

## **Spread enhancement for firefly algorithm with application to control mechanism of exoskeleton system**

### **ABSTRACT**

Firefly algorithm (FA) is a swarm intelligence based algorithm for global optimization and has widely been used in solving problems in many areas. The FA is good at exploring the search space and locating the global optimum, but it always gets trapped at local optimum especially in case of high dimensional problems. In order to overcome such drawbacks of FA, this paper proposes a modified variant of FA, referred to as spread enhancement strategy for firefly algorithm (SE-FA), by devising a nonlinear adaptive spread mechanism for the control parameters of the algorithm. The performance of the proposed algorithm is compared with the original FA and one variant of FA on six benchmark functions. Experimental and statistical results of the approach show better solutions in terms of reliability and convergence speed than the original FA especially in the case of high-dimensional problems. The algorithms are further tested with control of dynamic systems. The systems considered comprise assistive exoskeletons mechanism for upper and lower extremities. The performance results are evaluated in comparison to the original firefly and invasive weed algorithms. It is demonstrated that the proposed approaches are superior over the individual algorithms in terms of efficiency, convergence speed and quality of the optimal solution achieved.

**Keyword:** Swarm intelligence; Firefly algorithm; Exoskeleton system