

Collision-Free Path Planning for Spray Painting Robots

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Abstract

Spray painting of 3D complex shape (such as car body) consists of external or surface coating and internal coating. Previously, we developed an automatic trajectory planning system (ATPS) for free-surface coating considering painting mechanics and robot dynamics. Since internal coating requires the robot access the structured area, collision-avoidance should be considered. Although many research results have been reported on the collision-avoidance (robot path planning), they are difficult to apply for internal coating as the robot path is governed by painting mechanics (for coating uniformity) while avoiding collisions. In this research, we propose a new collision-avoidance path planning scheme which can be applied for internal coating.

The proposed scheme is to decompose the robot path planning into two: collision-avoidance path planning for upper arm followed by spray-gun path planning for lower arm. The decomposition is based on the observation that collision-avoidance is necessary for the upper arm when the robot accesses internal painting area, and spray-gun path planning is to incorporate path constraints due to painting mechanics. In other words, the former can be viewed as gross motion and the latter fine motion. In this paper, we develop an algorithm for the former; i.e., collision-avoidance path planning for upper arm and discuss methods to cover the lower arm. To test the validity and efficiency of the developed algorithm, numerical simulations are given.