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# Planning Form-Closure Grasps of 2D Objects for Robotic Hands

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## Abstract:

Grasp planning is the problem of finding the contact locations and the forces to apply by the fingers on the object surface to grasp it. This work proposes a new technique that solves a simplified version, (2-D), of this planning problem. This technique is used for planning form-closure grasps. In this type of grasp, the fingers surround the object and hold it securely against the palm. It could be used successfully to restrain the object with minimum concern about the applied forces even when the coefficient of friction is small. Instead of using shape primitives or hand preshapes to simplify the problem solution, this work suggests an optimization technique. This technique searches for the maximum value of a Grasp Quality Metric ( ) which corresponds to the best form-closure grasp. To find this value, the proposed technique requires the development of two algorithms. The first one generates a grasp for a given object at a specific approach angle of the robotic hand, and it is called the Grasp Generator. The second one is called the Search Algorithm. This algorithm explores all approach angles for the best grasp. The outputs of this algorithm are the position and the orientation of the palm and the joint angles of the fingers at the best grasp. The proposed method is used for a two-fingered robotic hand with eight degrees of freedom, and it is implemented and tested on a wide variety of 2D objects. The results show the effectiveness of the method to achieve the planning of form-closure grasps of any 2D object.

## Keywords:

Keywords: Anthropomorphic Robotic Hand, Enveloping Grasp, Form-Closure Grasp, Grasp Planning, and Grasp Quality Metric.

## Published In:

Journal of Engineering Sciences , Vol. 40 - No 6 , PP. 1759 -1780



( 2 )

# Planning Enveloping Grasps of 2D Objects for Anthropomorphic Hands

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## Abstract:

This work proposes a new technique to plan enveloping grasps of 2D objects. The method is guided by the idea that the best grasp is the grasp that has a complete and proper contact between the hand and the object. This technique searches for the maximum value of a Grasp Quality Metric (Q) which corresponds to the best enveloping grasp. To find this value, the proposed technique requires the development of two algorithms. The first one generates a grasp for a given object at a specific approach angle, and it is called the Grasp Generator. The second one is called the Search Algorithm. This algorithm explores all approach angles for the best grasp. The proposed method is used for a two-fingered robotic hand with eight degrees of freedom, and it is implemented and tested on a wide variety of 2D objects to show its effectiveness.

## Published In:

IROS2013 Workshop on Caging and Its Applications in Grasping/Multi-agent Cooperation , ,