Simulation of ARMAX model for Forecast of Power Output of PV Grid

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***Abstract*—This work is devoted to the simulation of an ARMAX model proposed in the literature for better forecasting of power output of a Photo-Voltaic (PV) grid; the model includes information of environmental inputs (average temperature, precipitation amount, insolation duration, humidity) that classical time series approaches did not include. The simulation is performed using three different noise distributions in order to establish a comparison of the time series.**

***Index Terms*—ARMAX, Photo-Voltaic grid, simulation, random noise, outliers, environmental inputs, time series.**

I. Introduction

Photo-Voltaic (PV) systems, nowadays, are growing relevant due to the increasing obligation to global warming and production of renewable energies. It is often desired to forecast the amount energy that can be obtained through these systems, in order plan its distribution and usage.

II. Problem Formulation

As mentioned before, the output of the PV system is an stochastic process. The standard approach to forecasting the behavior of this system has been modelled using ARIMA models, using only information of the past of the same system, but it does not take into consideration the external environmental factors that may affect the power output [1]; as for the problem of this particular work, the main objective is to simulate the ARMAX model proposed in [1] with different noise distributions, particularly with outlier behavior.

III. Theoretical Approach

A. General ARMAX model

As previously mentioned, this work uses an ARMAX model presented in the literature; hereby, let the general ARMAX model be presented:

$$z_{t+1} = \sum_{i=0}^{h_1} a_i z_{t-i} + \sum_{i=0}^{h_2} b_i u_{t-i} + \sum_{i=0}^{h_3} c_i \xi_{t-i} \tag{1}$$

for $t = 0, 1, 2, \ldots$, and u_k are external inputs and ξ_k are random noises. In this particular case, the model obtained in [1] is:

$$\begin{aligned} z_t =& 237.565 + 0.426 z_{t-1} + \xi_t - 0.153\xi_{t-1} + 8.9087 u_{1,t} \\ &- 1.557 u_{7,t} + 31.919 u_{8,t} - 2.045 u_{9,t} \end{aligned} \tag{2}$$

where z_t is the power output of the PV grid in Watts (W); $u_{1,t}$ is the daily average temperature, $u_{7,t}$ is the precipitation amount, $u_{8,t}$ is the insolation duration and $u_{9,t}$ is the humidity.

IV.

V. Numerical Aspects

VI. Numerical Results

VII. Conclusions

References

[1] Y. Li, Y. Su, and L. Shu, "An armax model for forecasting the power output of a grid connected photovoltaic system," *Renewable Energy*, vol. 66, pp. 78–89, 2014.