Optimization of Energy Distribution in Solar Panel Array Configurations by Graph Theory and Minkowski's Paths

Salvador Merino, Francisco J. Sánchez, Mariano Sidrach de Cardona, Francisco Guzmán, Rafael Guzmán

University of Málaga (Spain)

smerino@uma.es, fsanchezp@uma.es, msidrach@uma.es, f_guzman@uma.es, rguzman@uma.es

Abstract

Nowadays, the development of the photovoltaic (PV) technology is consolidated as a source of renewable energy. The research in the topic of maximum improvement on the energy efficiency of the photovoltaic plants is today a major challenge. An important requirement for this purpose is to know the performance of each of the PV modules that integrate the PV field in real time.

In this respect, a PLC (Power Line Communications) Smart Monitoring and Communications Module, which is able to monitor at PV level their operating parameters, has been developed at the University of Málaga. With this device you can check if any of the panels is suffering any type of overriding performance, due to a malfunction or partial shadowing of its surface. Since these fluctuations in electricity production from a single panel affect the overall sum of all panels that conform a string, it is necessary to isolate the problem and modify the routes of energy through alternative paths in case of PV panels array configuration.

The methodology followed for the reconfiguration of the distribution network has required the application of graph theory and Minkowski paths. These algorithms, developed in MatLab, dynamically establish the appropriate weights for the solution found, allow the affected panels to be isolated temporarily, or even replaced, without compromising the optimal production of the rest of the installation.

References

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