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Материалы сборника отражают круг актуальных проблем и задач в сфере робототехнических систем и средств безопасности, представленных на 30-й Международной научно-технической конференции «ЭКСТРЕМАЛЬНАЯ РОБОТОТЕХНИКА».

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SIMULATION MODEL OF TWO-ROBOT COOPERATION IN COMMON OPERATING ENVIRONMENT

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Abstract

The article considers a simulation modelling problem related to the chess game process occurring between two three-tier manipulators. The objective of the game construction lies in developing the procedure of effective control of the autonomous manipulator robots located in a common operating environment. The simulation model is a preliminary stage of building a natural complex that would provide cooperation of several manipulator robots within a common operating environment. The article addresses issues of training and research.

Keywords: manipulator robot, chess, operating environment, simulation model.

Introduction

Modern robotics has a wide range of tasks where robots are to perform various manipulations with objects. These applications include: products' assembly, room cleaning, cargo moving etc. [1, 2].

As a rule, university students of robotics study mostly construction of separate robotic units and their control. Thus, little attention is paid to the issues of robots' cooperation in groups. The main focus of the work is the construction of models and robotic complexes that would allow obtaining necessary research and development skills related to the robot cooperation in groups and their coordinated actions to solve the problems that require participation of several robots and/or heterogeneous "robot-human" groups.

The important subset of such problems is comprised of the operations that are executed by several robots or in robot-human groups. They are also called "collaborative robots" [3, 4]. The main requirement set for such robot-robot groups or robot-human groups is taking into account other group members or coordination of their engagement. Thus, in various assembly operations, robots must adhere to a certain sequence of actions. Therefore, the chess game between two manipulator robots may become a useful model for developing the robot operation algorithms, their sequence of actions etc.. Moreover, using the framework of the model, it is also possible to work over various types of grips and/or to optimize the control system used for grabbing different objects etc. [2]. There are many publications that are devoted to the above-mentioned research [1-4].

Usually, the first stage of solving such problems would include mathematical modelling [4], in particular – simulation modelling. Here we have demonstrated a simulation model of cooperation between two manipulator robots within the chess game environment. The simulation is based on the geometrical dimensions of the robots' tiers, chess game logic and time required to make a move by each robot competitor. Statistical time characteristics pertaining to the moves of each robot may be changed as a part of the simulation model.

Currently, there are several implementation types of mechatronic devices [5-12] that can move chess pieces on the board and choose the move (see Fig. 1). Industrial robots are also used when moving the chess pieces in a robot-human game (see Fig. 1c) or in other games like Go [5] (see Fig. 1d). However, the work is focused on the chess game between two manipulator robots. This problem is a part of a wider research on a robot-robot and robot-human cooperation as well as the robot training.