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异构MAS结构下的空天资源多阶段协同任务规划方法

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Space-air Resources Multi-phase Cooperation Task Planning Approach Based on Heterogeneous MAS Model

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摘要

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摘要

利用空天资源的互补优势进行协同观测是对地观测领域的新趋势。为提高对地观测效益和多阶段观测任务的完成度,分析了空天资源协同观测任务规划问题中的观测资源异构性和多阶段观测任务分解方式的多样性。针对卫星和无人机的任务规划模型不一致的特点,建立了异构多智能体系统(MAS)多阶段协同任务规划模型,根据模型特点将问题求解分解为两个协商过程,并分别提出了基于市场模型的异构MAS多阶段协同任务规划算法和基于自适应“超级步”的资源Agent协同任务规划算法。最后,研究了该方法在空天资源联合观测中的应用情况,实验及分析结果表明该方法能够有效解决空天资源对地观测协同任务规划问题。

关键词: 空天协同 遥感 多智能体系统 马尔可夫过程 规划算法 市场模型

Abstract:

Coordinated observation of air and space assets is the trend of earth observation and it is expected to continue in the future. In order to increase the information gain of earth observation and improve the completion ratio of multi-phase missions, this paper analyzes the heterogeneity of observation resources and the diversity of decompositions for complex observation missions. Considering the differences between a satellite task planning model and an airplane task planning model, a heterogeneous multi-agent system (MAS) multi-phase cooperative planning model is constructed. Based on this model, the problem solving process is divided into two coordinated parts. A heterogeneous MAS multi-phase cooperative planning algorithm based on the market model, and a resource agent cooperative planning algorithm based on the adaptive "Super Step" theory are proposed. Finally, the above method is used to solve the joint observation problem of air and space assets. Experiment and analysis show that the proposed approach can solve the problem effectively.

Keywords: space-air cooperation remote sensing multi-agent system Markov process scheduling algorithm market model

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