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EXTREMAL CONTROL FOR PHOTOVOLTAIC PANELS

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Rezumat. Lucrarea propune o procedura de control extremal folosind un controller de tip polinomial pentru utilizarea eficienta a panourilor fotovoltaice. Deasemenea, a fost dezvoltata si o structura de testare a sistemelor de urmărire solara prin intermediul unei arhitecturi Hardware In the Loop. Metode de optimizare eficiente bazate pe tehnici de gradient au fost implementate pentru a determina parametrii panoului cat si pentru a calcula punctul de maximă putere generată (MPPT). Un controler de tip RST a fost dezvoltat pentru a urmări mişcarea soarelui spre atingerea maximului de putere posibil. După o analiza de robustete, comanda (nominala) proiectata este îmbunătățită, în vederea implementarii pe sisteme care pilotează sisteme fotovoltaice. Configurația Hardware In the Loop permite dezvoltarea unei platforme de test şi dezvoltare care poate fi folosită la aducerea de ameliorări în designul actual şi, de asemenea, la testarea a diferiți algoritmi de control. Performantele sistemului robust pentru un panou cu orientare valabilă, sunt validate in simulare folosind mediul de programare MATLAB/SIMULINK si produsul software dedicat WinPim & WinReg.

Abstract. In this paper a methodology for extremal control of photovoltaic panels has been designed through the use of an embedded polynomial controller using robust approaches and algorithms. Also, a framework for testing solar trackers in a hard ware in the loop (HIL) configuration has been established. Efficient gradient based optimization methods were put in place in order to determine the parameters of the employed photovoltaic panel, as well as for computing the Maximum Power Point (MPP). Further a numerical RST controller has been computed in order to allow the panel to follow the movement of the sun to obtain a maximum energetic efficiency. A robustness analysis and correction procedure has been done on the RST polynomial algorithm. The hardware in the loop configuration allows for the development of a test and development platform which can be used for bringing improvements to the current design and also test different control approaches. For this, a microcontroller based solution was chosen. The achieved performances of the closed loop photovoltaic panel (PP) system are validated in simulation using the MATLAB / SIMULINK environment and the WinPim & WinReg dedicated software. As it will be seen further in this paper, the extremal control of this design resides in a sequential set of computations used for obtaining the new Maximum Power Point at each change in the system.

Keywords: identification, optimal criterion, adaptive and robust control, industrial process, simulation results