利用位能場規劃多具機械手臂共持物體之路徑

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摘要

本論文針對三維空間中多機械手臂共持物體的路徑規劃問題提出演算法。此演算法在工作空間中運作，只需利用工作空間中的資訊，不必將之轉換至高維度的組態空間處理，因此計算相對快速許多。我們利用三度空間的廣義位能場模型計算障礙物對物體和機械手臂的排斥力，保證物體及手臂在運動時不會與障礙物發生碰撞，規劃出最安全的路徑。此外，除了環境中的障礙物之外，本論文還加入了數個虛擬的輔助障礙面，輔助障礙面將各手臂的活動範圍加以切割，確保了手臂之間不會有碰撞產生，也因為空間的分割，各手臂在路徑規劃時不需要考慮到其他手臂的存在，因此可以採用平行處理的架構，同時為多隻手臂規劃路徑。藉由電腦模擬，我們發現本論文的演算法在大部分情況下均能為物體和手臂規劃出安全的路徑，所規劃出的路徑也都能夠平滑與連續。

Potential-Based Path Planning of an Object Held by Multiple Manipulators

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ABSTRACT

An algorithm for path planning of object held by multiple manipulators is presented in this thesis. The proposed path planning method is efficient because there is no need to convert workspace information into high dimensional C-space. The algorithm utilizes generalized potential model to evaluate the repulsion between obstacles and manipulators and obstacles and objects, thus the avoidance of collision is guaranteed. In addition to the obstacle planes, we also put some virtual assistant obstacle planes in the environment. These planes roughly divide the workspace into several parts each defines the space of operation of a manipulator. By using such assistant planes, collisions between manipulators can be avoided. Therefore, we don't need to consider interactions between manipulators, and paths of all manipulators can be planned at the same time. Simulation results show that safe and spatially smooth paths can be obtained successfully almost always.