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COMPATIBILITIES OF THE CAD - CAM PROGRAMS APPLIED TO THE CYCLOID PROFILE WHEELS PROCESSING

Anamaria Dăscălescu[1], Flavia Chira[2], Liliana Drăgan[3],
[1]Lecturer, Eng. PhD., [2]Lecturer Eng., [3]Lecturer Eng.,
North University of Baia Mare, RO-430083 Baia Mare, Dr.V.Babeş St., 62/A, Romania
e-mail: dascalescu_anamaria@ubm.ro

A***bstract:*** *The classic manufacturing process of the cycloid profile involves important technological problems. Therefore, in this paper we propose a computational method of manufacturing and control process of the cycloid satellite gears, based on the theoretical 3D Model (obtained in CAD program) using compatibles CAD-CAM programs. The same computational method can be used in generating, manufacturing and control process of other complex profiles assuring the precision of the real profile related to the theoretical 3D model.*
Key words: *generation, analyzing, simulation, manufacturing, control.*

1. INTRODUCTION

Numerous experiments point out that a major influence in the vibroacoustic performances of the cycloid gear reducer has the precision of the cycloid profile of the satellite gear. Therefore, to obtain the complex form of the cycloid profile we propose to use a CAD – CAM processing method in the generating – analyzing – simulation – manufacturing - control process of the cycloid profile wheels.

The computational method starts with 2D profile curve generation, 3D model generation and ends with the satellite gear final control.

The 3D Model of the cycloid wheels obtained in the design process is used in Finite Elements Analysis (FEA) to determine the optimal dimensions of the satellite gear's geometrical parameters observing the stress and the deformations while it is being loaded.

In the very complex situation of the satellite gear gearing with some of the sun gear's roller teeth simultaneously with some of the homocinetic coupling's thumb, the simulation of the gearing, using the 3D Models of the gear reducer parts, provides the visualisation of the gearing's type.

The 3D Model of the cycloid wheels is also used in precise manufacturing and final control process based on the capabilities of the *Coordinate centre 3D* machine and the *Coordimeter 3D* measurement machine new generation.

2. THE PROCESSING STAGES

In figure 1 we present the six stages of the proposed computational method consist in design, analyze, manufacturing and control process of the cycloid profile wheels. It is pointed out also the utilitarian programs used and the necessary machines and soft machines used in manufacturing and control of a complex cycloid profile wheels. The same CAD- CAM processing method can be used to other wheels' profile, in scientific analyses, in didactical

presentation, in current manufacturing process. Using the facilities of the parametrical drawing, we obtain increasing efficiency of the design process, increasing profile's precision and decreasing manufacturing time.

CAD – CAM PROCESSING OF THE CYCLOID WHEELS

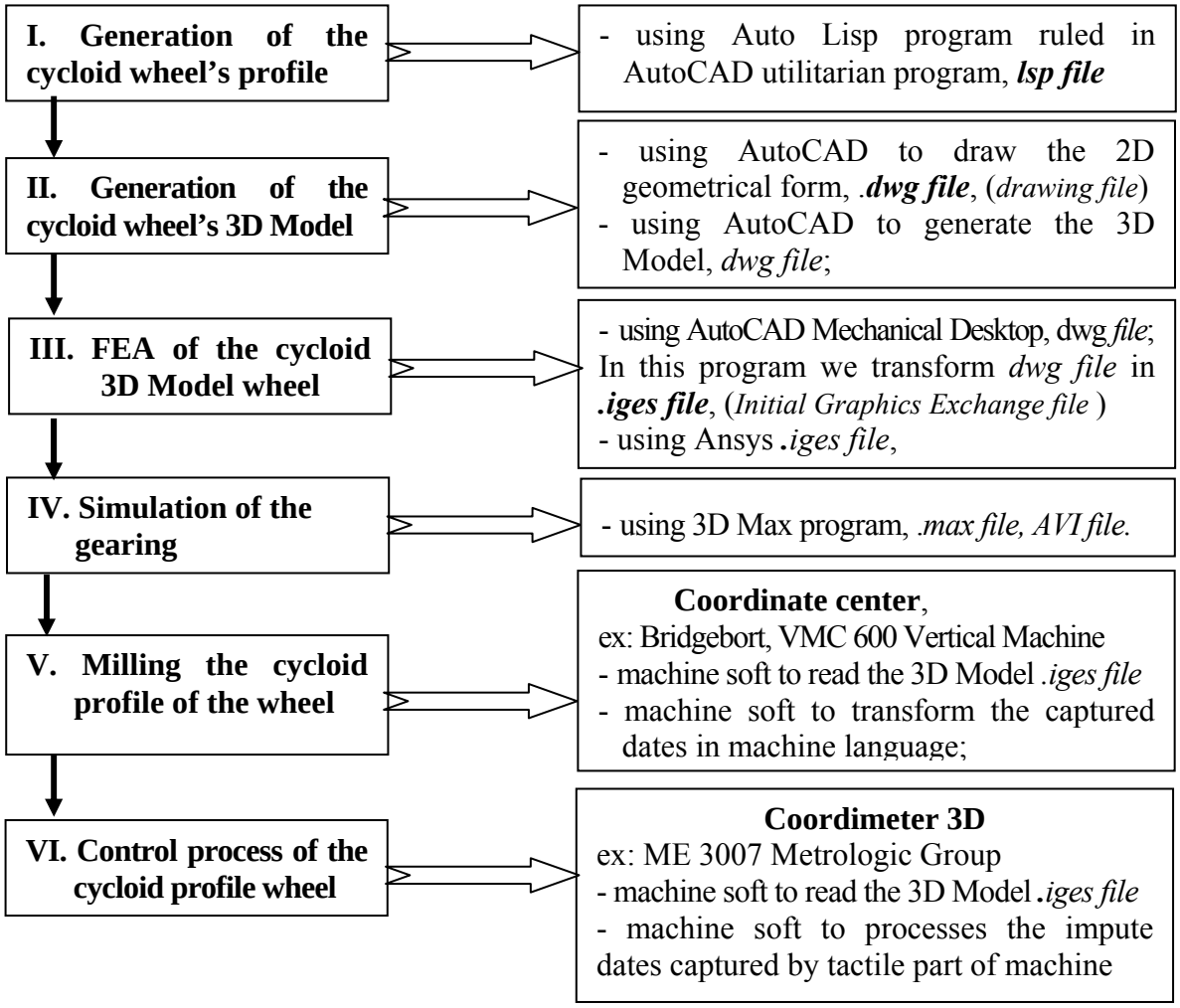

Fig. 1. The stages of the cycloid wheels CAD-CAM processing

The cycloid profile of the satellite wheels of the cycloid gears has a complex form obtained through the generation of the equidistant curve to an epi-cycloid curve. The theoretical studies and the practical experiences give as the necessary modification applied to the bottom and the peak of the teeth to obtain important improvement of the working conditions. Therefore, the resulting equidistant is modified to the beginning and to the end of the active cycloid profile of the teeth obtaining a complex form of the wheel profile.

The wheel's cycloid profile is generated in a program writhed in AutoLisp ruled in AutoCAD utilitarian program, figure 2, [1]. In the same program we operate modification of the theoretical cycloid curve resulting the 2D modified complex wheel's profile and also the 3D model of the cycloid wheel, figure 3.

In AutoCAD Mechanical Desktop we obtain the FEA verifications [3,4]. The *.dwg file* is transformed in *.iges file* using the command *File < Export* from the main Menu. With this extension, the 3D Model of the cycloid wheel it is read by the machine program of a Coordinate centre 3D machine used in milling process of the cycloid real profile using the 3D Model. The solid 3D generated in CAD programs is considerate model in coordinate center machine language.

In the process of transferring the dates from the *.iges* file of the 3D Model to the coordinate center machine, two utilitarian programs are involved:

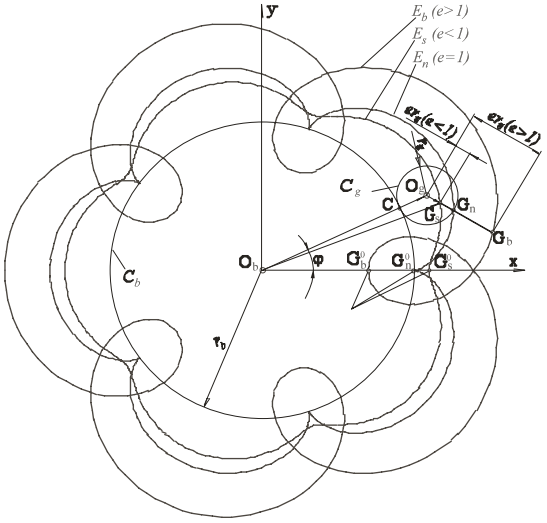

Fig. 2. Generation of the cycloid profile

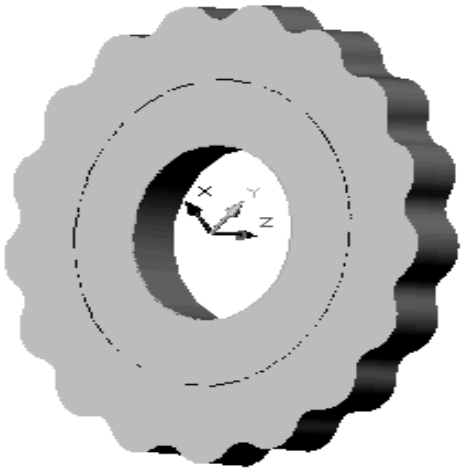

Fig. 3. 3D Model of the cycloid wheels

- a machine program who „reads" the 3D Model of the cycloid shape of the wheel and generates the points that the peak of the milling cutter go through – the preprocessor stage;
- a machine program who transforms the dates in machine language and transfers them like „extern data input" –***postprocesor*** stage.

With this technology is assured the precision and the quality of the complex cycloid shape.

The precise measurements of the cycloid profile can be obtained using a Coordimeter 3D machine, figure 4. The impute dates captured by tactile part of machine are processed by machine soft. These results are registered in data base files and also can be printed related to the solid.

For the before mentioned measurements, we present, in figures 5, 6, the processed results for a used cycloid wheel, obtained in the classic manufacturing process.

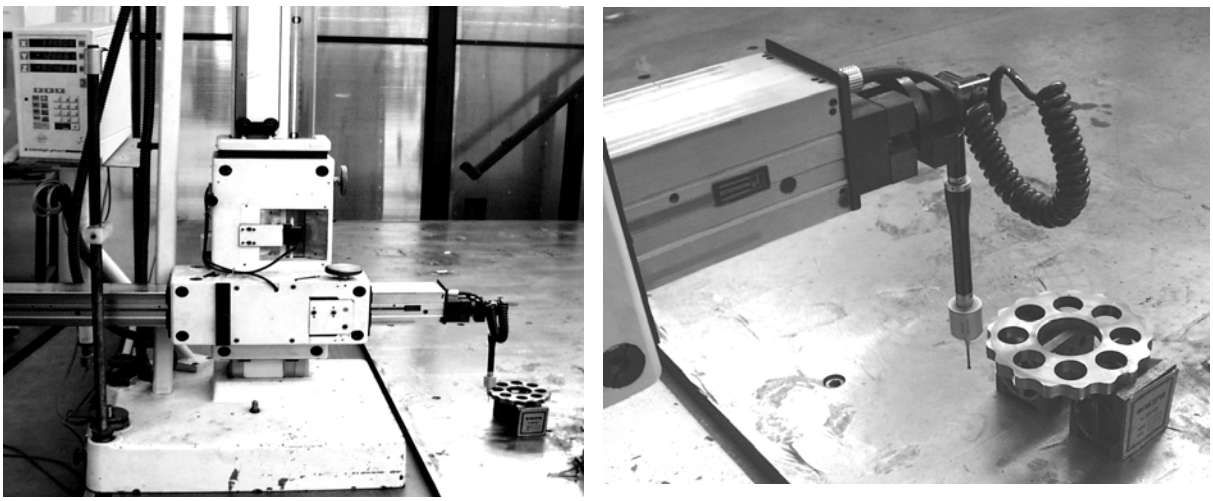

Fig. 4. The Coordimeter 3D machine used to measure the parameters of the cycloid profile wheel

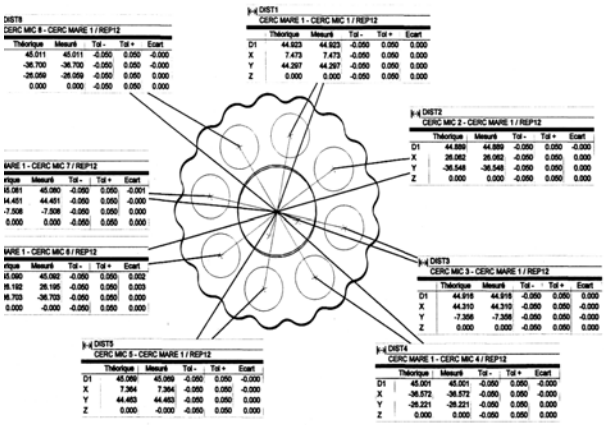

Fig. 5. The wheel holes centers circle's eccentricity.

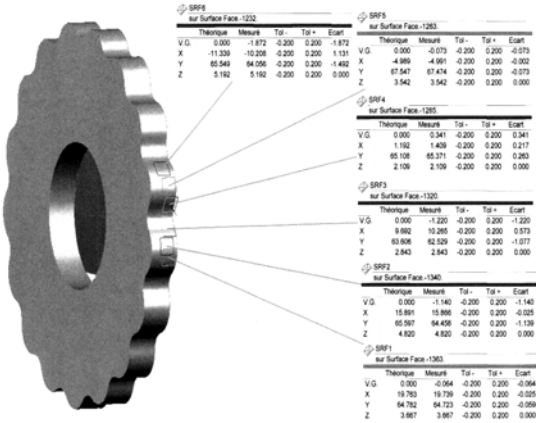

Fig. 7. The radial errors of the real cycloid profile.

Using the 3D Models of the gear reducer parts, we realize the simulation of the gearing in 3D Max utilitarian program who provides the visualisation of the gearing's types in the very complex situation of the satellite gear gearing with some of the sun gear's roller teeth simultaneously with some of the homocinetic coupling's thumb.

3. CONCLUSION

The behavior of the cycloid gear reducer is influenced by the constructive parameters of the cycloid satellite wheel [2]. Also, major influences have the technological parameters: *the shape errors of the wells' tooth* and the *roughness of the active cycloid profile*. The classic manufacturing process of the cycloid profile involves important technological problems.

Using the capabilities and the facilities of the new generation of CAD utilitarian programs and CAM process we assure the quality of the complex satellite gear.

The same computational method of manufacturing and control process can be used in generating and control process of other complex profile assuring the precision of the real profile related to the theoretical 3D model.

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