ANNALS of Faculty Engineering Hunedoara
International Journal of Engineering
ISSN: 1584 - 2673

SENSORS DESIGN IN THE SHELF STORAGE SYSTEM

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ABSTRACT:
In this contribution is presented a complex design of sensorial system shelf storage system, which is one of the main subsystems of intelligent manufacturing cell. This manufacturing cell is situated at the Institute of Production System and Applied Mechanics. The complex design of shelf storage system is going out intelligent manufacturing systems knowledge. As a tool for design of shelf storage system running are used a sequential diagrams. Individuale sensors was designed for all axis X,Y,Z of shelf storage system.
KEYWORDS: system, mechanics, shelf, manufacturing, sensors

1. INTRODUCTION

It was necessary to solve the single traction scanning of manipulator shutdown to result from sequential diagram script. That means the proper sensors placement on individual traction in X, Y, Z axis that was possible the movement, manipulator shutdown with ejector and comfortable choice of individual palettes from the shelf.

Shelf storage system manipulator works in cartesian axis system. The X, Y, Z axis movements have the main translate character. The manipulator also practises the supplementary movements which the result is movement of palettes and main motion arrestment the manipulator in precisely specified positions. All these movements are so important for accurate orientation and r manipulation (charging and selecting of palettes from the cell) by the manipulator finger.

2. APPLICATION OF SENSORS FOR THE MAIN MOTION IN X-AXIS

X-axis actuation insures all manipulator movement between individual columns of shelf. The movement is done by linear pneumatic actuation. It depends whether motion without piston with integrated conductance and adjustable mutual pneumatic damping. The piston consists of permanent magnet for sensors function and direction possibility.

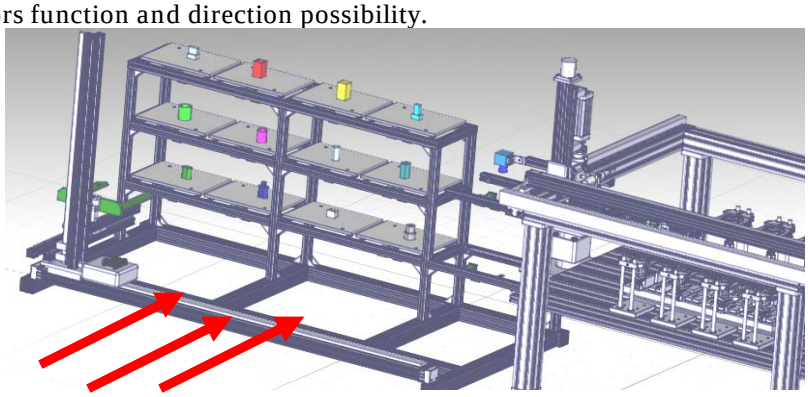

Fig. 1 The magnetic sensors placement in linear T-slots of pneumatic motion

Because it was necessary to ensure five positions of manipulator discontinuance in X-axis direction. These approximation sensors are applied as proper variant unloading individual positions of movement. Five pieces of magnetic contactless sensors are applied in this variant. Specifically it is

advisable to apply the type SME-8-K-LED-24 of magnetic sensors with tonque relay. It was very necessary to slow the actuation before the final position for continuous direction requirement. The next eight magnetic sensors is applied for approach manipulator signalization to the final position. The magnetic sensors placement on the pneumatic motion basis is situated on the bottom side of linear feed in T-slots (Fig.1).

The direction unit abridges its speed motion before the manipulator stop in final position on the ground of signals from sensors situated on linear pneumatic movement in required positions. The deceleration of manipulator is solved in three middle positions of movement in X-axis.

We cannot decelerate of outer positions because the pneumatic movement has final backstops with continuous run down. The applied system consists of pneumatic duplex cylinder and conical V-shape die (which is pressed into the precision slot in Z-axis direction). This way is secured the precise position of manipulator in directed station. It is necessary to regulate two positions of its movement. The first signalizes the piston engagement and manipulator may disposal move i X-direction. The second position insures the precise setting of manipulator in required position by piston inserting into the slot. The same types of magnetic sensors are applied for scanning of piston position in cylinder. It is concerned about sensors of **SME-8-K-LED-24** arrestment mechanism. It is possible to see magnetic sensors placement in pneumatic cylinder.

It is possible to stop manipulator in directed position by the designed sensors in X-axis direction. X-axis movement also may be move, but only suppose that finger is not situated in shelf area.

3. APPLICATION OF SENSORS FOR THE MAIN MOTION IN Z-AXIS

Z-axis application insures all manipulator movement between individual rows of shelf. The movement is done by linear electric actuation. It is possible to program the unit to the sixteen different stop positions. Because it is necessary to ensure four positions of manipulator discontinuance in X-axis direction. These approximation sensors are applied as proper variant unloading individual positions of movement. Three variants of shutdown are selected for palettes manipulation situated in shelf storage system. The first variant is for giving palettes to rotation unit. The fundamental position presents the highest location of electric motion. This position will be always reached whenever the system start. The back accouplement of interpolator mechanism in Z-axis direction is secured by sensor situated in proper place of electric linear motion. We applied magnetic sensors type SME-8-K-LED-24. Sensors are directly situated for main motion into required positions and distances (Fig. 2)

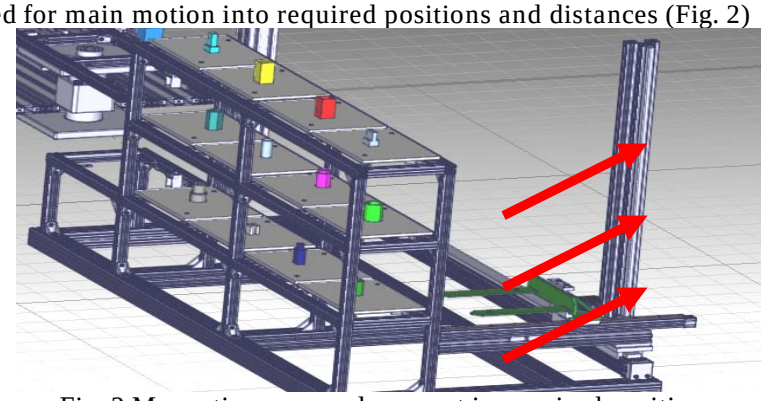

Fig. 2 Magnetic sensors placement in required positions
and distances in electrical motion slots

Applicated sensors officiated for manipulator presence verification on required position.

4. APPLICATION OF SENSORS FOR THE MAIN MOTION IN Y-AXIS

Y-axis actuation insures engaging and disengagement of manipulator finger into the designated shelf cell (Fig. 3). Its necessary to scanning two positions. The first position of peumatic piston signalizes the safety finger position out of shelf area. The second position signalizes disengagement finger into the shelf cell. The magnetic sensors of final positions type SME-8-K-LED-24 are applied for scanning.

The signal have to come from direction unit about the proper position of X and Z motion before the moving in Y-axis. It is also important to have a palette in finger and in shelf cell. Otherwise it can start colision between manipulator and shelf.

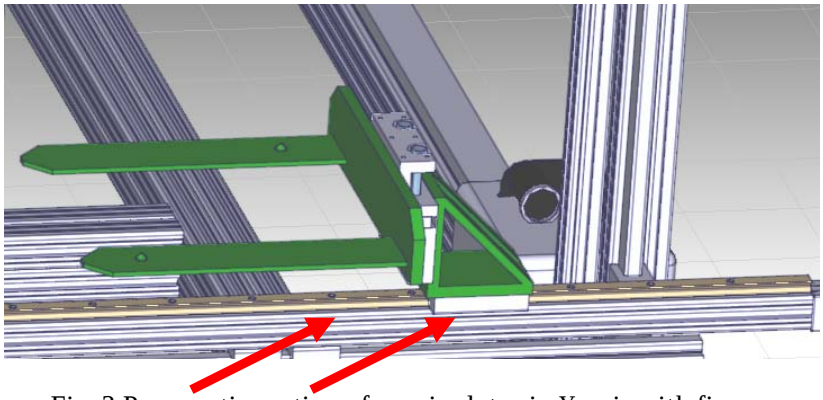

Fig. 3 Pneumatic motion of manipulator in Y-axis with finger.

5. THE SCANNING PROJECT OF PALETTE APPEARANCE IN MANIPULATOR FINGER

The finger function is important for palette touching and its safe movement to rotation unit. The construction is optimised by the shapes dimensions of palette. When we can choice each palette from the shelf cells then it has to engage to area between palette and shelf. The disengagement of palette from the staydown plugs is done by the elevatory mechanism movement. At the same time have to place on finger (Fig.4).

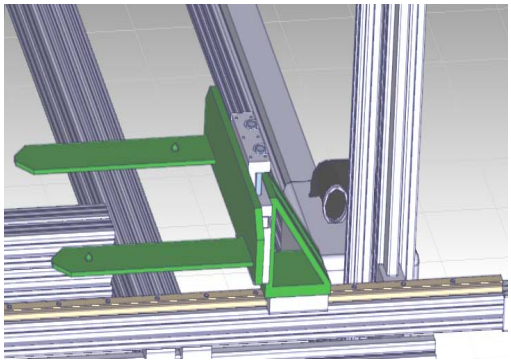

Fig.4 Manipulator gripper

Palette situation in finger is scanned by two simple pushing mechanic switches which are diagonaly mounted on finger.

6. THE SCANNING APPEARANCE AND PALETTE RESOLUTION IN SHELF CELL

The manipulator have to get the fundamental information from direction unit before, then its stated to execute the required motion: about the position in which the palette is situated in shelf.

Then must come to the verification yet:

- about the each palette presence in shelf,
- required palette number in shelf.

After the folowing final controll manipulator can find the required position in shelf in which the palette is situated.

As proper solution for required things solution (e.g. required position identification of palette placement and required palette number) are applied and placed individual shelf cells sensors with the mechanical sensors. The palettes are equipped by the holes sequences (Fig.5) which are antipole to switches and represents the binary code.

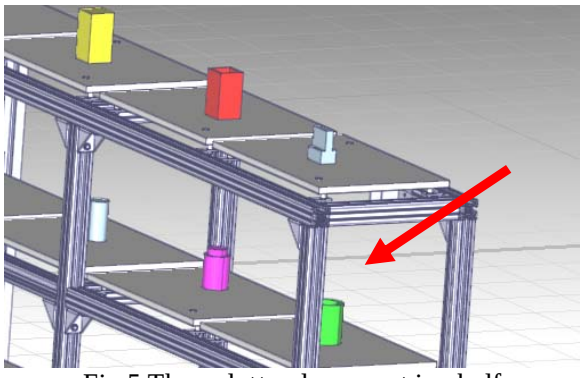

Fig.5 The palette placement in shelf

After the start of required program for machining, one of the parts group which is situated on X palette, then for the first must be sent signal from the unit for finding the palette position. Next step is identification of palette presence in cell and then is the time for the proper number of palette controll. The last step is palette selection from shelf storage system.

4. CONCLUSION

The main aim of this research project was the sequential diagram method application for intelligent cell by the sensors and its practical usage for education proces and laboratory purposes. The flexible manufacturing systems are indivisible part of manufacturing industrial process. The systems of new generations are the trends (intelligent manufacturing systems) in production process. It is necessary to say that intelligent production systems area is still in reseach phase.

This paper was realised by feasibility study: VEGA 1/0206/09 lntelligent assembly cell

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