Modeling and verification for PV power system

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ABSTRACT

This paper proposes a practical photovoltaic (PV) model to be extensively used for commercial PV modules and arrays of different cell type. The proposed model is programmed with both icon and dialog box using Simulink to have a user friendly graphic user interface (GUI) like the Simulink block libraries. The main objective of this paper is to improve the model accuracy by the exact selection of series and shunt resistance and the suitable parameter modification for the real operating conditions. Based on the available information in the Manufactures ’ datasheets, the parameters of the nonlinear characteristics are determined by the built-in functions. Finally, the validation of the proposed model using the experimental data of a commercial PV module demonstrates its simplicity, user friendliness, and accuracy.

Keywords : practical photovoltaic (PV) model, Simulink, series resistance, shunt resistance

Table of Contents

REFERENCES

[1]李宜達(民95)，控制系統設計與模擬:使用MATLAB/ SIMUINK，全華圖書股份有限公司，台北。

[2]邱國偉(民91)，太陽能電力系統故障分析之研究，雲林科技大學電機工程研究所碩士論文。

[3]葉倍宏(民98)，MATLAB 7 程式設計基礎篇，全華圖書股份有限公司，台北。

[4]蒲仲偉(民93)，太陽能電池參數分析與部分遮蔽故障之研究，雲林科技大學電機工程研究所碩士論文。

[5]趙偉嚴(民98)，太陽能光電系統裝置於建築物頂樓之節能模擬分析----以一棟辦公大樓為例，中興大學機械工程研究所碩士論文。

[6]戴寶通、鄭晃忠(民96)，太陽能電池技術手冊，台灣電子材料與元件協會，新竹。

[7]蘇義傑(民98)，聚光型太陽能光電供發電系統設計，大葉大學電機工程研究所碩士論文。

[8]Altas, I. H. and A. M. Sharaf (2007) A photovoltaic array simulation model for Matlab-Simulink GUI environment. International Conference on Clean Electrical Power, Capril, IT.

[9]Bradie, B. (2006) A Friendly Introduction to Numerical Analysis, 58-66. Pearson Prentice Hall, Upper Saddle River, NJ.

[10]Carrero, C., J. Amador and S. Arnaltes (2007) A single procedure for helping PV designers to select silicon PV modules and evaluate the loss resistance. Renewable Energy, 32(15), 2579-2589.

[11]Celik, A. N. and N. Acikgoz (2007) Modelling and experimental verification of the operating current of mono-crystalline photovoltaic modules using four- and five-parameter models. Applied Energy, 84, 1-15.
[12]Chenni, R., M. Makhlouf, T. Kerbache and N. Bouzid (2007) A detailed modeling method for photovoltaic cells. Energy, 32(9), 1724-1730.
[13]De Blas, M. A., J. L. Torres, E. Prieto and A. Garcia (2002) Selecting a suitable model for characterizing photovoltaic devices. Renewable Energy, 25(3), 317-180.
[14]De Soto, W., S. A. Klein and W. A. Beckman (2006) Improvement and validation of a model for photovoltaic array performance. Solar Energy, 80(1), 78-88.
[15]Hua, C. C. and C. M. Shen (1998) Study of maximum power tracking techniques and control of DC/DC converters for photovoltaic power system. Proceedings of 29th Annual IEEE Power Electronics Specialists Conference, 1, 86-93, Fukuoka , JP.
[16]James, B. D. and L. H. Thomas (2004) Mastering Simulink. Pearson Prentice Hall, Upper Saddle River, NJ.
[17]King, D. L., W. E. Boyson and J. A. Kratochvil (2004) Photovoltaic Array Performance Model: Sandia Report. SAND2004-3535, Sandia National Laboratories, Albuquerque, NM.
[18]Roger, M. and Jerry V. (2000) Photovoltaic Systems Engineering, 41-51. CRC Press, Boca Raton, FL.
[19]Siemens Solar (1998) Solar Module SM55, Retrieved June 1, 2011, from http://www.solardirect.com/PDF/SolarElectric/ sm55.pdf.
[20]Villalva, M. G., J. R. Gazoli and E. R. Filho (2009) Comprehensive approach to modeling and simulation of photovoltaic arrays. IEEE Transaction on Power Electronics, 24(5), 1198-1208.