



基于启发式自适应离散差分进化算法的多UCAV协同干扰空战决策

薛羽¹, 庄毅¹, 张友益², 倪思如¹, 赵学健³

1. 南京航空航天大学 计算机科学与技术学院, 江苏 南京 210016;
2. 中船重工集团公司 第723研究所, 江苏 扬州 225001;
3. 南京邮电大学 物联网学院, 江苏 南京 210046

Multiple UCAV Cooperative Jamming Air Combat Decision Making Based on Heuristic Self-adaptive Discrete Differential Evolution Algorithm

XUE Yu¹, ZHUANG Yi¹, ZHANG Youyi², NI Siru¹, ZHAO Xuejian³

1. School of Computer Science and Technology, Nanjing University of Aeronautics and Astronautics, Nanjing 210016, China;
2. No.723 Institute, China Shipbuilding Industry Corporation, Yangzhou 225001, China;
3. College of Internet of Things, Nanjing University of Posts and Telecommunications, Nanjing 210046, China

摘要

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摘要

研究了多无人作战飞机(UCAV)协同干扰空战决策(MUCJAD)问题,在干扰效能评估指标量化方法的基础上为该问题建立了优化模型。为有效求解该模型,提出一种启发式自适应离散差分进化(H-SDDE)算法。在H-SDDE算法中,设计了包含4种候选解产生策略的候选策略池,引入了候选解产生策略及其参数的自适应学习过程。此外,结合实际问题为算法设计了基于威胁度的扩展型整数编码方案、基于威胁度的启发式个体调整操作、基于约束满足的个体修复操作。在12个测试实例上进行了仿真验证,结果表明,H-SDDE算法与其他同类算法相比在求解质量和求解速度上具有明显优势,能够更好地发挥多UCAV协同干扰整体效果。

关键词: 无人机 协同干扰 决策 启发式算法 自适应 优化 差分进化

Abstract:

This paper presents a multiple unmanned combat air vehicle (UCAV) cooperative jamming air combat decision-making (MUCJAD) problem. An optimal model is constructed for the MUCJAD on the metric methods of the jamming effect evaluating indexes. In order to solve the model effectively, a heuristic self-adaptive discrete differential evolution (H-SDDE) algorithm is proposed in which, a strategy candidate pool which including four candidate solution generating strategies is designed and two self-adaptive learning processes are introduced for candidate solution generating strategy and its parameters. Furthermore, a threat degree based extensional integer coding scheme, a heuristic individual adjust operator and a constraints satisfaction based individual repair process are designed according to the real-word application. Simulation experiments are conducted on twelve test instances. The results indicate that the H-SDDE algorithm is better than other algorithms in terms of convergence speed and solution quality. The H-SDDE algorithm can enhance the effect of multiple UCAV cooperative jamming.

Keywords: unmanned aerial vehicles cooperative jamming decision making heuristic algorithm self-adaption optimization differential evolution

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Corresponding Authors: 庄毅 Email: zhuangyi@nuaa.edu.cn

About author: 薛羽,男,博士研究生。主要研究方向:智能计算、电子对抗、物联网。Tel:025-84890790,E-mail: xueyu_123@nuaa.edu.cn; 庄毅,女,教授,博士生导师。主要研究方向:分布计算。Tel:025-84896779,E-

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mail: zhuangyi@nuaa.edu.cn

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