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Peer Review

Review of: "Dynamic and Power-Quality Impacts of High Photovoltaic Penetration on Distribution Feeders That Static Load-Flow Studies Overlook"

Shaik Mohammad Irshad[1]

1. Electrical Engineering, King Khaled University, Saudi Arabia

Abstract

The abstract should briefly state the review methodology, including databases, publication period, source-selection criteria, and number of studies reviewed. The statement presenting 5% as an IEEE 519 current-THD limit should also be corrected because IEEE 519 distinguishes voltage THD from current TDD requirements.

Introduction and Novelty

The authors should clearly state the specific novelty of this review compared with existing reviews on PV hosting capacity, voltage rise, harmonic distortion, and smart-inverter control. The contribution should be defined beyond simply combining dynamic and power-quality effects.

Problem Statement

Several quantitative claims, including 70–80% PV power reduction during cloud events and associated equipment wear, flicker, relay mis-operation, and harmonic problems, require stronger and direct literature support.

Literature Review

The literature coverage is insufficient for a review article. Only 13 references are included, and only three studies receive detailed comparison. The authors have to expand the literature to include recent studies on QSTS, stochastic PV variability, harmonic power flow, smart-inverter coordination, unbalanced feeders, storage, and hosting-capacity enhancement.

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Comparative Literature Analysis

If feasible, Table 1 can be expanded to compare more studies using common parameters such as feeder type, voltage level, PV penetration definition, time resolution, inverter model, weather condition, hosting-capacity criterion, harmonic metric, and mitigation technique.

PV Penetration Definition

The manuscript correctly notes that PV penetration can be defined using peak load, transformer capacity, or available rooftop capacity. However, subsequent comparisons of 20%, 40%, 50%, or 100% penetration should always identify the corresponding definition before drawing conclusions.

Review Methodology

The manuscript is described as a "structured literature review," but the methodology does not provide databases, search strings, publication period, inclusion/exclusion criteria, screening procedure, or number of papers identified and retained. It is appreciated to add these details with a literature-selection flow diagram.

Analytical Voltage-Rise Model

The sign convention for active and reactive power in $\Delta V \approx (PR + QX)/V$ should be explicitly defined. The worked example subtracts the reactive-power contribution when the inverter absorbs reactive power, so the definitions of positive and negative P and Q must be clear.

Worked Example and R/X Ratio

The worked example uses $R = 0.45\ \Omega$ and $X = 0.55\ \Omega$, corresponding to $R/X \approx 0.82$, while the manuscript earlier states that LV feeders may have $R/X \approx 4$. The authors should justify these values and explain this apparent inconsistency.

Dynamic Analysis and Time Resolution

The manuscript should clearly distinguish steady-state power flow, quasi-static time-series analysis, dynamic simulation, and electromagnetic transient analysis. The recommendation of "sub-minute resolution" is too general because cloud ramps, OLTC operation, flicker, and switching phenomena require different simulation time scales.

Voltage Fluctuation and Flicker

The flicker discussion should be strengthened using standard indices such as Pst and Plt, together with applicable limits and measurement procedures. The manuscript should also distinguish local distribution voltage fluctuations from bulk-system frequency and transient-stability problems.

IEEE 519 and Harmonic Assessment

Section 6 requires technical revision. IEEE 519 should not be represented as imposing a universal 5% current-THD limit. Voltage THD, current TDD, individual harmonic limits, and the dependence of current limits on Isc/IL should be clearly distinguished.

Harmonic Results and Figure 5

Figure 5 presents harmonic spectra from nonlinear loads with THD values of 44% and 133% and then relates these to PV inverter behavior. This comparison is weak because modern PWM PV inverters with LCL filters can exhibit different harmonic characteristics. A measured or simulated PV-inverter harmonic spectrum would be more appropriate.

Harmonic Mitigation Techniques

The claim that increasing multilevel-inverter levels monotonically reduces THD and may eliminate filtering should be qualified. Harmonic performance also depends on modulation, switching frequency, filter design, grid impedance, operating point, and inverter control.

IEEE 1547-2018 and Smart-Inverter Control

The discussion of volt-var, volt-watt, ramp-rate control, and inverter coordination should be supported by a formal IEEE 1547-2018 reference. Typical volt-var and volt-watt characteristic curves would also help explain deadbands, slopes, reactive-power limits, and active-power curtailment.

Results and Conclusions

Since no original simulations or experiments are performed, Section 8 could be renamed “Synthesis and Discussion.” Claims that dynamic or power-quality limits are “often reached first” and that problems occur at 20–40% penetration should also be qualified as feeder- and scenario-dependent rather than general limits.

References and Overall Presentation

The reference list should be substantially expanded and standardized. ResearchGate figure links should be replaced with original publications, peer-reviewed versions should be preferred over arXiv where available, and IEEE 1547-2018 should be formally cited. The manuscript should also replace conversational expressions with formal scientific language throughout.

Declarations

Potential competing interests: No potential competing interests to declare.