自动化学报 2010 36 (10): 1409-1416 ISSN: 0254-4156 CN: 11-2109/TP

论文与报告

基于机器人群的主动传感器网络自组织的运动规划

樊玮虹, 刘云辉, 周东翔, 蔡宣平

1. 国防科学技术大学电子科学与工程学院 长沙 410073

2. 香港中文大学机械自动化工程学系 香港

收稿日期 2009-9-25 修回日期 2010-4-19 网络版发布日期 接受日期

摘要
主动传感器网络的自组织通常要求移动节点群(机器人群)通过障碍物环境移动到指定地点后, 重新调整并按预定布局组网. 在网络的自组织过程中要保证每个移动节点(机器人)与整个网络之间的连通性. 在对移动机器人的保持连通性进行优化的基础上, 提出了单步位置预测与群体势场相结合的分布式运动规划方法进行主动传感器网络的部署和重置, 证明了机器人运动控制的稳定性和网络的连通性保持, 进行了有和无障碍物环境下超过40个机器人的仿真, 结果表明该方法适用于大规模的主动传感器网络重置, 并对不同规模的网络具有可扩展性.

关键词 主动传感器网络 自组织 保持连通性 单步位置预测 群体势场 稳定性分析

分类号

Motion Planning for Self-organization of Active Sensor Networks Based on Multi-robots

FAN Wei-Hong, LIU Yun-Hui, ZHOU Dong-Xiang, CAI Xuan-Ping

1. College of Electronic Science and Engineering, National University of Defense Technology, Changsha 410073

2. Department of Mechanical and Automation Engineering, Chinese University of Hong Kong, Hong Kong

Abstract
Self-organization of an active sensor network always requires a group of mobile nodes (robots) to move from an area to a desired area in the environment with obstacles to reconfigure the network topology according to the scheduled layout. During the self-organization, it needs to be ensured that each mobile node (robot) maintains the wireless link to the network. By optimizing the preserved connectivity of the mobile robots, a distributed motion planning algorithm based on a single-step location prediction and collective potential field is presented to deploy and reconfigure the active sensor network. The stability of controlling the mobile nodes and the preserved connectivity of the network are analyzed. Simulations are conducted for a group of more than 40 robots with and without obstacles in the environment. The results show that the proposed algorithm is effective for reconfiguration of a large scale active sensor network, as well as the networks with different sizes.

Key words Active sensor network self-organization preserved connectivity single-step location prediction (SSLP) collective potential field (CPF) stability analysis

DOI: 10.3724/SP.J.1004.2010.01409

通讯作者 樊玮虹 whfan@nudt.edu.cn

作者个人主页 樊玮虹; 刘云辉; 周东翔; 蔡宣平