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Two-handed robot control algorithm by neural network method

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I. INTRODUCTION

Two-handed robots allow you to perform complex household and technological operations inaccessible to robots with one mechanical arm. [1]

Creation of methods of design and control of two-armed robots is now considered as one of the new directions of development of robotics, which is of great practical importance for remote work in space, transport safety and in emergency situations.

The complexity of controlling a robot manipulator with many degrees of freedom is well known due to the nonlinearity and large dimension of the system.

Control of a two-handed robot is even more difficult due to the fact that when performing operations with two hands, closed spatial systems of solids with many degrees of freedom are formed [2].

The second feature of the construction of control algorithms of two-handed robots is the need to take into account the restrictions on the relative position of workers and other links.

This is due to the fact that, as a rule, when two manipulators perform operations together, they operate in the same working area and in close proximity to each other, which can lead to a collision of structural elements.

To solve these problems of robotics, it is advisable to use bionic neural network algorithms. [3]

Neural network technology today implies bio-like software and hardware systems capable of self-learning and adaptation. [4]

In cybernetic feedback systems, a mismatch (error) signal is used between the required and the current state. With the help of optimization methods of selection of coefficients of adaptive neural network algorithm, this signal is minimized.

Consider the neural network control system of prosthetic arms or two-handed robots in solving the problem of moving the working links in a given relative position. The task is the selection of control parameters, in which the technical system goes to the desired state in the shortest time. In this case, the adaptive algorithm should be trained on examples. In General, this problem can be reduced and solved by optimization methods, which include artificial neural networks. The adaptive parameters will be the weight coefficients of synaptic connections of the neural network algorithm. [5]

A variant of the structure of the tactical level of the control system of a two-armed robot based on neural networks has the form (Fig.1).

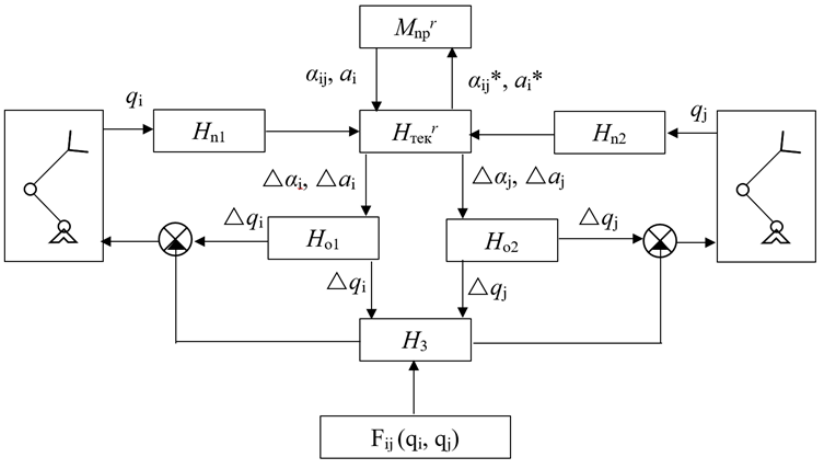

Figure 1. The scheme of the tactical management level two-handed robot.

Given, the relative position of the working units of the two-handed robot manipulators at some point in time is determined by the matrix. Mg, elements which are the guides of the cosines of the axes of the coordinate system associated with a link of the first manipulator in the coordinate system of the second manipulator, and the coordinates of the beginning of the coordinate system associated with the first manipulator in the coordinate system of the second link of the manipulator.

The current relative position of the working units determined by the matrix of the current relative position does not coincide with the specified one.

The matrix of the current relative position H Tek is determined by the values of the generalized coordinates of the first and second manipulators.

According to these values, the matrix of the current relative position of the working units of the manipulators – NTEK is formed.

Neural network NTEK compares the elements of the given and the current matrix of relative positions and generates the signals for misalignment of generalized coordinates for both manipulators using neural networks No. 1 was and Ho2.

However, these signals should be adjusted to take into account the restrictions on the relative position of the manipulator links.

These signals are neural network H3 for the accepted ratios, simulating the limit on acceptable convergence of the elements links.

The proposed algorithm makes it possible to implement the given relative movements of the working links of two-handed robots and prosthetic arms in the performance of technological and domestic operations.

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