



To model spur gear using FEM, a three-dimensional model is adopted (Canau, 2009). After applying linkages between components, constraints and forces acting on the surface tensions were determined elongations and displacements that may occur. We determined also the safety factor. Safety factor specify if the part, which is subject to various static and dynamic tests by applying forces and couples, can be validate in mechanical strength terms. If the safety factor does not have correspondent values we proceed to resize the part and running again studies still obtaining the value of a correct safety factor, fig. 3.

### 2.3 NC program generation for processing piece on CNC milling machines

To generate NC programs for machining on CNC milling machine used CamWorks2009 program that generates the CNC program for different types of CNC machines. The program generated by introducing all the necessary cutting operations, to achieve the workpiece. Milling operations, drilling, etc. take place in a three-dimensional work, tool describing the movements by determining the coordinates on the three axes. It is determined for each operation:

- Type of cutting tool,
- Movement speed of the tool;
- Angular speed of the tool;
- Inclination angle of the tool and the workpiece for each pass;
- Number of passes for each individual operation;

Tool wear influences the tool geometry this may affect the dimension of the component produced in a machine with set cutting tool position (Patrascu et al., 2009). After realization of machining program of the piece, specifically for each type of CNC machine, the machine it is loaded into memory and it is executed the piece. For this case, was choised for a machine type DMG DMU 100T

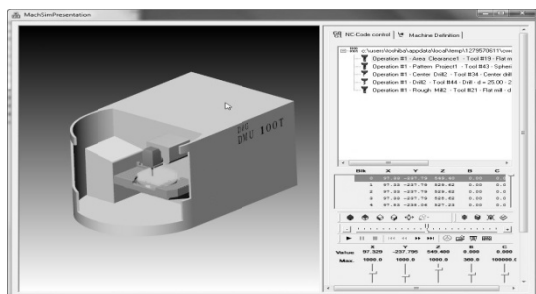


Fig. 4. CNC milling machine type DMG DMU 100T

### 2.4 Effective execution of the gear

Economic reasons, preferred to achieve piece in two stages:

- Through large-scale piece pinion type, the first phase was making by casting the piece, by conventional casting methods;
- The second stage of processing is removing additives, on processing milling machine, type CNC DMG-DMU 100T.

It is preferred the option of casting ingots because of the large scale of the pinion, and because of the reasoning for saving energy and cutting tools.

For processing of the piece from a lump, ingot type, the tool consumption, energy, realization of the program, would have been much higher.

After casting the piece, were applied the operations to remove cavity and to eliminate fishes. The piece has then placed on the working table CNC machine and processed according to program designed and uploaded for this piece. Machining allowance removed from the processing operations performed by cutting executed by machine CNC, figure 5. Finished piece has undergone to sandblast operation and to remove oxides and blast debris processing and quality control of processed surface and ultrasonic inspection for determining

casting faults. No casting defects had detected and no out of shape of the gaps and processed surfaces, fig. 5.



Fig. 5. Gear after machining and sandblast operation

## 3. CONCLUSIONS

Using techniques CAD, CAE and CAM in rapid prototyping of mechanical parts are very useful in many different situations that arise in daily practice, as follows:

- Taking decision in internal and external promotion of a product; Presentation of final project 2D, with the technical details necessary to complete the physical model of the product easier to understand, which gives an overall much better, more accessible to those who perform, modify or search for better solutions;
- Selling and foreign promoting foreign, as many products have sold before production starts. These products are usually complex and small series. Recipient will want to know everything about this new product's full presentation is more useful and easier by exposing a functional prototype;
- Models and designs to support a proposed product; In many cases, even for a trained eye is difficult to evaluate a product drawing or virtual model presented on a monitor or projector.
- Making a physical model of a given material is much more convincing, especially if it is expose to the environment in which will work and will make default a positive decision on product purchase.

This paper is part of the main author PhD. thesis that aims to optimize mechanical assemblies of industrial facilities, particularly facilities withdrawing the continuous casting of metal blanks. Future studies will focus on design, optimization and prototyping for mechanical parts to modernize and optimize plant profiles withdrawing from vertical and horizontal continuous casting of metals with direct application in iron and steel industry

## 4. ACKNOWLEDGEMENTS

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