

# Photovoltaic System Reconfiguration strategy for mismatch condition

1<sup>st</sup> Dafang Zhao  
dept. name of organization (of Aff.)  
name of organization (of Aff.)

2<sup>nd</sup> Given Name Surname  
dept. name of organization (of Aff.)  
name of organization (of Aff.)

3<sup>rd</sup> Given Name Surname  
dept. name of organization (of Aff.)  
name of organization (of Aff.)

**Abstract**—This document is a model and instructions for L<sup>A</sup>T<sub>E</sub>X. This and the IEEEtran.cls file define the components of your paper [title, text, heads, etc.]. \*CRITICAL: Do Not Use Symbols, Special Characters, Footnotes, or Math in Paper Title or Abstract.

**Index Terms**—component, formatting, style, styling, insert

## I. INTRODUCTION

As the world of fossil energy constantly exhausted and the increasingly serious environmental pollution, the research and utilization of renewable energy and green energy have become maintain necessary means of survival and development of the human. Photovoltaic (PV) energy received significant attention since it has unlimited energy and easy to be scaled up. Thanks to extensive technology and research on photovoltaic energy generation, large scale photovoltaic energy generation system have been deployed into many practical application. But due to PV arrays are sensitive to shading and PV cell's fault or aging. That means when interconnection of PV cells or modules do not have identical properties or experience different conditions from one another. PV arrays are in mismatch condition. In order to avoid mismatch condition damage PV cells, we proposed an algorithm that can re-configure photovoltaic arrays to minimize mismatch loss.

In this paper, we using non-uniform irradiance levels to represent mismatch condition and analyzes the efficiency of a PV system under different shaded working condition is presented. When photovoltaic arrays operating in non-uniform irradiance levels may present multiple local maximum power points (MPPs) [1], which been generated by turning on bypass diodes. By changing electrical connection among the panels to prevent activate bypass diodes is a recent appealing solution [2].

The main difficulty facing the reconfiguration problem is that some or even all panels can be subjected to partial shading, so there may be more than one MPP for each panel. Reconfiguration strategy need also consider to group PV modules which provided high power separately [3] [4].

This procedure enables to detect panel's operating conditions, in more than two-strings, receiving different irradiance levels. The reconfiguration algorithm will analyzes panels' working conditions and reorganizes panels into different strings by different irradiance levels. However, in sparse of

mismatching conditions, distribution of panels among different irradiance levels are not significant. For that, by increasing number of strings in the PV array and using exhaustive search can be a solution [3]. Another approach to optimize photovoltaic arrays is using genetic algorithm [5]. However, computing cost is too significant, and this algorithm can't detect best configuration precisely.

## II. ASSUMPTION OF A PV ARRAY

In this paper, we using following definitions of PV arrays, modules, strings and panels. A PV array formed by several parallel connected PV strings, and string is several series connected PV panels. For a PV panel, formed by two or three PV modules connected in series with bypass diodes. An equivalent connection as shown in Fig. 1.



Fig. 1. Definition of PV array and internal components.

The algorithm we proposed based on following assumptions.

- The current versus voltage ( $I$ - $V$ ) curve of each panel calculated by algorithm presented in [6]. This algorithm will analyzes panel's  $I$ - $V$  curve sample and coordinate to maximum or minimum power point in  $P$ - $V$  curve.

- All the panels in PV array have same number ( $N$ ) of modules. For particular module, using ( $V_{mppn}$ ,  $I_{mppn}$ ) to identify MPP voltage and current by index  $n$ . Those parameter can be directly estimated by the process provided in [7].

Futhermore, it is also assumed that for each string it has same number of panels in PV array. Means every string in PV array have same length. String's length are identical based on when they connected in parallel, a string has more panels may cause current back flow into other strings which have less panels [8].

### III. PREPARE YOUR PAPER BEFORE STYLING

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#### B. Units

- Use either SI (MKS) or CGS as primary units. (SI units are encouraged.) English units may be used as secondary units (in parentheses). An exception would be the use of English units as identifiers in trade, such as “3.5-inch disk drive”.
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- Use a zero before decimal points: “0.25”, not “.25”. Use “cm<sup>3</sup>”, not “cc”.)

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$$a + b = \gamma \quad (1)$$

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#### E. Some Common Mistakes

- The word “data” is plural, not singular.
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- In American English, commas, semicolons, periods, question and exclamation marks are located within quotation marks only when a complete thought or name is cited, such as a title or full quotation. When quotation marks are used, instead of a bold or italic typeface, to highlight a word or phrase, punctuation should appear outside of the quotation marks. A parenthetical phrase or statement at the end of a sentence is punctuated outside of the closing parenthesis (like this). (A parenthetical sentence is punctuated within the parentheses.)
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- Be aware of the different meanings of the homophones “affect” and “effect”, “complement” and “compliment”, “discreet” and “discrete”, “principal” and “principle”.
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An excellent style manual for science writers is [7].

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a) *Positioning Figures and Tables:* Place figures and tables at the top and bottom of columns. Avoid placing them in the middle of columns. Large figures and tables may span across both columns. Figure captions should be below the figures; table heads should appear above the tables. Insert

TABLE I  
TABLE TYPE STYLES

Table Head	Table Column Head		
	Table column subhead	Subhead	Subhead
copy	More table copy <sup>a</sup>		

<sup>a</sup>Sample of a Table footnote.



Fig. 2. Example of a figure caption.

figures and tables after they are cited in the text. Use the abbreviation “Fig. 2”, even at the beginning of a sentence.

Figure Labels: Use 8 point Times New Roman for Figure labels. Use words rather than symbols or abbreviations when writing Figure axis labels to avoid confusing the reader. As an example, write the quantity “Magnetization”, or “Magnetization, M”, not just “M”. If including units in the label, present them within parentheses. Do not label axes only with units. In the example, write “Magnetization (A/m)” or “Magnetization {A[m(1)]}”, not just “A/m”. Do not label axes with a ratio of quantities and units. For example, write “Temperature (K)”, not “Temperature/K”.

#### ACKNOWLEDGMENT

The preferred spelling of the word “acknowledgment” in America is without an “e” after the “g”. Avoid the stilted expression “one of us (R. B. G.) thanks . . .”. Instead, try “R. B. G. thanks. . .”. Put sponsor acknowledgments in the unnumbered footnote on the first page.

#### REFERENCES

Please number citations consecutively within brackets . The sentence punctuation follows the bracket. Refer simply to the reference number, as in [3]—do not use “Ref. [3]” or “reference [3]” except at the beginning of a sentence: “Reference [3] was the first . . .”

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Unless there are six authors or more give all authors' names; do not use "et al.". Papers that have not been published, even if they have been submitted for publication, should be cited as "unpublished" [4]. Papers that have been accepted for publication should be cited as "in press" [5]. Capitalize only the first word in a paper title, except for proper nouns and element symbols.

For papers published in translation journals, please give the English citation first, followed by the original foreign-language citation [6].

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