RESEARCH PARKS
INTERNATIONAL JOURNAL ON ORANGE TECHNOLOGIES
www.journalsresearchparks.org/index.php/IJOT e-ISSN: 2615-8140|p-ISSN: 2615-7071
Volume: 03 Issue: 03 | March 2021

The Basis is a Mobile Industrial Robot Core Characteristics and Shape of The Spatial Structure

A.K.Abdullayev,
N.R.Abdullayeva

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Abstract: The geometric characteristics of the robot's work area - the size of the robot's work area, the cut surface, the linear, angular dimensions or a combination of them, the complexities of industrial robot movement are considered.

Key words: mobility of a robot, industrial robot is complex, geometric characteristic.

Introduction

Whether industrial robot is complex in a technological process or a simple spatial manipulation operation, a number of its characteristics are involved in the process. The main characteristics of industrial robot are:

The working space of a robot is the space that can be located in the movement of the robot's actuator.

The working area of a robot is the space in which the robot's holding device can be located in motion.

The geometric characteristic of the robot's work area is the size of the robot's work area, the cut surface, the linear, angular dimensions, or a combination of them.

Basic coordinate system of the robot - a coordinate system in relation to the transfer of geometric characteristics of the working area of the robot.

The number of moving levels of the robot is the set of the number of free levels of the kinematic chain of the robot's actuator relative to the base coordinates and the number of free levels of the moving device.

The degree of mobility of a robot between positions is the degree of mobility of a robot using the movement of a robot or the path it traverses using a moving device.

The portable mobility level of the actuator of the industrial robot is the level of mobility of the robotic actuator using the displacement of the gripping device.

The degree of mobility of the actuator in targeting is the degree of mobility of the robotic actuator using the grasp of the target device.

An industrial robot with six or more links is a complex technical system. Therefore, according to the real construction of the industrial robot, six or fewer links are involved in the technological process. The smaller the number of links, the simpler the control of the robot. In a very simple industrial robot, the number of links is up to three. Given the complexity of the SR movement, it can be divided into the following types:

- global - the base is specific to moving robots, the movement of the robot base increases the range of motion;

- regional - typical of transport robots, the movement of the links ensures the continuous movement of the material point in the grip device;

- local - the robot restricts the movement of the links, directs the grip device to increase positional accuracy, ie to get the target correctly.

Let us determine the mobility, maneuverability, service angle of the industrial robot in the example of a three-link robot. The appearance of the robot is shown in Figure 1.

Compounds are the capital letters of the Latin alphabet A, B, C, and so on. determined by The kinematic pair is 0/1, 1/2, and so on. is shown in the view.

The mobility of the industrial robot is the number of generalized coordinates of the variable that determine the position of the spacecraft in one go:

$$W = 6n - \sum_{i-1}^{5} (6-i) \cdot p_i$$

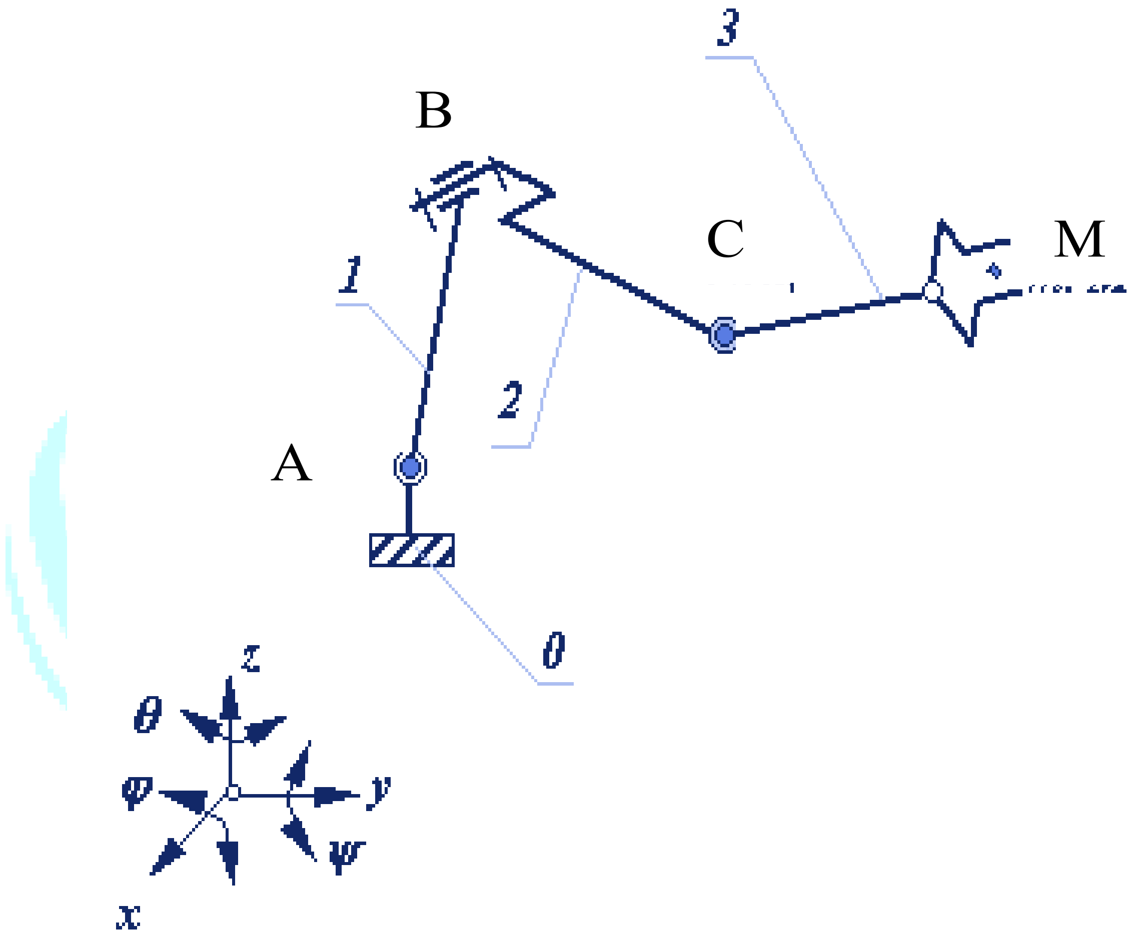

Figure 1. An overview of the three-link industrial robot.

The maneuverability of the SR when the gripping device is fixed is as follows:

$$M = W - 6.$$

The concept of service angle is introduced in increasing the positional accuracy of the movement of the industrial robot. The service is considered in three-dimensional space, and the number of free levels can be 6, 7 and more. This is because it is necessary not only to lower the gripping device to a given point, but also to direct it to the desired point. The service angle is ψ determined as follows:

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$$\psi = \frac{f_A}{l_A},$$

where is f_A – the spherical surface of the last link holding device.

l_A – the length of the holding device.

The relative magnitude $k_\psi = \frac{\psi}{4\pi}$ is called the service ratio.

The number of mobility of a three-link industrial robot

$$W = 6 \cdot 3 - (3 \cdot 2 + 5 \cdot 1) = 18 - 11 = 7.$$

Maneuverability $M = 7 - 6 = 1.$

Suppose, l_1, l_2, l_3 – the lengths of the links are $l_1 \geq l_2 + l_3$, $l_2 \geq l_3$ to be comfortable. Let the holding device stand at a point *x* in space.

The maximum distance of the base relative to the base coordinate system $|x|_{max} = l_1 + l_2 + l_3.$

The minimum distance is $|x|_{min} = l_1 - l_2 - l_3.$

It is known that there will be $0 \leq k_\psi \leq 1$ a service ratio. To determine the full service area, the following work is performed:

$k\psi = 1$ when the zone:

The first zone

$$l_1 + l_2 - l_3 \geq |x| \geq l_1 - l_2 + l_3.$$

The second zone

$$l_1 + l_2 + l_3 \geq |x| \geq l_1 + l_2 - l_3.$$

A comparison for him

$$l_3^2 + |x|^2 - (l_1 + l_2)^2 = 2|x| l_3 \cos\psi.$$

The last zone

$$l_1 - l_2 + l_3 \geq |x| \geq l_1 - l_2 - l_3.$$

A comparison for this zone

$$l_3^2 + |x|^2 - (l_1 - l_2)^2 = -2|x| l_3 \cos\psi.$$

$$f_A = 2\pi l_3^2 (1 - \cos\psi).$$

Service ratio for the second zone

$$k_\psi = \frac{(l_1 + l_2)^2 - (|x| - l_3)^2}{4|x| l_3}.$$

Service ratio for the last zone

$$k_\psi = \frac{(|x| + l_3)^2 - (l_1 - l_2)^2}{4|x| l_3}.$$

The graph of the service ratio is given in Figure 2.

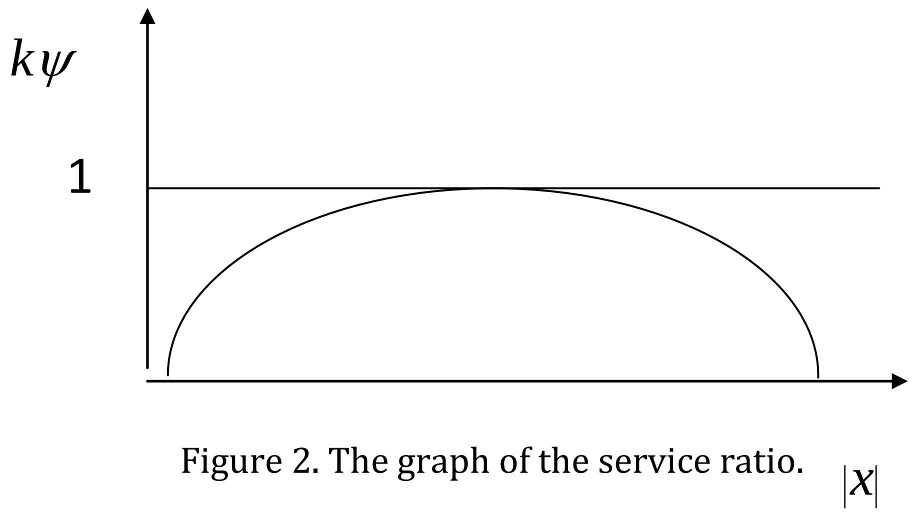

Figure 2. The graph of the service ratio.

Summary

The geometric characteristics of the robot's work area - the size of the robot's work area, the cut surface, the linear, angular dimensions or a combination of them, the complexities of industrial robot movement are considered.

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