DESIGN OF A SPECIFIC TOOL RACK FOR THE TMA AL 550 FLEXIBLE MANUFACTURING SYSTEM

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Abstract: The paper will present the design of a specific tool rack for the TMA AL 550 flexible manufacturing cell. At the TMA AL 550 flexible cell the ATR function is being implemented and in this context appeared the need for a specific tool pallet to be used in the system.

1. SYSTEM STRUCTURE AND CHARACTERISTICS

The TMA AL 550 flexible manufacturing system is located at the University of Oradea and is designed for the prismatic part machining. The main components of the system are the TMA AL 550 equipped with Fanuc CNC control (figure 1), two ABB IRB 1600 robots with SCHUNK PNG 100 grippers (figure2), an storage station (Regal storage station) and a conveyor (figure 3).

Figure 1- The TMA AL 550 machine with FANUC five axis CNC

Figure 2- The ABB IRB 1600 robot with IRC 5 controller

Figure 3- Conveyor

According to [1] the main flows through the system are:
1. Working parts fixed on the fixtures;
2. Tool-set of each working part;
3. CNC programs launching.

In order to realize the tool flow in such a manner as to have in the ATC magazine the necessary tool for each work piece the ATR function must be implemented.

2. THE ATR FUNCTION FOR THE TMA AL 550 FLEXIBLE CELL.

The ATR (Automatic Tool Readjustment) function is specific to the FMC (Flexible Manufacturing Cell) and FMS (Flexible Manufacturing System) and consists of automatic setup of a new set of tools in "hidden" time necessary for the next work piece. The solutions vary depending on the type of ATC mounted on the main machine tool in the cell or system [2].

Several options are available for the automatic tool readjustment function at the TMA AL 550 flexible manufacturing cell. The best option for this situation was determined to be the tool readjustment with reduced flexibility using a tool rack type pallet that can be accessed by the ATC.

This solution was chosen for several reasons among which we mention the fact that this method in using the least space, it doesn't need a high number of additional components (additional tool magazines, rails, a new manipulator etc) and it has low implementation cost. The disadvantage is the low flexibility, the time required to realize the tool readjustment function and the impossibility of having any "hidden time" in the system.

Basically in order to realize the ATR function at the TMA 55 AL flexible system the following components will be used. The tool will be stored in the central storage, from where based on a list of necessary tools will be picked up the ABB robot 1 and placed on the conveyor for transport to the second ABB robot which will place the tools on a tool pallet that can be loaded on the CNC machine using the APC function. The layout of the system is presented in figure 4.

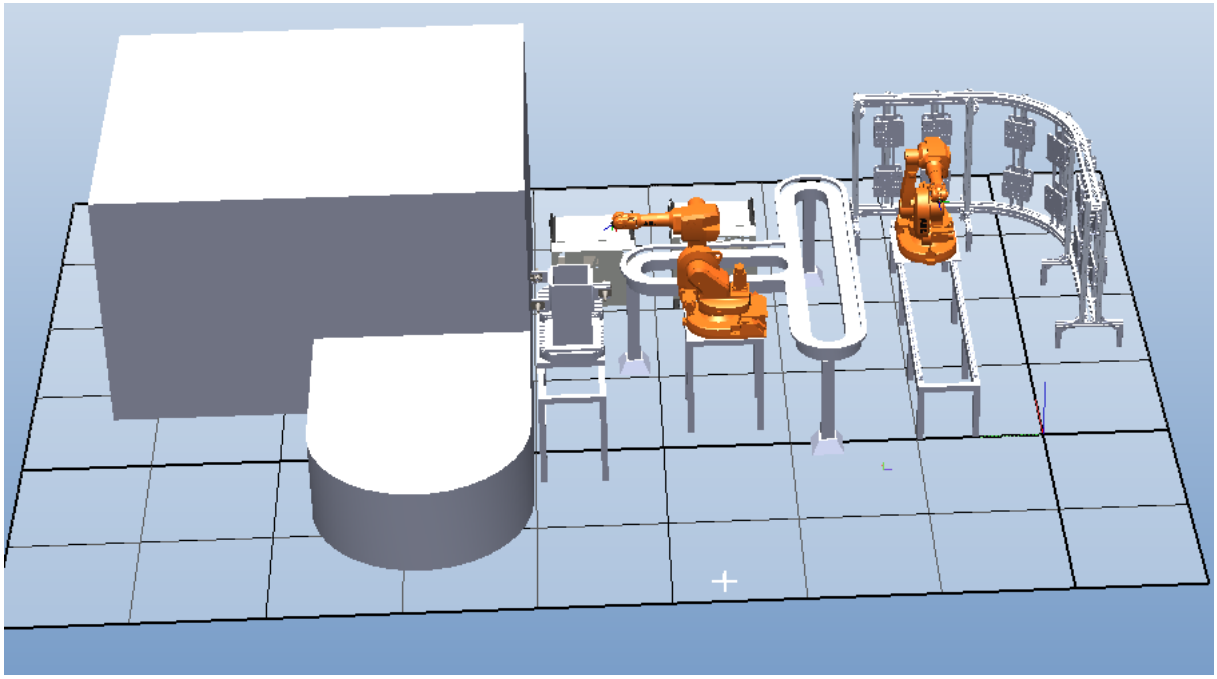

Figure 4- The layout of the TMA AL 500 FMS.

3. DESIGN OF A SPECIFFIC TOOL RACK.

3.1. THE EXISTING TOMBSTON DEVICE.

The TMA AL 550 FMS is equipped with an TOBSTONE device which uses pallets to store the materials/finished work pieces. This device is mounted on a machine table.

The device can hold 8 pallets each one containing a raw material piece/finished work pieces.

This device can be used for implementing the ATR function nut would substantially increase the time needed for a tool chance since the device is designed to always have components on it.

3.2. SIMILAR TOOL RACKS

A similar tool pallet was realized at Stimin Oradea for the CPFUS 50. The design allowed for a large number of tools (15 tools) but this was accomplished bay specially designing the machine to be able to use the pallet.

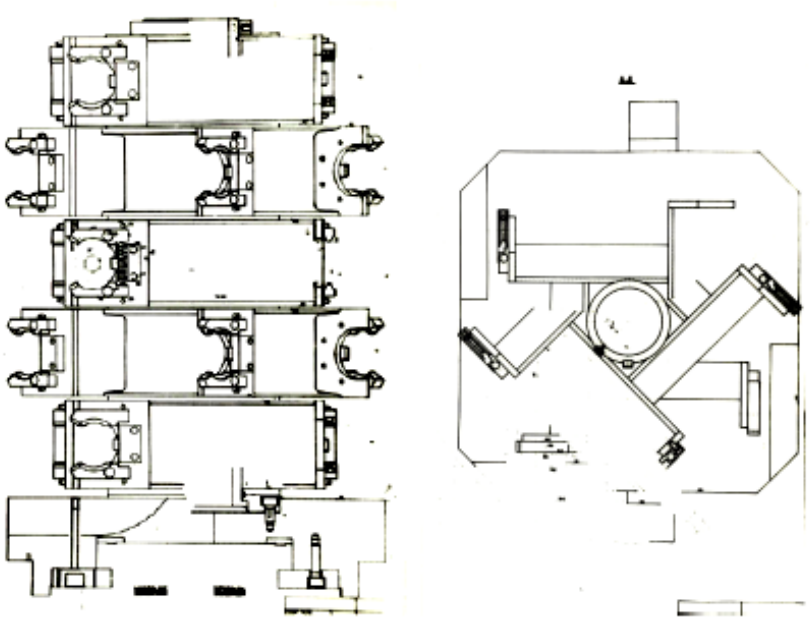

Figure 5- Tool rack storage system at CPFUS 50 CF [2]

3.2. DESIGN OF THE TOOL PALLET.

The tool pallet for the TMA AL 5450 FMS must comply with several criteria. Mainly it has to be compatible with the machine APC system. In order to ensure the compatibility the pallet had to be designed with an system that will allow it to be loaded on the APC. Also the tool rack must be compatible whit the pallets used by the tombstone device. This is necessary because the robots and conveyor are set up to use only one type of object. Basically by using this solution we can ensure the possibility of transfer trough the system on any object that meets the criteria of the transfer pallet.

In figure 6 the general structure of the rack is presented.

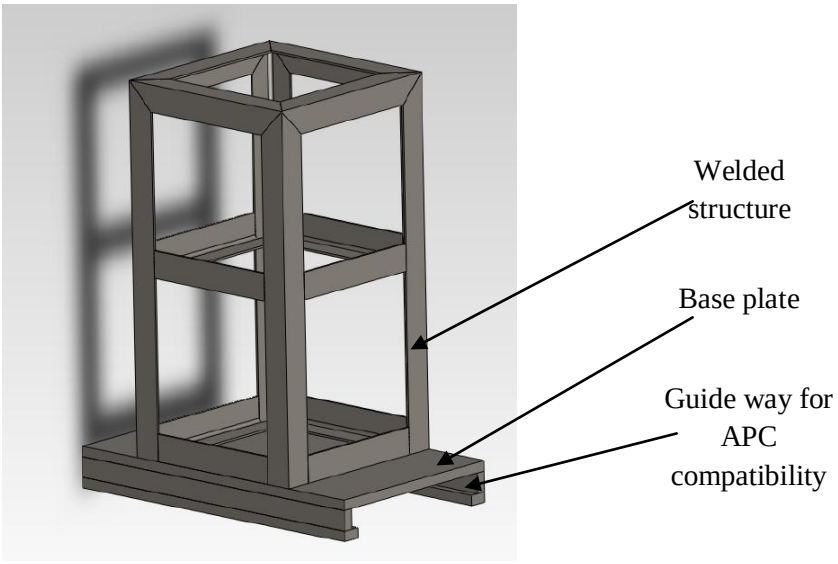

Figure 5- Tool rack

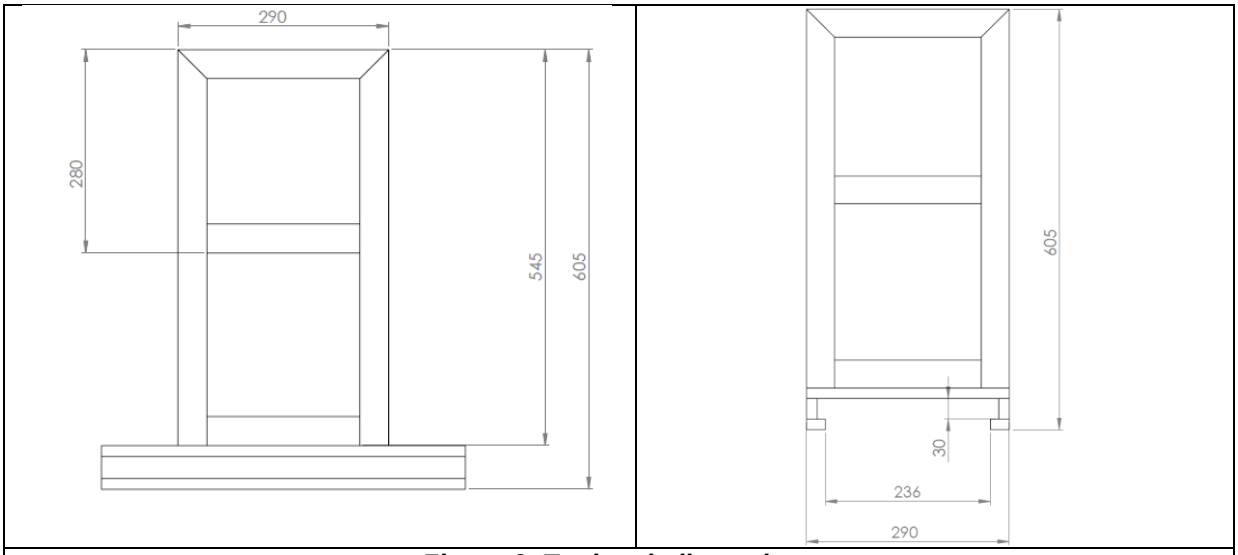

Figure 6- Tool rack dimensions

The designed pallet is compatible with the transfer pallets used in the FMS and cam be loaded on the APC. In order to use the rack a tool holding device that can be mounted on the transfer pallets needs to be designed.

AKWNOLEDGEMENT

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