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DEVELOPMENT OF REAL-TIME SIMULATOR BASED ON INTELLIGENT TECHNIQUES FOR MAXIMUM POWER POINT CONTROLLER OF PHOTOVOLTAIC SYSTEM

Syafaruddin[1], Engin Karatepe[2] and Takashi Hiyama[1]

[1]Department of Computer Science and Electrical Engineering
Kumamoto University
2-39-1 Kurokami, Kumamoto 860-8555, Japan
syafa@st.eecs.kumamoto-u.ac.jp; hiyama@eecs.kumamoto-u.ac.jp

[2]Department of Electrical and Electronics Engineering
Ege University
Bornova-Izmir 35100, Turkey
engin.karatepe@ege.edu.tr

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Abstract. *The power conversion efficiency of solar cell depends on material science. On the other hand, it is a very important issue to reduce the power losses in photovoltaic systems. Many available commercial PV modules have been used. However, since their characteristics are not unique and on-site testing of PV system is costly, time-consumed and highly dependent on the prevailing weather conditions, a real-time simulator becomes an important tool to support the research and development in PV system. The impact of operating conditions on different solar cells performance should be well understood at optimal operating points to increase the efficiency of photovoltaic systems. This paper firstly explores the relationships between solar intensity and operating temperature variations and key solar cell parameters for commercial available photovoltaic modules. The results show that the characteristics of different solar cell technologies at maximum power point (MPP) have different trends in current-voltage characteristic. In this reason, a robust real-time simulator is very important for different solar cell technologies. Then, this paper presents intelligent real-time simulator for simulating and testing the effect of the fluctuation of irradiance level and cell temperature on the MPP performance of PV modules. Intelligent techniques are becoming useful for non-linear problems because of their symbolic reasoning, flexibility and generalization capabilities. There is a trade-off between the complexity of system and efficiency in optimally operating photovoltaic modules. This method is highly dependent on ANN training process for each cell technology and simply generates control signal required in fuzzy logic controller. The developed real-time simulator has been successfully demonstrated for different commercially available photovoltaic modules.*

Keywords: Photovoltaic system, MPP, ANN, Fuzzy logic controller, Real-time simulator

1. **Introduction.** Despite its tremendous potential as a limitless resource of energy, solar power is currently a small fraction of the global energy supply. The researchers have been studying on how to develop more efficient solar cells. Solar conversion efficiency depends on the intrinsic characteristics of the semiconductors used to fabricate the cell. Over many years of research, there are several workings on the characterization of materials and how they affect the solar cell efficiency. While nanotechnology have opened the door to the production of cheaper and slightly more efficient solar cells, it is very important to understand the electrical output characteristics of PV modules and keep the operation of solar cells at rated efficiency by continuously tracking the maximum power point. On the