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A scheduling method based on a hybrid genetic particle swarm algorithm for multifunction phased array radar

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Key words: Phased array radar; Scheduling; Particle swarm algorithm; Genetic algorithm; Pulse interleave

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Motivation

- The scheduling algorithm in the multifunction phased array radar (MFPAR) is the key to improving its efficiency and releasing its full potential.
- Research on the intelligence algorithm for the scheduling problem in MFPAR is rather limited.
- Most traditional approaches use only a single optimization algorithm to solve the problem.

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Main idea

- The genetic algorithm, particle swarm algorithm, and heuristic interleaving algorithm are combined in this study.
- An effective hybrid scheduling algorithm is proposed for MFPAR.

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Method

1. The scheduling principles of importance, urgency, and timeliness in MFPAR are synthesized to structure the objective function under multiple resource constraints.
2. Through optimizing the particle swarm algorithm by a chaos parameter, designing the dynamic inertia weight and introducing crossover and mutation operations of the genetic algorithm, the hybrid algorithm can achieve quick convergence and global exploration.
3. The heuristic interleaving algorithm is presented to improve the time resource utility further in the intelligence algorithm's framework.

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Major results

- The proposed algorithm can provide better performance than the three state-of-the-art scheduling algorithms while satisfying the real-time demand of the MFPAR.

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Major results

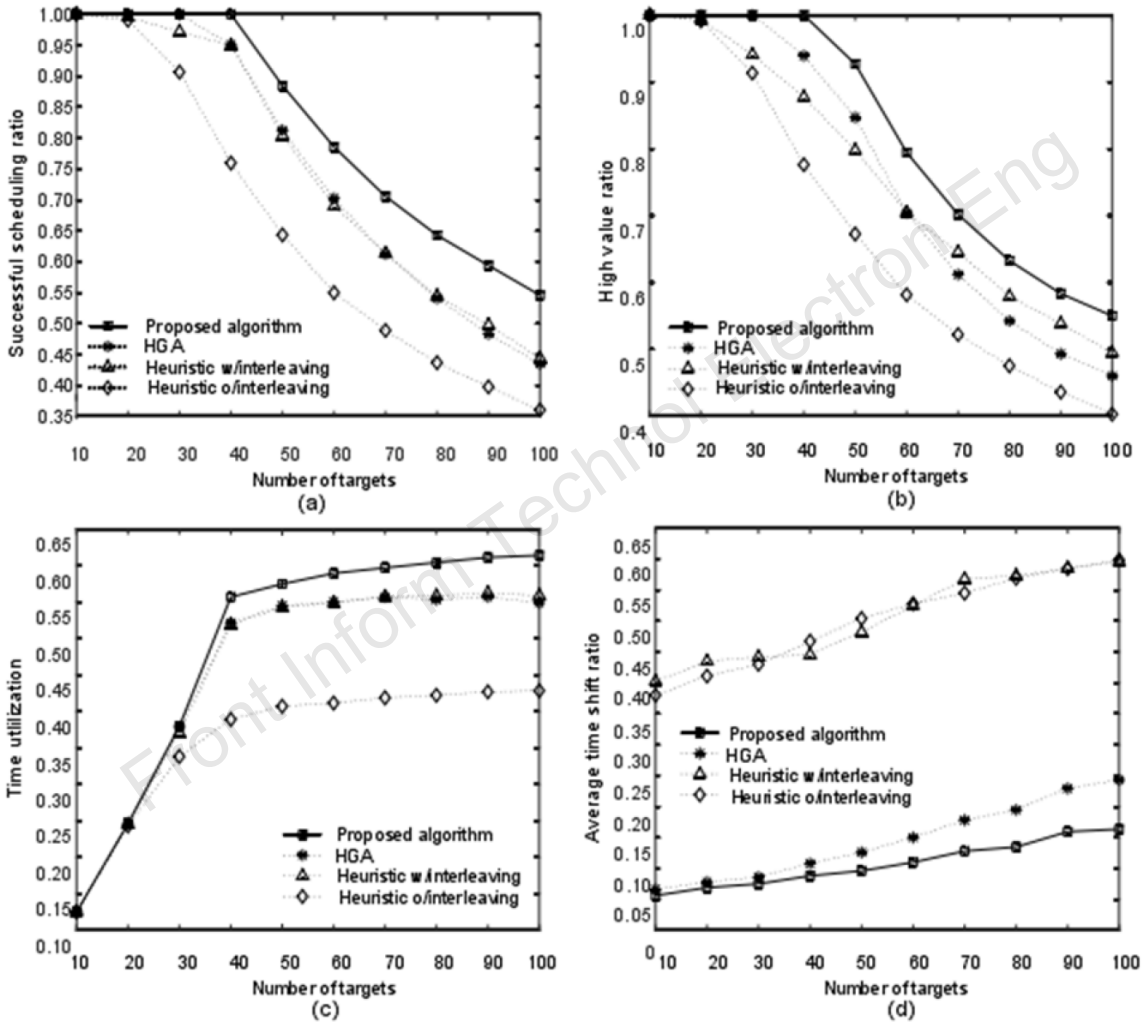

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Fig. 5 Statistical results: (a) comparison of the successful scheduling ratio; (b) comparison of the high value ratio; (c) comparison of the time utilization ratio; (d) Comparison of the average time shift ratio

Major results

Table 2 The run time of the algorithms (ms)

Number of target	10	20	30	40	50	60	70	80	90	100
Proposed algorithm	18.6	22.2	24.6	25.8	29.0	31.6	33.4	35.5	40.2	41.6
HGA	138.5	142.4	148.1	152.3	163.4	178.8	200.4	202.3	221.5	245.4

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Conclusions

- The optimal objective function was established and a hybrid algorithm was proposed for the task scheduling probem in the MFPAR.
- The objective function integrated multiple scheduling principles. It ensures better algorithm performance in many aspects.
- The proposed algorithm composited the particle swarm algorithm, genetic algorithms and the heuristic interleaving algorithm, and many optimization methods were introduced.
- The simulations show that the proposed algorithm possesses the merits of global exploration, fast convergence, and robustness to solve the problem.

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