D. Yousri, E. Elsadany, Y.Shaker, S. Babu, A.F. Zobaa and Dalia Allam. “Mitigating Mismatch Power Loss of Series- Parallel and Total Cross-Tied Array Configurations Using Novel Enhanced Heterogeneous Hunger Games Search Optimizer”, Energy Reports, Elsevier. Volume 8, Page 9805-9827, DOI10.1016/j.egyr.2022.07.153, Published NOV 2022.


## Abstract

The location of shaded or faulty Photovoltaic modules in the PV array has a negative impact on the harvested power from the entire array. To overcome this significant limitation, PV reconfiguration is a considerable technique developed via interchanging the PV modules' location physically or electrically. By this inspiration, in this article, the authors propose a novel enhanced heterogeneous hunger games search optimizer (EHHGS) based PV reconfiguration. The innovated EHHGS introduces a modified variant for the basic hunger game search optimizer (HGS) to achieve a high diversity and robust exploitation of the optimal solutions. The EHHGS is applied to identify the optimal relocation for the shaded or faulty modules in two configurations of PV connected array: total-cross-tied array (TCT) and Series–parallel one (S–P). The proposed approach has applied symmetric and asymmetric connected PV arrays with dimensions of 9 × 9 and 10 × 8 throughout five different shade patterns. Moreover, for providing a flexible tool for the user/researcher to detect and observe the benefits achieved via the PV reconfiguration strategy, a simple graphical user interface (GUI) for the PV reconfiguration strategy of TCT or S–P PV connected array using meta-heuristic algorithms is designed. This implemented GUI can extend for any size of PV arrays, different optimization algorithms, and different connection schemes. The proposed EHHGS, HGS, and set of recent optimizers, including harris hawk optimizer (HHO), marine predators algorithm (MPA), and artificial ecosystem-based optimization (AEO), handle a new simplified objective function to boost the optimizer's ability in catching the optimal modules' location to alleviate the mismatched power in the studied arrays. Several statistical metrics are computed for providing an unbiased comparison. Through the comparisons, the proposed EHHGS exhibits superior performance. It achieves the best re-design for the considered arrays that helps in avoiding the mismatch losses in the cases of the partial shaded/faulty modules and enhances the power generated profiles. EHHGS enhances the power by percentages of 44.42%, 11.9%, 33.36%, 20. 86% and 13.17% compared to the TCT-connected system. In the case of the S–P connection, the proposed EHHGS generates 47.2% and 10.45%, 30.75%, 17.25%, and