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TWO-FINGER CAGING-BASED GRASPING REGION DETERMINATION OF POLYGONAL SPACE
DEBRIS WITH MOTION PARAMETERS UNCERTAINTY

Abstract

Grasping space debris is an emerging challenge due to lack of fixed grasping points and the limitation of known information. Multi-finger caging-based grasp, in which multi-finger surrounds an object and make it inescapable from the “cage” composed of multi-finger, offers a robust object grasping approach. In this paper, for planar polygonal space debris with motion parameters uncertainty, an algorithm for finding all the feasible two-finger cage formations based on the contact space formulation is presented. First, considering the motion parameters uncertainty of space debris, the motion envelope of planar polygonal space debris, which includes all the possible positions of the planar polygonal space debris during the transient caging process, is regarded as a substitution of space debris. And the motion envelope is constructed based on Euler equations. Then, the caging graph of space debris in contact space is constructed, which is an undirected graph composed of nodes and edges of the space debris. Starting from a given initial two-finger caging formation of space debris, the caging graph is used to search for the feasible caging regions. Finally, an example is carried out to illustrate and validate the proposed algorithm.