UAV Path Planning Using Evolutionary Algorithms

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Abstract. Evolutionary Algorithms have been used as a viable candidate to solve path planning problems effectively and provide feasible solutions within a short time. In this work a Radial Basis Functions Artificial Neural Network (RBF-ANN) assisted Differential Evolution (DE) algorithm is used to design an off-line path planner for Unmanned Aerial Vehicles (UAVs) coordinated navigation in known static maritime environments. A number of UAVs are launched from different known initial locations and the issue is to produce 2-D trajectories, with a smooth velocity distribution along each trajectory, aiming at reaching a predetermined target location, while ensuring collision avoidance and satisfying specific route and coordination constraints and objectives. B-Spline curves are used, in order to model both the 2-D trajectories and the velocity distribution along each flight path.

1 Introduction

1.1 Basic Definitions

The term *unmanned aerial vehicle* or UAV, which replaced in the early 1990s the term *remotely piloted vehicle* (RPV), refers to a powered aerial vehicle that does not carry a human operator, uses aerodynamic forces to provide vehicle lift, can fly autonomously or be piloted remotely, can be expendable or recoverable, and can carry a lethal or non lethal payload [1]. UAVs are currently evolving from being remotely piloted vehicles to autonomous robots, although ultimate autonomy is still an open question.

The development of autonomous robots is one of the major goals in Robotics [2]. Such robots will be capable of converting high-level specification of tasks, defined by humans, to low-level action algorithms, which will be executed in order to accomplish the predefined tasks. We may define as *plan* this sequence of actions to be taken, although it may be much more complicated than that. Motion planning (or trajectory planning) is one category of such

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