ODESSA NATIONAL ACADEMY
OF FOOD TECHNOLOGIES

IX ANNUAL SCIENTIFIC CONFERENCE

INFORMATION TECHNOLOGY AND AUTOMATION – 2016

Proceedings

Odessa
October 11-14
2016

CONTENTS

UDC 681.5+681.6:664

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REALIZATION OF A DELTA-ROBOT FOR CHOCOLATE PRINTING

In current years delta-robot can use in many industries (such as engineering, automobile industry and etc.). Delta robot has a difficult structure, but his functionality can provide different opportunities and precise positioning of output devices that perform processes in industry. Since the inception of this project, we have a lot different constructions and functionality. At the 1980's delta was designed for process for packaging conveyor lines, but now we can see this robot on many areas.

The basic idea behind the Delta parallel robot design is the use of parallelograms. A parallelogram allows an output link to remain at a fixed orientation with respect to an input link. The use of three such parallelograms restrain completely the orientation of the mobile platform which remains only with three purely translational degrees of freedom. The input links of the three parallelograms are mounted on rotating levers via revolute joints.

This robot is like a mechanical system, which changes position of extruder to print chocolate for confectionery and creating 3D objects made of chocolate.

A delta robot is a type of parallel robot. It consists of three arms connected to universal joints at the base. The key design feature is the use of parallelograms in the arms, which maintains the orientation of the end effector. By contrast, a Stewart platform can change the orientation of its end effector. Delta robots have popular usage in picking and packaging in factories because they can be quite fast, some executing up to 300 picks per minute.

Parallel manipulators are characterized as having closed-loop kinematic chains. Compared to serial manipulators, which have open-ended structure, parallel manipulators have many advantages in terms of accuracy, rigidity and ability to manipulate heavy loads. Therefore, they have been getting many attentions in astronomy to flight simulators and especially in machine-tool industries. Also known as parallel robots, or generalized Stewart platforms (in the Stewart platform, the actuators are paired together on both the basis and the platform), these systems are articulated robots that use similar mechanisms for the movement of either the robot on its base, or one or more manipulator arms. Their 'parallel' distinction, as opposed to a serial manipulator, is that the end effector (or 'hand') of this linkage (or 'arm') is connected to its base by a number of (usually three or six) separate and independent linkages working in parallel. 'Parallel' is used here in the computer science sense, rather than the geometrical; these linkages act together, but it is not implied that they are aligned as parallel lines; hereparallel means that the position of the end point of each linkage is independent of the position of the other linkages.

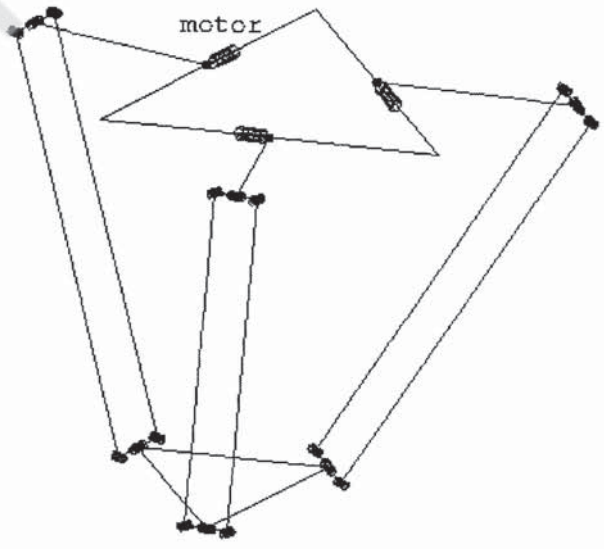

Fig. 1. Kinematic model of a delta robot

The key concept of the delta robot is the use of parallelograms which restrict the movement of the end platform to pure translation, i.e. only movement in the X, Y or Z direction with no rotation. The robot's base is mounted above the workspace and all the actuators are located on it. From the base, three middle jointed arms extend. The ends of these arms are connected to a small triangular platform. Actuation of the input links will move the triangular platform along the X, Y or Z direction. Actuation can be done with linear or rotational actuators, with or without reductions (direct drive).

The delta robot (a parallel arm robot) was invented in the early 1980s by a research team led by professor Reymond Clavel at the École Polytechnique Fédérale de Lausann. Since its invention in the early 1980s, the delta robot has evolved into an innovative and high-speed solution for a wide range of assembly, picking, and material handling applications.

The revolute joints of the rotating levers are actuated in two different ways: with rotational (DC or AC servo) motors or with linear actuators. Finally, a fourth leg is used to transmit rotary motion from the base to an end-effector mounted on the mobile platform.

Automation in the food industry has moved far beyond the simple labelling machines and conveyor belts. Now intelligent robotic arms perform dazzling movements and expert feats of coordination, getting everything from frozen fish chunks to cookies swiftly into their packaging. It's not a side of processed foods you see that much, but it is everywhere.

In this situation we are considering possibility of edible printing on the confectionery products. We can use this project for food manufactures such as a confectionery factories of course.

Chocolate delta robot. In contrast to 3D delta printers using as a plastic material, chocolate delta robot will use melted chocolate to create a confectionery products. Advantages of confectionery products by the delta robot consists including that you can create fabulous products that can be decorated a variety of higher value products (such as cakes). By accurately positioning of the extruder, products will have a perfectly forms that can't be set up in casting them in forms.

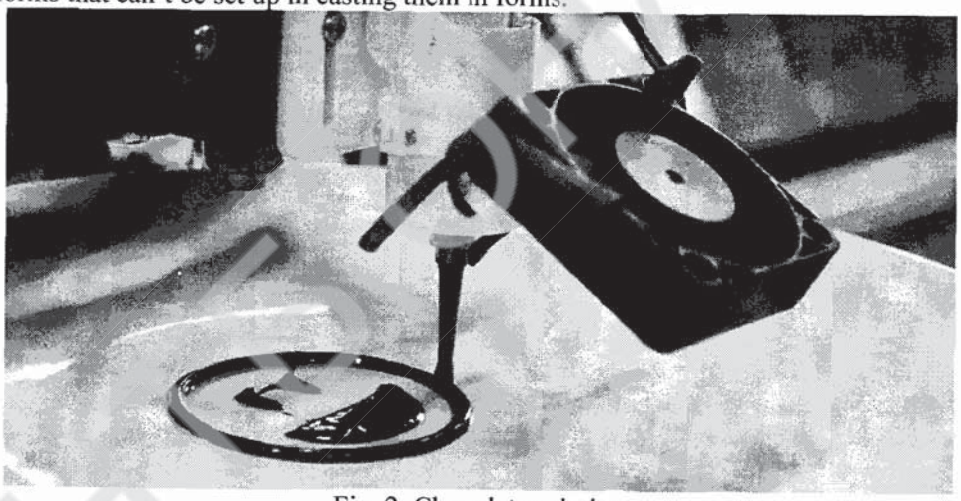

Fig. 2. Chocolate printing

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