

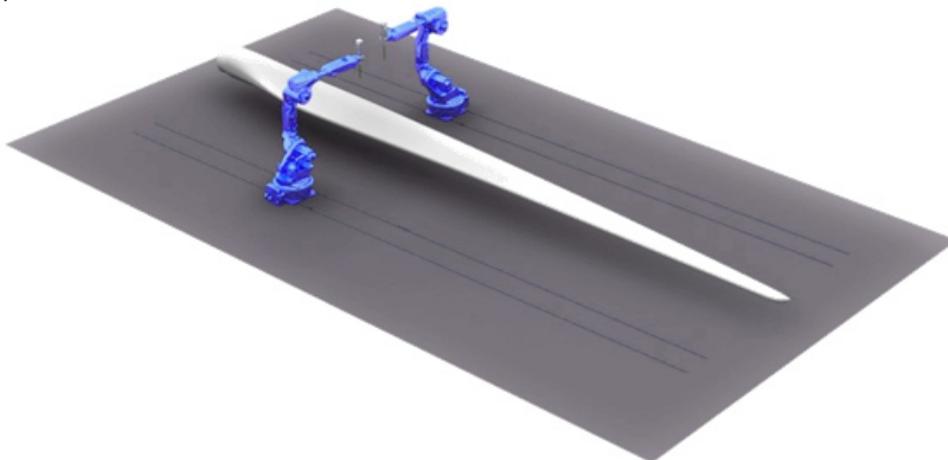
Robots change the industrial future replacing the CNC machines

Gizelis Robotics is participating in the European funded project called COMET that its purpose is to evolve industrial robots in machining operations. In this 30 month project its consortium consists of 14 participants from 8 European countries including well known companies in industrial automation, software development and metrology as also universities and research centers that with their research knowledge help to the evolution of these new technologies.

WHY THE MACHINING FUTURE SHOWS INDUSTRIAL ROBOTS

In the past the largest amount of workshops was working with standard machining operations at which each CNC machine was “running” standard programs. With the passing of years and mainly due to the big competition the word flexibility was incorporated in the industry which equals to the buy of new and expensive CNC machines. Robots can give the solution to this problem for the following reasons:

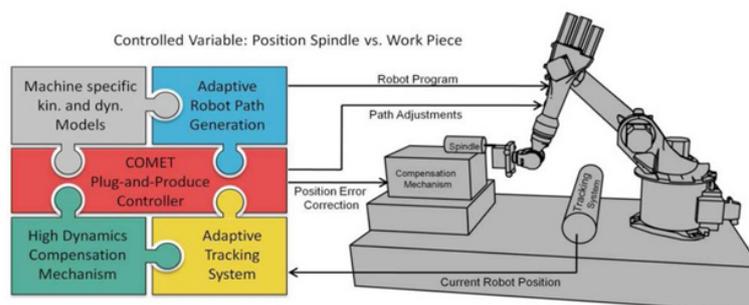
- 1) The total cost of a machining robot is 30% less compared with an equivalent CNC machine
- 2) Robot can also make the handling of the product, something that in CNC machines is done by an operator
- 3) It has at least 6 degrees of freedom providing reach ability in very difficult spots
- 4) It can be mounted on a base or in front of a positioned expanding its working envelope thus giving the opportunity to enter new application in the machining process (e.g. machining a blade of a wind generator)



Machining a blade of a wind generator with robots

PURPOSE OF THE COMET PROJECT

In order of robots to fully replace the conventional machining machines some obstacles must be exceeded and these are what the COMET consortium must do.



Working principle of the COMET robot cell

1. Robot Kinematic

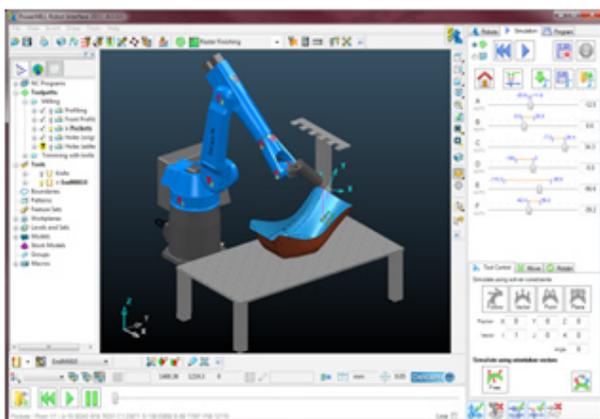
For the better understanding of the use of robots in machining operations a kinematic model must be constructed and several measurements must be made with that. With the kinematic model we can observe the forces produced to the robot during machining and movements, we can check possible creation of vibration and to finally seek better approach paths of a position. The reason is that robots compared to CNC machining centers have joint axes instead of Cartesian and so they are vulnerable to torque forces that can easily lead to a loss of accuracy.

2. Auto programming software

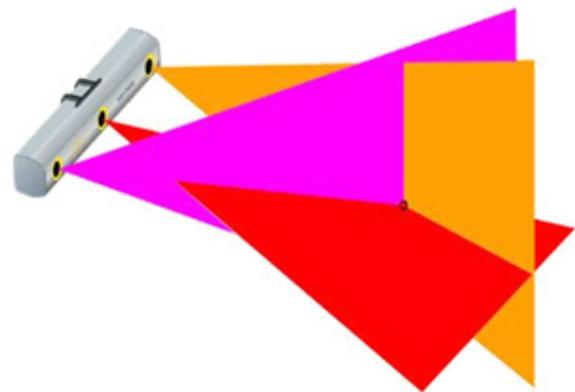
As in CNC machines the programming is easy so it must be made in the robot side as the points that the tool must pass through an operation are thousands and the standard programming language for the robot manufacturers is not so flexible for this kind of application. With this special software, the operator can generate and import automatically the entire machining program into the robot without any special robotics knowledge, as also he can interfere if he thinks that a better approach in a path will provide better results. The software will also be able to locate and fix any problems of axes alignments, singularities, angle velocities or movements out of the working envelope of the robot.

3. Tracking of the robot path

The accuracy of the path of the robotic manipulator is very critical for the final accuracy of the products. Since the robot is with joint axes the accuracy is less as due to the forces been created during the machining process a divergence from the desired path can occur. For this reason a tracking system with cameras will be placed, measuring with a frequency of 1000Hz that can calculate the divergence of the path been created from the software, of the speed as also of the accelerations and decelerations. These data will be imported to the robot controller in order to correct them as also to a special compensation mechanism.



Auto programming Software of machining



Tracking system of the robot path

4. High Dynamics Compensation Mechanism

A special mechanism of auto correction called HDCM (High Dynamics Compensation Mechanism) will be placed in the system for achieving accuracy of $<50\mu\text{m}$. The HDCM will be mounted either in the last axis of the robot or in a fixed place and it can rapidly move correcting the wrong path movement of the robot. The correction data will be imported from the tracking system and the correction movement is been made in 3 dimensions.

GIZELIS ROBOTICS IN THE COMET PROJECT

Gizelis Robotics will provide to the project its experience and knowledge in the robotics integration, will make a large number of experiment and tests and in the future will commercialize the machining robots in the industry market. For the experiments of the COMET project a fully operational robotic cell with a Yaskawa ES165D will be installed in its facilities from where crucial conclusion will occur for the different machining operations (plastic, aluminum etc). Since Gizelis Robotics is an official partner of Yaskawa Motoman it can use the latest technology that the robot brand provides for the achievements of the COMET objectives..

For more information for the COMET project connect to the web address www.comet-project.eu where you can find useful articles, pictures and videos.

Acknowledgements:

This project is co-funded by the European Commission as part of the European Economic Recovery Plan (EERP) adopted in 2008. The EERP proposes the launch of Public-Private Partnerships (PPP) in three sectors, one of them being Factories of the Future (FoF). Factories of the Future is a EUR 1.2 billion program in which the European Commission and industry are collaborating in research to support the development and innovation of new enabling technologies for the EU manufacturing sector.

For further information please visit:

http://ec.europa.eu/research/industrial_technologies/lists/factories-of-the-future_en.html