

CONSTRUCTIVE AND TECHNOLOGICAL OBJECTIVES OF THE RESOURCES FLOW (WORKING PARTS, TOOLS, PROGRAMS) AT THE FLEXIBLE MANUFACTURING CELL TMA-AL-550

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Abstract: The IMT Faculty of the University of Oradea are trying to develop on own forces the newest and most modern laboratory of computer integration manufacturing, based on retrofitting activities. This laboratory will cover all the study levels (bachelor, master and PhD), having the main technical characteristics of the most advanced technological concepts as follows: five axes machining, computer assisted of the main technological flow, CAD-CAM, etc. The laboratory will contains one FMC (developed from one horizontal milling centre by IMT Faculty), two robots, one special conveyor, Regal lager, load-unload station for parts and tools, all these computer assisted and survived by the students, using one hierarchic net. The present paper work shows the main aspects of the resources flow, which will be installed over the FMC, in order to assures the automatic regime. The automatic regime at the FMC is based on resources flow, having the possibilities to adapt, to organize, to modify, to simulate all the virtual situations on the working place before the starting into manufacturing process. The resources flow need to be assured at the entry into the FMC, regarding the following resources objects: load-unload of different working parts (depending the manufacturing request), load-unload of different tools, load-unload of different CNC programs, load-unload of different other materials.

1. INTRODUCTION

The main resources flow components in the case of the FMC (flexible manufacturing cell) for the prismatic parts machining are:

- 1-- Working parts fixed on the fixtures, which are introduced together into the machining/cutting process, but on the base of manufacturing request and computer ordering/launching;
- 2— Tool-set of each working part, prepared before the machining start up;
- 3— CNC programs launching into the run process, on the base of the CAPP simulation (computer assisted ordering)
- 4— Other materials as: cooling liquid, chip evacuation, liquid for washing, etc.

The flexible manufacturing cell TMA AL 550 is developed by retrofitting from one horizontal machining centre (produced by CIMU-Italy) on own forces of the IMT Faculty.

2. DESCRIPTION

The retrofitting activity at this machine regards the following main parts/activities/functions:

- the changing of the CNC unit from Siemens 3M to Fanuc 30i – five axes;
- the changing of the motors/servomotors and drives with the newest AC-digital generation from Fanuc;
- the integration of 2 CNC axes rotary-tilting table as complementary 2 axes and as detachable manufacturing unit of the basic machine working table (on the board of the machine pallet system);
- the integration of one modular automatic fixture system, able to be loaded-unloaded assisted by robots as AWPC (Automatic Work piece Changing) function supplementary against the actual APC (Automatic Pallet Changing) function;

-- the integration of one modular tooling system in order to assures the ATR function



Fig. 1 – The general view on the actual laboratory

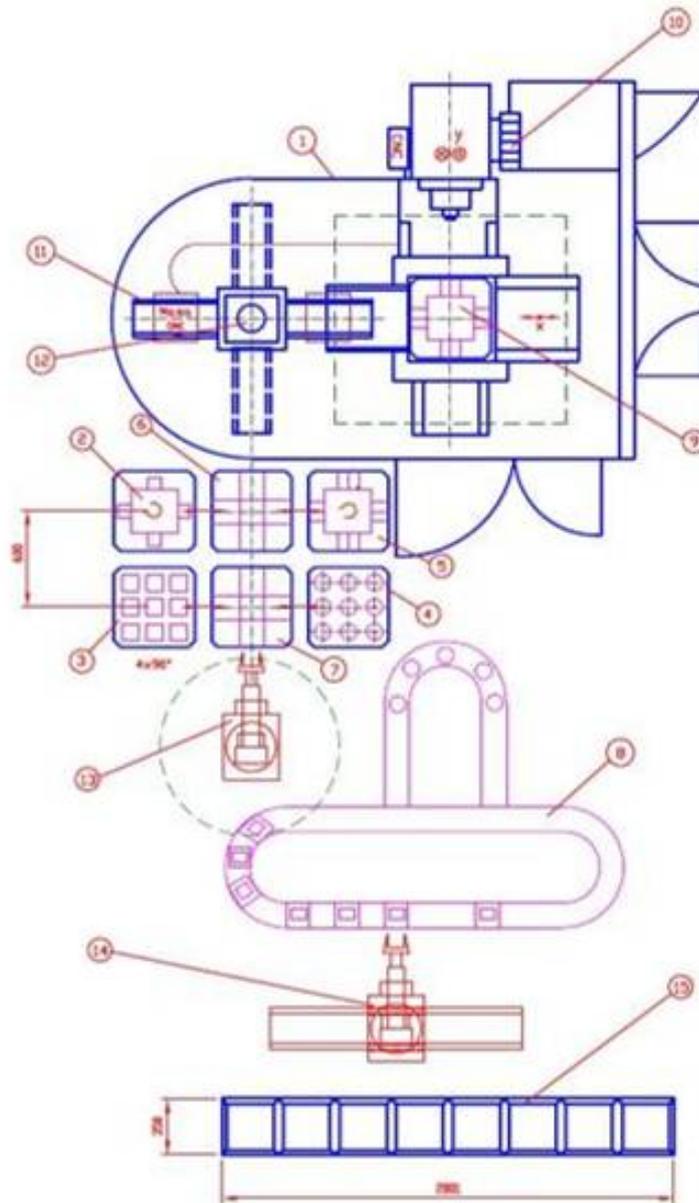


Fig. 2 – (left over) -The APC at the TMA AL 550 machine, [3].

Fig. 3 – (left) - The actual CNC unit Siemens Sinumerik 3M, [3].

Fig. 4 – (over) - The ATC unit chain type and hydraulic manipulator, [3].





Legend

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|---|---|
| 1-Flexible manufacturing cell TMA-AL550 | 8-Conveyor |
| 2-Tombstone Fixture Load station | 9-Working table |
| 3-AVPC temporary magazine | 10-Automatic tool changing |
| 4-ATR temporary magazine | 11-2 axes rotary table as detachable unit |
| 5-ATR Tool support Load station | 12-Automatic pallet changing |
| 6-Pallet Load-Unload station | 13,14-Robot |
| 7- Tool offset caption station | 15-Regal Lager |

Fig. 5 – The new layout regarding the future FMC developed by retrofitting, [5].
The basic machine TMA AL 550 (1) will be equipped with Fancuc CNC control, APC with four positions, load station for working parts on tombstone fixture (2), load station for tools on detachable support (5), pallet station with the access to APC (6), working parts support (3), tool support (4), off-set caption station (7), robot (13) and (14), conveyor (8), regal lager (15)
On the second pallet of the machine APC is disposed the 2-axes CNC rotary table as detachable unit.

(Automatic Tool Readjustment), supplementary at the actual ATC (Automatic Tool Changing) function, [1], [2], [4].

It can be find some detailed pictures over the actual machine as in the figures 1 to 4, and respectively the new layout at the entire future FMC from this laboratory.

Regarding the resources flow at the FMC, the following components of this flow can be showed:

1.The working parts flow from Regal lager (15) to FMC (for not machined parts) is: Regal lager (15)– Robot nr.1 (14) - conveyor (8) – robot nr.2 (13) – part temporary support (3) – robot nr.2 (13) – tombstone fixture (2) – pallet on load station (6) – APC (12) – machine working table (9), and respectively the back way to the Regal lager (for the finished parts): machine working table (9) – APC (12) – pallet on unload station (6) – tombstone fixture at unloading (2) – robot nr.2 (13) – conveyor (8) – robot nr.1 (14) – Regal lager (15).

2.The tools flow for ATR function: Regal lager (15) – Robot nr.1 (14) – conveyor (8) – robot nr.2 (13) – tool temporary support (4) – robot nr.2 (13) – off-set station (7) – tool detachable support (5) – pallet load station (6) – APC (12) – machine working table (9) – machine main spindle – ATC manipulator (10) – ATC magazine (10), and respectively the back way to the Regal lager (for unused tools): ATC magazine (10) – ATC manipulator (10)– machine main spindle – detachable tool support on working table (9) – APC (12) – pallet unload station (6) – tool unload station (5) – robot nr.2 (13) – conveyor (8) – robot nr.1 (14) – Regal lager (15).

3.The programs flow is separate flow between DNC hierarchic computer and the other control units (CNC of the FMC, PLC of the robots, PLC of the conveyor, PLC of the load-unload station conveyor. All the programs are resident on which control unit; the orders to run will be done selectively depending the current stage of the machining, on the base of the CAPP function at the DNC level.

4.Other material flow (cooling liquid, chip evacuation, liquid for washing, etc) will be introduced on programmable selection from which part program.

3. CONCLUSIONS

The new FMC (named TMA AL 550 after the basic machining centre) as horizontal spindle machine with ATC, APC, rotary-tilting table (detachable on the second place of APC), equipped with Fanuc CNC control on five simultaneously axes, assisted by two robots, double load-unload station (working parts and tools), one conveyor, one Regal lager, will be performed by retrofitting activity at University of Oradea on own forces. In this moment the activity started at the basic machine, in order to change the CNC control unit. The robots, the conveyor is now in position and other parts are in the project stage.

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