World Academy of Science, Engineering and Technology
International Journal of Computer and Systems Engineering
Vol:11, No:01, 2017

Increasing the Resilience of Cyber Physical Systems in Smart Grid Environments using Dynamic Cells

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Abstract : Resilience is an important system property that relies on the ability of a system to automatically recover from a degraded state so as to continue providing its services. Resilient systems have the means of detecting faults and failures with the added capability of automatically restoring their normal operations. Mastering resilience in the domain of Cyber-Physical Systems is challenging due to the interdependence of hybrid hardware and software components, along with physical limitations, laws, regulations and standards, among others. In order to overcome these challenges, this paper presents a modeling approach, based on the concept of Dynamic Cells, tailored to the management of Smart Grids. Additionally, a heuristic algorithm that works on top of the proposed modeling approach, to find resilient configurations, has been defined and implemented. More specifically, the model supports a flexible representation of Smart Grids and the algorithm is able to manage, at different abstraction levels, the resource consumption of individual grid elements on the presence of failures and faults. Finally, the proposal is evaluated in a test scenario where the effectiveness of such approach, when dealing with complex scenarios where adequate solutions are difficult to find, is shown.

Keywords : cyber-physical systems, energy management, optimization, smart grids, self-healing, resilience, security
Conference Title : ICCPS 2017 : International Conference on Cyber-Physical Systems
Conference Location : Zurich, Switzerland
Conference Dates : January 13-14, 2017