Dear ICIC Express Letters Editor,

Thank you for considering our paper entitled by 'A Simple Method for Determination of Electrical Characteristics in Different PV Modules Technologies', Reference No.: ICICEL-1802-005 with Author(s): Syafaruddin., Satriani Latief in the publication of *ICIC Express Letters*.

We would like to thank to reviewers for the beneficial comments and suggestions in order to improve the quality of the paper. We have revised our paper according to the ICIC-EL template and answered the following the reviewer comments as shown in the bold font as follows:

Best regards,

Syafaruddin

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The paper is generally well written and organized. The results presented in the paper seem correct, and potentially useful in practice. The techniques employed to tackle the problems are generally standard with some novelties. The paper can be accepted for publication subject to some necessary minor changes as below:

Thank you for your beneficial comments and suggestion to improve the quality of our paper.

Comments:

(1) The "Different PV Modules Technology" in the title of this manuscript is ill-formed, which is suggested to be modified into the "Different PV Modules Technologies".

The title has been modified into 'A Simple Method for Determination of Electrical Characteristics in Different Photovoltaic (PV) Modules Technologies'.

(2) Please give the full name of the acronym "MPP" in the second paragraph of the introduction.

The acronym of MPP has been clearly stated in the paragraph as 'maximum power point'.

(3) The main difference between this study and the methods in the literature is not well stated and explained.

The literature review has been improved by comparing several methods in determining the electrical characteristic of PV modules. These methods are also being compared with our proposed method. The improvement parts is shown as follows.

Different types of real-time simulation models for electrical characteristics of PV system have been developed so far. Xiao et.al [1] proposed polynomials with least-squares method to demonstrate the power–voltage relationship of PV panels where the Newton–Raphson method is used to identify the voltage at the optimal operating point. However,

this analytical approach might be failed to identify the correct maximum power point (MPP) voltage under fast-changing in irradiance conditions. Fast shifting in irradiance conditions make this method to lose the maximum power point momentarily, and the time lost in seeking it again, because the point has moved away quickly and then moved back to the original position. In addition, various real-time simulators for PV modules were presented in different configurations, such as Field Programmable Gate Arrays (FPGAs)-based unit using the Pulse Width Modulation (PWM) principle [2], Growing Neural Gas (GNG) method based-controlled DC-DC buck converter circuit [3] and using a real-time digital simulator (RTDS) [4]. However, these methods required extensive number of iteration process and built-in elaborated power electronic components. Veerachary et al. in [5] measured solar insolation and the output voltage of PV module to track the MPP of PV module by using the hybrid algorithms of feed-forward neural network and fuzzy controller. However, the proposed methods end up with complicated control algorithms with the potential accumulative error occurs when the number of data training inreases.

The electrical characteristics are important to be determined in order to investigate the technology performance for the research and development (R&D) of solar cells. In this respect, modelling of photovoltaic system is highly important with the expectation of simple model and high accuracy. Simple model of systems means less computational effort, less data resources with some parameters are ommited, but the accuracy is reduced from the results of real systems. The accurate model of photovoltaic systems that has been proposed with the implied electrical parameters provided low percentage error [6]. Similar target of modelling PV modules with high accurracy achievement is performed using mathemmatical model including provision the thermal characteristic based on environmental parameters in real practice [7]. In addition, the experimental approch to determine the electrical characteristic is very important for data commersialisation of photovoltaic industry [8]. The electrical performance of several commercial PV modules have been investigated under standard test condition (STC) in order to obtain the similarity performance of PV module which independently on technology [9]. Similar investigation on electrical performance of different technologies and manufacturers of commercial PV modules was performed to provide the database information for photovoltaic market [10]. All efforts in these researches have attempted to provide the cccurate and reliable modelling of photovoltaic (PV) modules for design and performance estimation of PV systems.

(4) Some notations are used in section 2, but no definitions. For example, the "V_load" and the "I_sbd".

These parameters have been clearly explained in the manuscript. For instance, V_{load} is the part of Figure 1 indicated as the output terminal voltage connected to load side, I_{sbd} is the saturation current of bypass diode and other parameters have been explained as well.

(5) This paper mainly investigates the impact of operating conditions on different solar cells performance by experiment analysis, so the academic contributions are not sound. It should be improved significantly.

When the electrical characteristic for PV modules are discussed, the important parameters are the voltage at maximum power point (V_{MPP}), the coefficient of current and voltage constants which are in k_I and k_V, respectively and fill factor (FF) for the information in maximum power point tracking control design. These parameters are also presented as the beneficial information in 3D graphs representation for some lecture topics regarding the different characteristics of PV technologies according to the irradiance and cell temperature variations. The academic contribution of this research is more focused discussed in Section 3 and later restated in Conclusion.