考量日照強度影響太陽電池溫度下最大功率追蹤器設計

啟翔、蔡渙良

E-mail: 9806487@mail.dyu.edu.tw

摘 要

本文提出一新的太陽能電池模型是使用Matlab/Simulink軟體工具來分析。針對日光照度對電池溫度的影響，所提出的模型是用周圍溫度作為輸入參考和使用日照作為唯一的動態變數。電池溫度是很明確地是受日照強度影響。太陽能電池(PV)模型的輸出電流和功率特性是使用本文所提出的模型來模擬和分析，使得太陽日照的影響對電池溫度和輸出功率特性上變得更實際。這將使太陽能電池系統的功率能夠容易地被分析，而且最佳化有關周圍的溫度和太陽光的環境參數。

經模擬證實日照強度影響電池溫度，進而影響功率輸出後，則再進一步針對現有最大功率點追蹤器加入此因素，以便調整追蹤器的控制法則。

關鍵詞 : 日照強度、太陽能電池模型、電池溫度、Matlab/Simulink

目錄

參考文獻

[1] Angrist, Direct Energy Conversion, Allyn and Bacon, Inc., 4th edition, pp.177-227, 1982.
[2] M. R. Patel, Wind and Solar Power Systems, CRC Press, pp. 127-132, 1999.
[3] J. C. H. Phang, D. S. H. Chan, and J. R. Philips, “Accurate Analytical Method for the Extraction of Solar Cell Model Parameters,” Electronics Letters, Vol. 20, No. 10, pp.-406-408, May 1984.
[4] M. G. Jaboori, M. M. Saied, and A. A. R. Hanafy, “A contribution to the simulation and design optimization of photovoltaic systems,” IEEE Transactions Energy Conversion, Vol. 6, No. 3, pp. 401-406 , September 1991.
[5] J. A. Gow and C. D. Manning, “Development of a Photovoltaic Array Model for Use in Power-Electronics Simulation Studies,” IEE Proceedings-Electric Power Applications, Vol. 146, No. 2, pp. 193-199, March 1999.
[6] K. S. Phani Kiranmai, and M. Veerachary, “Maximum Power Point Tracking: A PSPICE Circuit Simulator Approach,” Power Electronics and Drives Systems, 2005. PEDS 2005. International Conference on, pp. 1072- 1077, Nov. 2005.
[7] S. Singer, and A. Braunstein, “Maximum Power Transfer from a Nonlinear Energy Source to an Arbitrary Load,” IEE Proceedings of Generation Transmission & Distribution, Vol. 134, No. 4, pp. 281-287, 1987.
[8] F. Harashima, and H. Inaba and N. Takashima, “Microprocessor-Controlled SIT Inverter for Solar Energy System,”,IEEE Trans. on Industrial Electronics, Vol. IE-34, No. 1, pp. 50-55, Feb. 1985.
[9] C. C. Hua and C. M. Shen, “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, Vol. 1, pp. 86-93, May 17-22, 1998.
[10] K. H. Hussein, I. Muta, T. Hoshino, and M. Osakada, “Maximum Photovoltaic Power Tracking: A Algorithm for Rapidly Changing Atmospheric Conditions,” IEE Proceedings of Generation, Transmission and Distribution, Vol. 142, No. 1, pp. 953-959, January 2005.
[11] V. Salas, E. Ol?as, A. L?zaro, and A. Barrado, “New Algorithm Using Only One Variable Measurement Applied to a Maximum Power Point Tracker,” Solar Energy Materials & Solar Cells, Vol. 87, No. 1-4, pp. 675-684, May 2005.
[12] I.-S. Kim and M.-J. Youn, “Variable-Structure Observer for Solar Array Current Estimation in a Photovoltaic Power-Generation System,” IEE Proceedings-Electric Power Applications, Vol. 152, No. 4, pp. 953-959, July 2005.
[13] Il-Song Kim, Myung-Bok Kim, and Myung-Joong Youn, “New Maximum Power Point Tracker Using Sliding-Mode Observer for Estimation of Solar Array Current in the Grid-Connected Photovoltaic System,” IEEE Transaction on Industrial Electronics, Vol. 53, No. 4, pp. 1027-1035, August 2006.
[14] B. J. Huang, F. S. Sun, and R. W. Ho, “Near-Maximum-Power-Point Operation (nMPPO) Design of Photovoltaic Power Generation System”, Solar Energy, Vol. 80, No. 8, pp. 1003-1020, August 2006.
[15] T. K. Kottas, Y. S. Boutalis, and A. D. Karlis, “New Maximum Power Point Tracker for PV Arrays Using Fuzzy Controller in Close Cooperation With Fuzzy Cognitive Networks,” IEEE Transactions on Energy Conversion, Vol. 21, No. 3, pp. 793-803, September 2006.
[16] E. Kputroulis, K. Kalaitzakis, and N. C. Voulgaris, “Development of a Microcontroller-Based, Photovoltaic Maximum Power Point Tracking Control System,” IEEE Transactions on Power Electronics, Vol. 16, No. 1, pp. 46-54, January 2001.
[17] M. Veerachary, T. Senjyu, and K. Uezato, “Voltage-Based Maximum Power Point Tracking Control of PV System,” IEEE Transactions on Aerospace and Electronic Systems, Vol. 38, No. 1, pp. 262-270, January 2002.
[18] O. Wasynczuk, “Dynamic Behavior of a Class of Photovoltaic Power Systems,” IEEE Transactions on Power Apparatus and Systems, Vol. PAS-102, No. 9, pp. 3031-3037, September 1983.
[19] J. M. Enrique, E. Dur?n, M. Sidrach-de-Cardona, and J. M. And?jar, “Theoretical Assessment of the Maximum Power Point Tracking Efficiency of Photovoltaic Facilities,” Solar Energy, Vol. 81, No.1, pp. 31-38, January 2007.
[20] H. L. Tsai, C. S. Tu, and Y. J. Su, “Development of Generalized Photovoltaic Model Using Matlab/Simulink” Proceedings of the World Congress on Engineering and Computer Science 2008, San Francisco, USA, pp. 846-851, 2008.

[21] 張建偉，“太陽能電池最大功率點追蹤之研究”，成功大學航空太空工程學系碩士論文，2009。
[22] 李振誠，“太陽能最大功率追蹤器之研究”，大同大學電機工程研究所碩士論文，2004。
[23] 王耀諄、李東諭，“獨立太陽能電力系統動態模擬與最佳化設計”，雲林科技大學電機工程研究所，2002。
[24] R. Messenger and J. Ventre, Photovoltaic Systems Engineering, CRC Press, pp.41-51, 2000.
[25] 吳財福、陳裕愷、張健軒“太陽光電能供電與照明系統綜論”全華圖書公司，2007。
[26] 戴寶通、鄭晃忠“太陽能電池技術手冊”台灣電子材料與元件協會，2007。
[27] 沈輝、曾祖勤“太陽能光電技術”五南文化事業，2008。