IBR (Inverter-Based Resources) Model Verification Using EMT (Electromagnetic Transient) Playback Simulation

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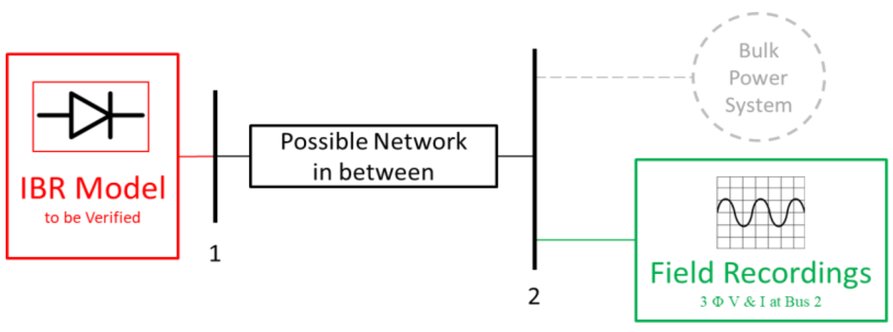
Playback Simulation Approach

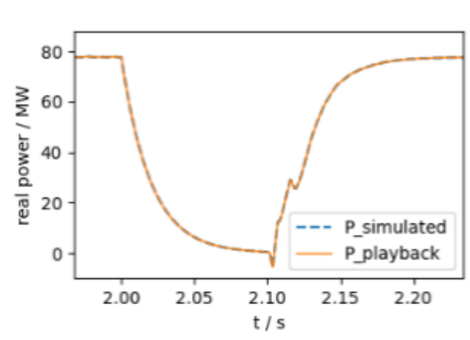
Playback Simulation Setup



Advantages

- No need to simulate the whole system
- Results are straightforward to interpret
- Provides a solution for facility owners to verify their models

Playback of Simulated Data

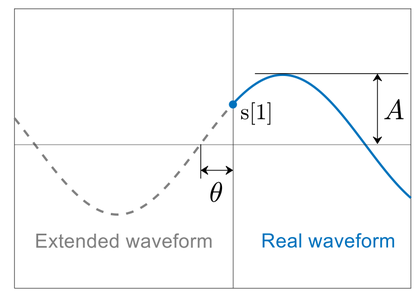


IBR Model Ramp-up Technique

Waveform Extension

Match the magnitude and phase angle with a given sine signal *s*.

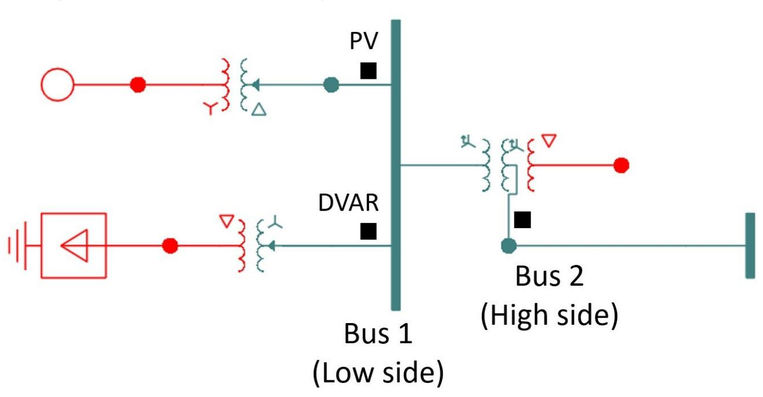
$$A = \sqrt{2} \times \mathrm{RMS}(s) \qquad \theta = \arcsin(s[1]/A)$$



Application on Real Event

Facility Information

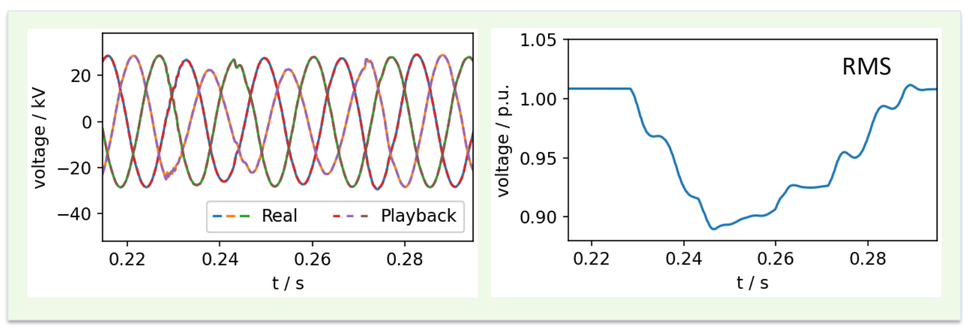
PV generation facility near the event site.



Event Information

A bus near a power station tripped, causing a voltage dip in the neighborhood.

Bus 1 Voltage



Waveform Analysis

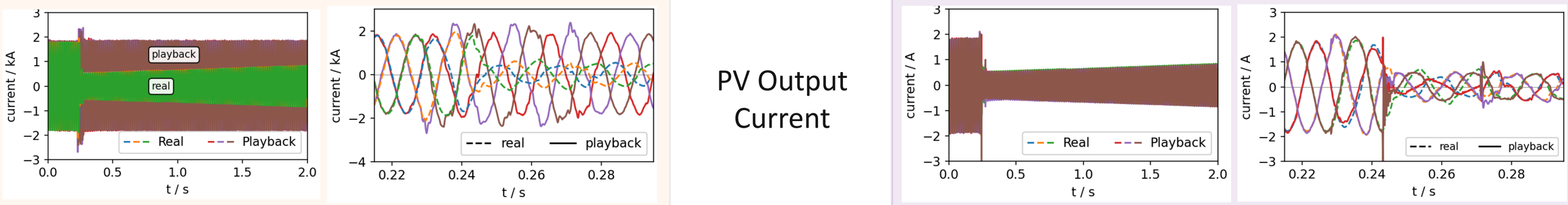
The original model provided by PV plant owner does not reflect the actual protection and control logics during this event.

Playback Results

Original model provided by PV Owner

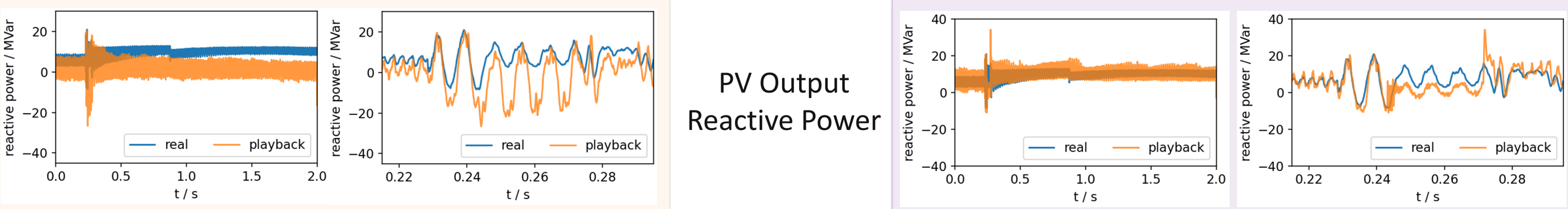
Tuned model to match real data

PV Output Current



PV Output Real Power

PV Output Reactive Power



Conclusions

- EMT playback simulation is efficient and effective as an IBR model verification solution.
- The subject IBR did not perform well during the minor voltage event like its EMT model did.