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Extended Abstract

Review on Harmonic Domain Modeling of PV System for the Assessment of Grid Integration Impact

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ABSTRACT

In the document, we study the fundamentals of design to model the photoelectric system to evaluate the impact of network integration using the harmonic domain. The model is useful to evaluate the harmonic correlation between the photovoltaic system and the network. Several components of the photovoltaic system, such as the inverter, the LCL filter, and the connected transformer are integrated into the model. Using this model, consistent flows of photovoltaic systems connected to deformed and undamaged networks were measured

Keywords:

PV grid integration, Grid-interactive photovoltaic system, Resonance, Harmonic domain, Medium voltage distribution network

INTRODUCTION

Operational and technical issues such as power quality issues, reverse power flow, increased power loss, and harmonic pollution are very important and require technological innovation. Harmonic contamination often challenges the operation of the system due to device failure, device overheating, resonance, and the like. In this study, public surveys related to harmonic pollution were the most common survey.

Accurate models are essential when designing photovoltaic (PV) systems. Since the PV model relies on a set of transcendental nonlinear equations, the complexity of the model increases. The letter proposes an easy and simple model method for simulation of the solar power generation system. This improves accuracy by utilizing the simplicity of the ideal model, deriving a mathematical representation and extracting accurate estimates of model parameters directly related to the manufacturer's data sheet. Experimental measurements demonstrate the effectiveness of this method. The PV system is modeled as a current source in parallel with the impedance. This impedance is modeled as a single capacitor.

PV SYSTEM MODELLING

The photovoltaic system includes a range of photovoltaic modules, power conditioning unit, filter, control circuits, protection devices (for example, isolation keys), connected transformer, etc. VSC is a type of PV in this work although the method is also applicable .The reflector of current source photovoltaic systems. Figures 1 and 2 are used to develop circuit equations for single and triple phase photovoltaic systems, respectively. The DC voltage is estimated from PV modules/matrices that act as inputs to the inverter using different formulations. The inverter is designed using the conversion function technique. This method treats the inverter unit as a black packet and, therefore, depends on its operation instead of a circuit-based model.

PROPOSED MODEL VALIDATION

Some of the previous works have achieved the effect of network distortion on the output performance (in terms of harmonic generation) of photovoltaic systems. In SPICE simulations were used for simulations and experiments were performed to verify the results by the author. Both the ideal grid and the real (deformed) effects of the voltage were examined. The researchers concluded that the nature of the harmonic currents of interconnected photovoltaic systems depends on the state of the voltage. Similarly, measurements were made and then some models and simulations were published (using a phase-scale approach) to verify their results. The idea of "phase angle variations" and "attribution of combinations" was also proposed to evaluate the compatibility interactions between the network and the photovoltaic system in its model.

Secondly, the harmonic interpretation between the photovoltaic system and the non-linear component (such as the transducer in the saturated state) or the load (like the asynchronous speed motor) can be fully calculated in our proposed analytical model, unlike the interval approach of phases that separates the interaction. From this point of view, the possible

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cancellations between the PV harmonics and the network can also be easily captured using our model. Therefore, the assumption about the variation of the phase angle of the harmonic components becomes unnecessary.

The resonance test carried out with the proposed model also confirms the effect of the resistance to inhibition and the negative charge on the inhibition of the resonance affected by the interaction between the LCL inverter filter and the network. This is also consistent with.

After validating our model, it is important to clarify that the model proposed in this document is the first HDRF model for the VSC-PV system (for better knowledge of the authors) and has useful applications beyond the resonance probe where it can also be published in HPF studies developed in HDRF.

CONCLUSION

In this work, we propose a complete HDRF system model for the PV VSC system for interactive single-phase and triple interactive systems. These HD models were used to evaluate and measure the interaction between the performance of the harmonics in the photovoltaic system and the network. The results of the simulation show a consensual interaction between the harmonic currents of the photoelectric system and the background distortions of the network. In addition, an MVDN resonance was investigated in a three-phase photovoltaic system using the previous model. The results confirm that the resonance excitation (both sequences and parallelism) is possible due to the interaction of the systemic impedance with a PV filter capacitor. Although the well-known buffer solution of the chain resistance was able to discourage phase A and C resonances, the parallel resonance of phase B cannot be completely avoided. This is not out of line with a different level of negative charges related to different stages. With equal loads, all three phases were wet, indicating that the negative charges on the PCC significantly helped to dampen the resonance.

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