

论文

不确定环境中多无人机协同搜索算法

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摘要

多无人机(Unmanned Aerial Vehicle, UAV)协同搜索是多UAV协同控制的一个重要研究内容。多架UAV同时对一个未知区域进行搜索, 目的在于获取搜索区域的信息, 降低环境的不确定度。该文提出了一种基于模型预测控制(MPC)理论和遗传算法(GA)的多UAV协同搜索算法。首先, 建立搜索环境的规则描述, 然后将多个UAV建模为一个控制系统, 建立系统的预测模型, 考虑到UAV传感器测量的不确定性和环境自身的不确定性, 建立搜索概率图描述搜索环境的不确定性, 给出了基于Bayes准则的搜索概率图更新方法, 继而基于搜索概率图定义信息增益来衡量搜索效果, 并将预测周期内的优化目标定为最大化信息增益, 采用遗传算法进行求解, 得到最优解作为被控系统的输入。仿真结果验证了算法的有效性。

关键词 [无人机](#) [协同搜索](#) [不确定环境](#)

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Cooperative Search Algorithm for Multi-UAVs in Uncertainty Environment

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Abstract

Multiple Unmanned Aerial Vehicles (UAVs) cooperative searching is an important research area in cooperative control. The objective is reducing the uncertainty of the search area and achieving the information about it. This paper presents an approach which combines Model Predictive Control (MPC) theory with the Genetic Algorithm (GA) to solve this problem. First, the formal representation of the search environment is established, the multi-UAV is modeled as a controlled system and the predictive model of the system is presented. Considering the uncertainty of the sensor measurement and the environment, a Search Probability Map (SPM) is defined and the updating method based on Bayes formula is presented. Based on SPM, information gain is defined to measure the search effects and used to be the optimization object in the predictive horizon. By using of GA, the solution of the optimization problem is got and it is taken as the input of the controlled system. Simulation results demonstrate the efficiency of the algorithm.

Key words [UAV](#) [Cooperative searching](#) [Uncertainty environment](#)

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