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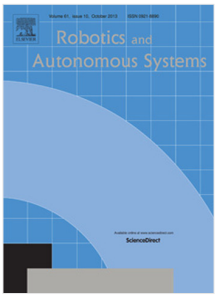

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Two-layer obstacle collision avoidance with machine learning for more energy-efficient unmanned aircraft trajectories

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Abstract

This paper proposes a new two-layer obstacle avoidance algorithm that allows an unmanned aircraft system to avoid multiple obstacles with minimal effort. The algorithm includes a global-path optimization that identifies the number of obstacles resulting from a clustering technique based on obstacle information from an airborne sensor, and specifies a potential threat. A local-path trajectory optimization employs a model predictive control structure based on a multi-phase optimal trajectory resulting from approximated dynamics, vehicle constraints, and the result of the global-path optimization. Numerical flight simulations are conducted with a conventional one-layer obstacle avoidance algorithm and the two-layer obstacle avoidance algorithm. The results of the numerical simulation show that the proposed two-layer optimal obstacle avoidance algorithm generates more energy-efficient avoidance trajectories when an unmanned aircraft meets multiple obstacles.

Keywords: obstacle avoidance, optimal trajectory, clustering algorithm, model predictive control, UAV, path-planning

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