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Identification of Photovoltaic Array Model Parameters. Modelling and Experimental Verification

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Extended abstract

The study of the semi-isolated and safety network for the self-feeding building with renewable electricity, especially generated by a photovoltaic array (PVA), requires a model that allows knowledge of the PVA behaviour under various meteorological conditions.
This paper aims to identify the model parameters of a PVA installed in our experimental platform. Two methods used for parameters identification in order to characterize the photovoltaic array are compared. Based on the electrical equivalent circuit of the photovoltaic cell, the mathematical model is deduced. From the data-sheet values, given by the manufacturer, we were able to determine the parameters of this model. On the other hand, the second method was applied by using one of the least squares fitting approaches. The measurement of the outdoor solar irradiance, cell temperature and current taken by dSPACE controller board and for a constant terminal voltage level includes the necessary data to be fitted with the model. The implementation of these two methods in MATLAB provides the model parameters which have to minimize as soon as possible the error involved between the calculated and measured output current. For the minimum obtained error, the corresponding method is the best one for the PVA characterization.

The experimental platform, shown in Fig. 1, has two PVA installed on the roof of centre Pierre Guillaumat 2 at the University of Technology of Compiegne in France. The test bench is shown in Fig. 2.

Fig. 1. Experimental platform

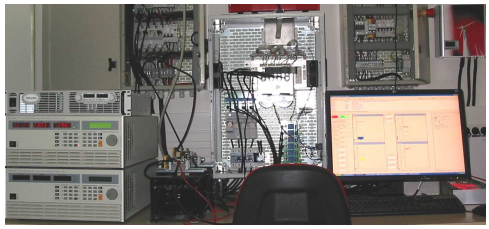

Fig. 2. Test Bench

Under various meteorological conditions, based on the carried out parameters, the two methods are compared in regarding to error between the calculated and measured output PVA current, calculation time and easiness of implementation.
The parameters related to the method based on the measurements give a little smaller error than those resulted using the method based on data-sheet parameters values. Also, the calculation time is shorter than the time elapsed while the data-sheet algorithm is running. But the quality of the minimisation by the MATLAB function "lsqcurvefit" depends on the initial values, lower and upper limits.
If the PVA model is not used in real time, the model identified using the data-sheet algorithm is simple and can be suitable to modelling the behaviour of PVA under all the operating conditions. Thus, the method based on the data-sheet values could be more appropriate to identify the PVA model parameters.

Key words: Photovoltaic, Modelling, Least squares fitting, Simulation.