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Abstract: Aiming at the trajectory optimization of the solar-powered UAVs (SUAVs) cooperative target tracking in urban environment, the distributed model predictive control (DMPC) method based on Adaptive Grasshopper Optimisation Algorithm (AGOA) is proposed in this paper. Firstly, the cooperative target tracking problem in urban environment is modeled by formulating the SUAVs kinematic and target models, the urban environment constraints, solar power harvesting and consumption models for SUAV, and sight occlusions by constructions. Especially, the sight occlusions in urban environment for SUAV are taken into consideration for the first time in this paper. A judgement method of sight occlusions for SUAV is proposed to make the calculation of the energy index more precise. Second, based on the precise modeling, the DMPC method is adopted as the framework for trajectory optimization in real time. Third, AGOA, a novel intelligent algorithm to mimic the behaviors of grasshoppers, is proposed to be the DMPC solver. The proposed AGOA has a better searching ability than the traditional GOA and some other intelligent algorithms by introducing some improvement measures e.g. the natural selection strategy, the democratic decision-making mechanism, and the dynamic feedback mechanism based on the 1/5 Principle. Finally, the effectiveness of the proposed method is demonstrated by the simulations.

Key words: Solar-powered UAVs (SUAVs); Target tracking; Urban environment; Sight occlusions; Distributed model predictive control (DMPC); Adaptive Grasshopper Optimisation Algorithm (AGOA)

1. Introduction

Solar-powered unmanned aerial vehicle (SUAV) has a better endurance performance than the traditional UAV and it has been widespread concerned in recent years. Many researchers focus on increasing the energy utilization efficiency of SUAV. An effective methodology is to optimize the flight trajectory of SUAV so that the solar cells can receive more solar radiation. Klesh, et al. [1,2] establish the energy harvesting and consumption models for SUAV and design the energy-optimal path for

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