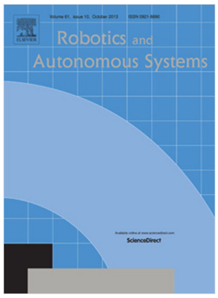

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Lei Liu, Rui Guo, Junan Wu

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A collision-free motion planning method by integrating complexity-reduction SLAM and learning-based artificial force design

Lei Liu[a,b], Rui Guo[b,*], Junan Wu[b]

[a]*School of Mechanical Engineering, Nanjing University of Science and Technology, Nanjing 210094, China*
[b]*Department of Mechanical Engineering, Eindhoven University of Technology, Eindhoven 5600 MB, The Netherlands*

Abstract

In order to generally solve the rotor-type UAV's collision-free motion planning problem in the unknown static environment, we propose a non-holonomic solution via integration of the KF-based SLAM technique and governing force design. The traditional SLAM is modified and reduced as a low-complexity form according to the fact that too early detected obstacle information can be regarded as nearly frozen after sufficient correction. The artificial force terms are designed in a intuitive and smart way, through employment of the wall-following rule and lessons from historical and current experience, which are taught by the bat's predation process. Further, they can be converted to the real-time thrust vector expectation. Multiple simulation tests in both continuous and discrete scenes indicate that: 1) using slight sacrifice on the state estimate covariance can exchange pronounced reduction on structural complexity of the complete SLAM in return; 2) the LBAFD can not only mitigate limitations on the path oscillation, no passage between closely spaced obstacles and goal unreachability, but also lead to a high flying and exploration efficiency; 3) the integrated method has a relatively stable performance under different parameter settings and is even unconcerned to the surrounding characteristics.

*Corresponding author.
Email address: guorui@njust.edu.cn (Rui Guo)