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Summary: The bounded knapsack problem (BKP) is a classic NP-hard problem. In order to use the monkey algorithm (MA) to solve this type of knapsack problem, this paper mainly proposes an improved monkey algorithm based on ring theory (Ring Theory-Based Improved Monkey Algorithm, RTIMA). This algorithm can reduce the adjustment of parameters in the calculation process and enhance the stability of the algorithm. According to the structural characteristics of the BKP problem itself, the RTIMA first uses the natural number encoding method to encode the MA and solves the infeasible solution. Then the ring theory is used to the climbing process and improve the climbing process to reduce the adjustment of parameters and reduce the time complexity. Finally, the information sharing mechanism and disturbance mechanism are applied to the translation process to ensure that the monkeys exchange information with each other to increase the diversity of solutions, thereby avoiding the tendency to fall into the local optimum. By comparing and analyzing the calculation results of other algorithms, it is proved that the performance of the RTIMA is better.

MSC:
90C27 Combinatorial optimization
90C59 Approximation methods and heuristics in mathematical programming

Keywords:
monkey algorithm; ring theory; bounded knapsack problem; information sharing mechanism; disturbance mechanism