**ABSTRACT**

The Social-Spider Optimization (SSO) is one among the recently developed swarm intelligence. It is impressed from the social behavior of spiders living in huge colonies. The spiders communicate among themselves to find prey and to find a suitable partner for mating. In this manuscript, a parallel version of this algorithm is modified and termed as MPSSO. Social spider optimization algorithm (SSO) was applied to develop a clustering algorithm since it does not favor the premature convergence or damage the exploration–exploitation balance. This scheme requirements a large number of iteration to achieve the desired convergence. So, a new parallel SSO was proposed via making the sequential movements of dominate male, non-dominate male and female spiders to parallel, in this manner decreasing the computational complexity of the algorithm. This approach was based on uniform distribution. The primary objective of the modified parallel SSO (MPSSO) scheme based on beta distribution and natural gradient (NG) local search for improving the performance of PSSO algorithm. The proposed approach is achieved a better exploration/exploitation trade-off while applied to optimization issues in the continuous domain. In this approach, a beta distribution is applied to tune the control parameters and a local search process is improved by the usage of the natural gradient.