STUDY OF MECATRONIC & HYDRAULIC ROTATION AXES CONTROL FOR INDUSTRIAL ROBOTS BY COMPUTER MODELING

Calin TRIPE-VIDICAN, Aron TRIPE-VIDICAN, Pavel Danut TOCUT
Universitatea din Oradea

Key words: rotation axes, control, industrial robots, mecatronic

Abstract

The paper presents the way to design a control program of the motion hydraulic axis combining speed-position controllers to optimize its functionality. At the base of the control program stands the scheme of the rotation hydraulic axis, the results of modeling and simulation of it.

1. INTRODUCTION

In this paper, starting from the computer modeling, presented in [5] and fig. 1, a control program had been designed using a computer (1).
The design of controlled axis is show in fig. 1 having the following elements:

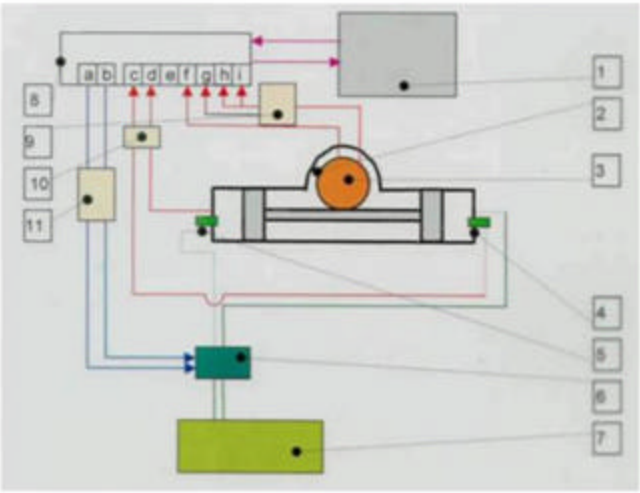

Fig. 1. Block diagram of rotational motor electro-hydraulic servo-system

2. THE DESIGN OF CONTROL SYSTEM

Motion and speed control can be made by means of controlling the oils which volume follows trough the distributor to the hydraulic motor. The proposed design solution makes possible computer control aided of a hydraulic drive, which is a modern concept. The control design can be made in various forms by electronically devices named axis processors, which are placed on every axis. These are driven by the trajectory generator from which they get

their prescribe values. The control design is presented in fig. 2.

The principles for the design of the control systems are stated below, having in mind the purpose is to try out control rules and controller parameters:

a) The control system must be flexible and must permit the change of control rules very easily.

b) This design allows the use of computer languages that are easier to use than special program languages (Visual C++ had been used).

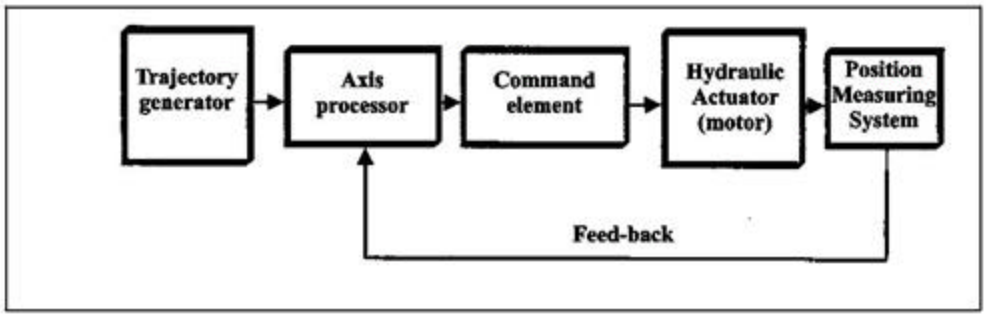

Fig. 2 Flow chart of hydraulic driver's control system

The chosen components of the control system are: an Intel Pentium 200 MHz PC, 32 Mb RAM, National Instruments PCI-1200 DAQ card, which has in ant channels as well. The software functions are follows: allow the specification of a programmed position; reads the position actual value; calculates the speed and acceleration from read position and internally measured time; calculates the needed values for position, speed and acceleration; calculates the differences between actual and needed values; based upon the control rule generates the command values; transmits the command values to the proportional distributor. For the calculus of the numeric values of mobile elements position PC software is used, which gains it's input values from the acquisition card.

The interface between the rotational transducer and the acquisition card is an electronic circuit, which transforms 2 sine wave U1, and U_2 generated by the transducer into a TTL signal.

The distributors are commanded in current in the range of –0,8A, but the DAQ card can give only voltage signals from 0 to 10V. To avoid this problem a voltage commanded current source had been design.

The command voltage levels are generated by the software and are actually made by DACOW1 and DAQOW2 analog out put channels of the DAQ card.

The DAQ card, which makes the A/D and D/A conversions, is a PnP device. In order to be programmable in a high level language (Visual C++) the card has soft function libraries. The software source code is given as follows and its flow charts are presented in fig. 3.

The program starts with the initial setting before executing the motion cycle synchronization must be made. All position values are given as absolute, and are measured from the 0 point of the hydraulic axis (the point in which the switch is coupled).

The command loop is executed as described in the flow chart. Several (P, PI, PID) controllers can be specificity and tested simple changing the corresponding instructions in the source code. After reaching-programmed position, the program let us stop or specify another position. At program stop all counting and timing as well voltage commands functions are reseted to zero.

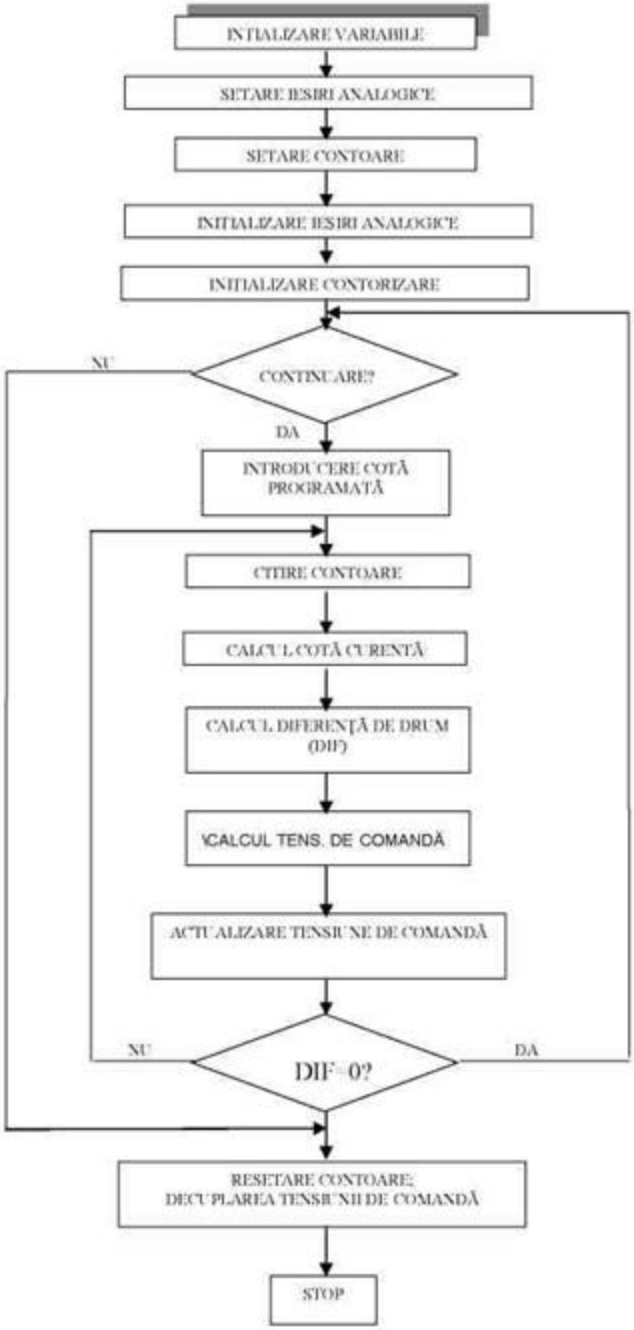

Fig. 3 Control program flowchart

3. CONCLUSIONS

The simulation results had proven the models efficiency.

The simulation helped the authors to design and build up the RH10 industrial robots rotation horizontal axis.

Applying different parameters on the designed model this can be extended to future applications.

4. REFERENCES

[1] Bogdanov I., *Microprocesorul în comanda actionarilor electrice*, Ed. Facla, Timisoara,1989;

[2] Hutte, *Manualul inginerului. Fundamente. Traducere din limba germana dupa a 29-a editie*, Ed. Tehnica, Bucuresti;

[3] MATLAB SIMULINK 5.1.2. *Users manual*, Mathworks Inc., 1998;

[4] Tripe-Vidican A., Optimizarea constructiva si functionala a manipulatoarelor si robotilor industriali cu actionare hidraulica, teza de doctorat, Timisoara;

[5] Tripe-Vidican A. s.a, Study of control system of a hydraulically translation axis by computer simulation, Fifth International Conferences on Hydraulic Machinery and Hydrodynamics, October 2000, Timisoara, Romania