

OPTIMAL PATH PLANNING OF AN UNMANNED COMBAT AERIAL VEHICLE WITH OBSTACLE AVOIDANCE

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ABSTRACT

The objective of this study is to optimize path planning for an unmanned combat aerial vehicle (UCAV) with obstacle avoidance by minimizing fuel consumption. A nonlinear constrained optimization solver, Fmincon, is used to find the optimal path. Two separate methods are implemented to obtain an excellent path and reduce the computation time. In the first method, an initial value problem (IVP) is used where discrete values of throttle and bank angle are the optimum control variables. In the second method, an inverse-dynamics approach is used where discrete values of velocity, heading angle, and mass are the optimization variables. Flight mechanics principles are applied to obtain thrust, bank angle, and position time histories. The geometrical path segments are minimized in order to estimate initial states for the aircraft flight mechanics model. Accuracy of the optimization is directly proportional to the number of variables in Fmincon. On the other hand, as the number of variables increases, so does the computational time to obtain the optimal path. Numerical results are presented for various scenarios.