UNIVERSITI TEKNOLOGI MARA

POWER QUALITY PREDICTION OF LOW VOLTAGE GRID CONNECTED PHOTOVOLTAIC POWER SYSTEM USING MATHEMATICAL MODEL

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Thesis submitted in fulfilment
of the requirements for the degree of
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CONFIRMATION BY PANEL OF EXAMINERS

I certify that a Panel of Examiners has met on 28th January 2016 to conduct the final examination of Faranadia Bt Abdul Haris on her Master of Science thesis entitled "Power Quality Prediction of Low Voltage Grid Connected Photovoltaic Power System Using Mathematical Model" in accordance with Universiti Teknologi MARA Act 1976 (Akta 173). The Panel of Examiners recommends that the student be awarded the relevant degree. The panel of Examiner was as follows:

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledge as referenced work. This thess has not been submitted to any other academic institution or non-institution for any other degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

With the rapid growth of Grid Connected Photovoltaic (GCPV) System interconnection brings new challenges that linked to the solar irradiance intermittency as well as limited on the behaviour predictability towards utility grid. Hence, the power quality assessment becoming increasingly important as the impact of this interconnection increased significantly. This occurrence might lead to power quality parameter could be out of acceptable limits. However, there is a lack of literature on power quality prediction associated with GCPV system and a method of prediction in identifying the relationship between power quality parameters and solar irradiance variation. In this study, the prediction of power quality of GCPV system is executed under Malaysia climate variation. Three objectives have been identified which are a development of Mathematical model GCPV system on power quality parameters mainly on the total harmonic current distortion, short term flicker, long term flicker, power factor and AC voltage. Then, verification of accuracy proposed model empirically and prediction of power quality on utility grid by comparing the proposed model with actual data. In this study, the proposed Mathematical model is developed to predict the total harmonic current distortion, flicker, power factor as well as AC voltage based on the fundamental equation that utilizes the solar irradiance as it input meanwhile the power quality parameters as it output. The process of model verification is based on the real data measurement on the GCPV system that involved in this study as well as on the utility grid which follows the IEC Standards requirement. Based on the analytical analysis between power quality parameters with environmental under different brands of the inverter, it revealed that the solar irradiance and the features of inverter give a significant influence on these power quality parameters that involved. Based on the comparative study and statistical approach, it shows a good agreement between simulation results of actual and prediction data. It shows that the proposed model provides an effective method for prediction mainly on the power quality parameters of GCPV system and feasible in time under the same accuracy. Furthermore, by developing a model for power quality prediction as well as exploring this relationship will illustrate an outline of their interconnection for power quality improvement schemes. By conducting a proper analysis and prediction also allow their use in any amount while maintaining the required standards of power quality.

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