CONTROL OF THE MACHINES ON AXES IN ROBOTICS WITH THE SIEMENS PLC help

Barz Cristian, Pop Radu, Chiver Olivian, Zoltan Erdei, Mihaela Stet
Faculty of Engineering - Northern University Centre of Baia Mare

Abstract

The paper presents the practical solution used to control the axial movements of a robotic arm, which is realized with servomotors, which are controlled by frequency converters on each axis, in order not using CNC commands. This is done by programming the PLC ladder diagram language that makes movement on the three axes. Siemens PLCs have modules for pulse frequency control for axis movement in the library, thereby transforming the coordinate distances to be achieved in pulse trains for servo drive converters. Using PLC makes it easy to control robotic equipment for robotics-free operators.

Keywords – stepper motor, PLC, TIA portal, frequency converters

Introduction

Through its conception, a programmable controller is adaptable for functioning in the industrial environment, it can operate in a large variety of temperature and humidity, it is easily adaptable to interfacing with any process and does not raise any special problems regarding the training of service personnel, due to the programming facilities it offers.

At the present, it is estimated that over 60% of the total industrial commands in the advanced countries are carried out with PLCs, and this percentage is increasing. [1, 2]

For majority of equipment in industrial processes are using different type of PLCs, a lot dedicate for some type of process. The commands from the PLCs are transfer to execution elements for operating the CNC machines, robot movements on different axis, different stage of process, etc. Programing the PLC, we made like operators to can work with complex equipment or machines even have a qualification only for operator. We can create in the same way, the program for a CNC machine or for a robotic arm with some PLC module, which transfer the coordinators of movement on a specifically axis in the command of a stepper motor in pulses, which makes the transmission to the mechanical components of system. [3]

Stepper motors and frequency converter

Stepper motors are used in low power applications that are characterized by quick movements, precise, repeatable and to the cases where high power is not required (usual powers between field's microwatt and kilowatt), like xy plotters, moving print head printers, operating mechanisms for the robots axial displacement systems, tables positioning 2D drilling machines, in aviation etc.

The stepper motor is used in pair with frequency converters for control the equipment, frequency converter made the pulses for command the speed and angle of the stepper motor. The frequency converters can give a variety of pulses for a complete rotation of the stepper motor, this variety establishing how high will be the precision of move, it has range between 200 and 12800 pulses. The use of computers

or the PLCs for the control of complex processes is necessary to process signals and command the moves on different axis.
Stepper motor Nema 42 using in our application, was developed primarily for installation with restricted space available and which need an increased torque (Fig. 1). Nema 42 motor uses advanced magnetics technology to give the couple a level significantly higher than that of a standard motor device and it can be placed on the three displacement axis (X, Y and Z). [3, 4]

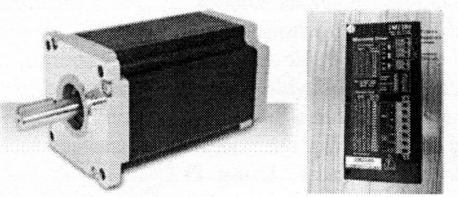

Fig. 1. Step by step engine and Microstep Driver 2M2280

STEP 7 - TIA Portal programming software
As part of the SIMATIC commitment to "totally integrated automation" (TIA), the S7-1200 product family and the TIA Portal programming software give to us the flexibility what we need to solve our automation needs. TIA Portal provides a user-friendly environment to develop controller logic, configure HMI visualization, and setup network communication. To help increase your productivity, TIA Portal provides a large library of module for using in application. The compact design, low cost, and powerful features make the S7-1200 compact controller a perfect solution for controlling small applications. [5]

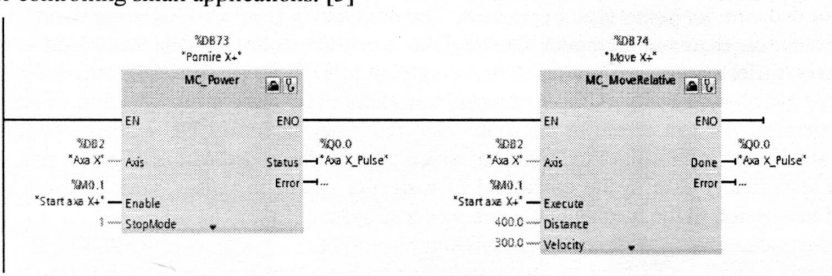

Fig.2. Power module and set module for distance and speed of stepper motor on X axis

In figure 2 it is present the settings of moves on X axis, give by distance which must be pass and the speed of movements. It is very important to set a good report between that in function about the type of operation, a big number of pulses for the steppe motor give us a great precision but in the same time, these will create an over temperature of motors if is very frequently use.

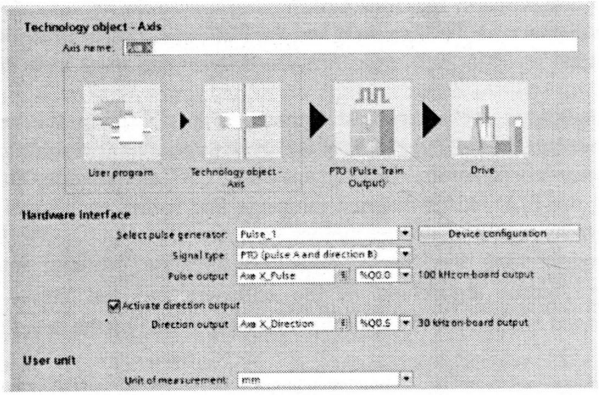

Fig.3. General settings for X axis

Figure 3 presents the options of setting for X axis, the data which can be used for controlling through HMI the movement in front and back on an axis, all these being made through pulses train give to the stepper motor with the frequency converter help.

It is necessary to continue with settings of pulses per motor revolution and the distance made on linear axis at a complete revolution of motor, with these the module convert the distance need to made on an axis in revolution of motor.

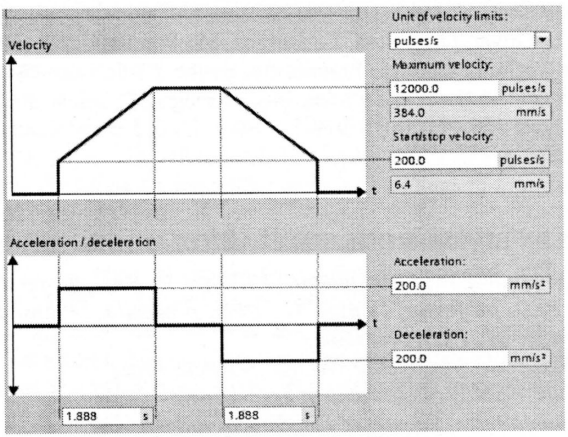

Fig.4. Dynamic setting of move

We have option for setting the Dynamic characteristics of steppe motor with period of acceleration and deceleration of speed for having a smooth movement. (Fig. 4).

After creating the program for control of moves on all axis, the operator need just to introduce the distance on the three axis and the PLC will convert these on movements of steppe motors.

Conclusions

The paper highlights the utility and importance of PLCs in the control of the industrial processes, command the function over three axis through simple dates of distance between coordinators, in order not using CNC commands. This is done by programming the PLC ladder diagram language that makes movement on the three axes of the arm by means of stepper motors.

PLC programming has the advantage of creating artificial intelligence by implementing control algorithms in the software and the ability to perform movements based on data provided by the sensors imposed by the developed.

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GREEN LIVING ROOF SIMULATION MODEL REVIEW

[1]Dimitrijević Jovanović D., *PhD student,* [2]Živković P., *PhD, professor,*
[2]Janevski J., *PhD, professor,* [2]Vukić M., *PhD, professor,* [2]Momčilović A., *PhD student,* [3]Dobrnjac M., *PhD, professor*
[1]University of Belgrade, Institute for Nuclear Sciences Vinča
[2]University of Niš, Faculty of Mechanical Engineering
[3]University of Banja Luka, Faculty of Mechanical Engineering

Integration of nature, live, organic materials, in the design of built areas and building structure is an architectural response to environmental problems of dense urban areas. At the site where green space is limited, greening the building envelope is the solution for the issues such as heat waves, flooding, and noise and air pollution. The benefits could be predicted only using accurate simulation model of this