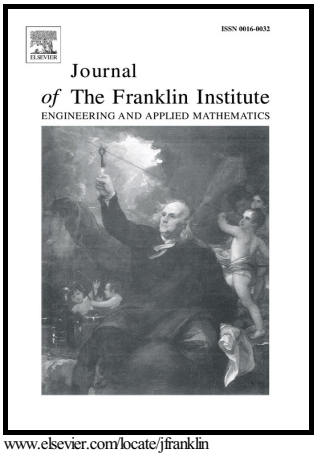

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Coordinated Formation Control Design with Obstacle Avoidance in Three-dimensional Space

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Abstract

This paper considers a problem of coordination formation control for multiple unmanned vehicles based on the behavioral control and virtual structures in three-dimensional space. The repulsive forces effect among unmanned vehicles to avoid collision with others and move them to the balance points on the spherical surface whose center is the virtual leader. The unmanned vehicles do not have specific identities or roles within the formation. The proposed method does not require specific orders or positions of the unmanned vehicles. The formation can transform automatically when unmanned vehicles enter or exit the formation. This paper also proposes a technique for avoiding obstacles based on the behavioral structure. In this technique, when an unmanned vehicle gets close to an obstacle, while moving toward its target, two kinds of potential fields with rotational vectors are applied to lead the unmanned vehicle to avoid the obstacle. Simulations are also given to verify the effectiveness of theoretical results.

Index Terms

Virtual Structure, Cooperative control, Assignment, Collision avoidance.

I. INTRODUCTION

The formation control of unmanned vehicles such as unmanned aerial vehicles (UAVs), mobile robots and autonomous underwater vehicles (AUVs) has been the subject of extensive research in recent years. Among them, unmanned vehicles group can improve task allocation, performance, the time duration required, the system effectiveness and the safety to achieve the desired outcome

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