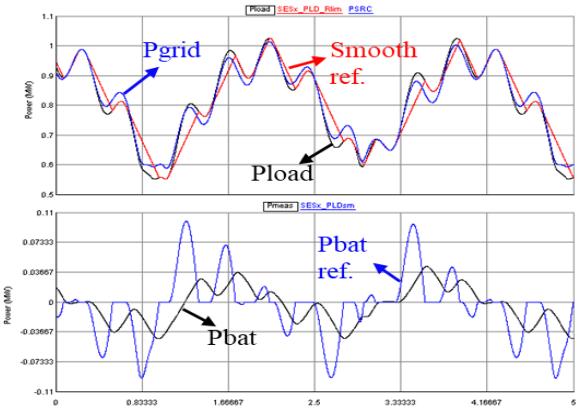

Fig. 5: Load smoothing mode

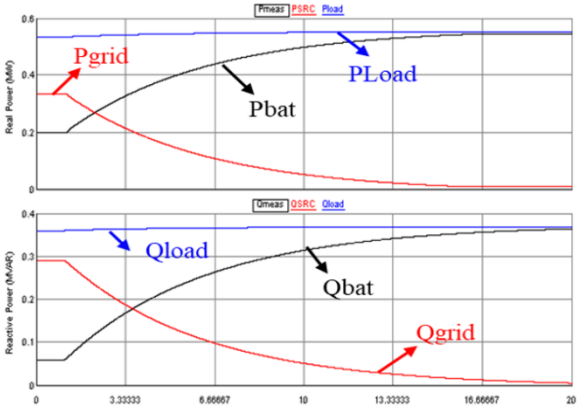

Fig. 7: Initiation of intentional islanding: Interchange Allow

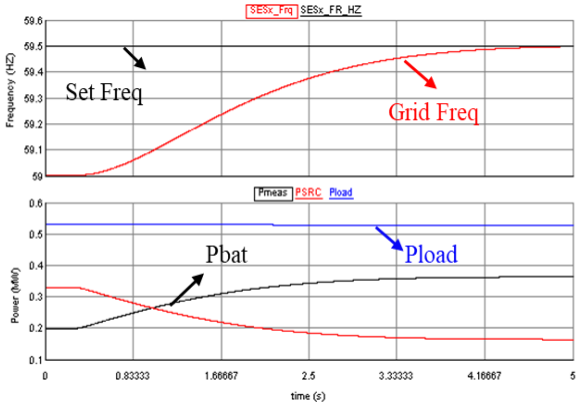

Fig. 6: Frequency regulation mode

References:

[1] MESA standards website, "Why MESA?", http://mesastandards.org/why-mesa/

[2] Sandia National Laboratories website: "Energy Storage System Safety – Codes & Standards" https://www.sandia.gov/ema_sp/_assets/documents/EMA_2_5_SAND_ESS_Codes_and_Standards_1130_Rosewater_Day_2m.pdf