

Modelling an Autonomous Energy System using a Software Simulator

Francisco Cabrera, Víctor Araña, Lourdes Suárez, Gonzalo Gutierrez, and Carlos M. Travieso

Department of Signals and Communications. Technological Centre for Innovation on Communication (CeTIC). University of Las Palmas de Gran Canaria. Campus de Universitario de Tafira, Ed. de Telecomunicación. Pabellón B. 35017, Las Palmas de G.C., SPAIN.
 {fcabrera,varana,lsuarez,ggutierrez,ctravieso}@cetic.eu

Abstract extended

Nowadays, exist some marine autonomous systems which applications are increasing. For this reason, it is indispensable to get a efficient energy system. In order to characterize the consumption and energy production is necessary to have a good model [1]. The aim of this software is to implement an energy system simulator just to evaluate buoy circuit's autonomous capacity under different conditions. We have called it: AEES – Autonomous Energy System Simulator. In this paper, it is shown the different parts of this software.

There have been various publications to model different power autonomous system [2]. But these only made the analysis of the element by element and it is not doing the analysis of the system in conjunction, generators, accumulators and charges to evaluate the charge of the battery or SOC (*State Of Charge*). In other articles, it has been simulated the performance of photovoltaic [3]-[5] and wind [6],[7] energy systems defined through mathematical models of the system components but without considering a climatic data scenario.

This simulator tries to give us an idea of the energy balance and therefore the circuit viability and battery availability. The use of a graphic user interface (GUI) and different wizards have simplified the user interaction. The simulator onion-like structure (Figure 1) where the GUI surrounds the main simulator core and its algorithms has created a good platform for circuit test giving the facilities to create, to access and to load climate scenarios, circuit and power consumption scenarios data files.

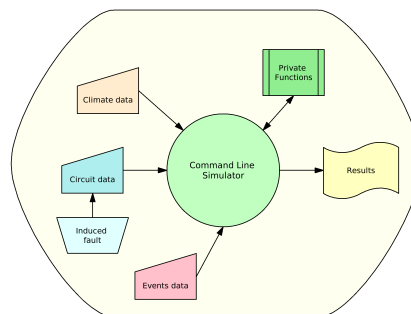


Figure 1. Simulator Functional Blocks

This simulator has been developed under Matlab R2007b Linux version but it should work with minor graphical differences under the same MS-Windows version and newer versions. The main features of this simulator are [8]:

- The possibility to create or load climatic scenarios that affects to a defined circuit, simulating consumptions under determinate events;
- The ability to represent graphically any parameter versus battery state of charge (SOC) along the simulation time period;
- A simple and an intuitive GUI;
- A wizard-guided data sourcing with a standardized XML data file structure following the W3C's DOM standards.
- A flexible file format and internal design that will let users characterize new user-defined elements and scenarios;
- The possibility to induce elements faults;
- The ability to save and load results for a later visual comparison;
- A settable time step with a minimum resolution of 1 minute.

Therefore, in this present paper, we have showed a new software for autonomus energy system, which includes climatic scenario analysis and the combination of different elements (batteries, solar pannels, wind generator, etc). The results (SOC) are shown on a graphical viewer with the combination of the defined previous elements and scenearios. This software allows the user to view and represent graphically two o more simulations at the same time. Because the user have the possibility to compare the simulation results.

References

1. Strachan, N.P.W.; Jovcic, D.: Dynamic Modelling, Simulation and Analysis of an Offshore Variable-Speed Directly-Driven Permanent-Magnet Wind Energy Conversion and Storage System (WECSS). In OCEANS 2007 – Europe, 1 - 6, June 2007
2. Markvart, T., Castañer L.: Practical Handbook of Photovoltaics Fundamentals and Applications, Ed. Elsevier, 2003.
3. Bialasiewicz, J.T.: Renewable Energy Systems With Photovoltaic Power Generators: Operation and Modeling. In Industrial Electronics, IEEE Transactions on Industrial Electronics, Vol 55, Issue 7, 2752-2758 July 2008.
4. Hansen, A.D., Sorensen, P., Hansen L.H., Binder H.: Models for a Stand-Alone PV System, Rio-R-1219 (EN)/SEC-R-12, 2000.
5. Castañer, L.: Photovoltaic Engineering in Solar Electricity. Edited by Markvart T., John Wiley, Chichester, 74 – 114, 1994.
6. Doumbia, M.L.; Agbossou, K.; Granger, E.: Simulink Modelling and Simulation of a Hydrogen Based Photovoltaic/Wind Energy System. In EUROCON, 2007. The International Conference on "Computer as a Tool". 2067 – 2072, Sept. 2007.
7. Schmitt, W.: Modeling and Simulation of Photovoltaic Hybrid Energy Systems Optimization of Sizing and Control. In Photovoltaic Specialists Conference, 2002. Conference Record of the Twenty-Ninth IEEE, 1656 – 1659, May 2002
8. Quaschnig V., Hanitsch R., Zehner M., Becker G.: PV simulation and calculation in the internet- the ILSE toolbox. In 16th European Photovoltaic Solar Energy Conference, 2497 – 2500, Glasgow, May 2000.