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CAD ASPECTS OF THE DESIGN PROCESS OF A COUPLING WITH FRICTION SHOES AND ADJUSTABLE CENTRIFUGAL DRIVING

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Abstract: *The paper presents few stages of the design process of a coupling with friction shoes and adjustable centrifugal driving. There are also presented some advantages of the using of CAD software.*
Key words: *Coupling, adjustable centrifugal driving, CAD.*

1. INTRODUCTION

The paper deals with constructive and functional elements of a coupling with friction shoes and adjustable driving [1, 2]. There are also presented some comparative results: Prototype vs. CAD model.

2. ELEMENTS OF MODELLING

The execution and the testing of one prototype of this kind of coupling had represented two of the major goals of the research activity. A special attention was accorded to the modelling activities based on using CAD software and methods. These aspects were solved by using the Mechanical Desktop® 6 [4] and Inventor™ 5 [5], software realised by Autodesk®. Thus, it could had been realised a 3D high resolution graphic model which simulate very accurate the prototype, according to both of dimensional and mass characteristics. In order of this, the figures 1 to 9 are shown some screen capture views of the CAD model.

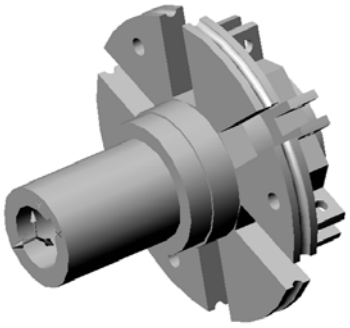

Fig. 1. The driving semi-coupling

Fig. 2. The driving semi-coupling subassembly

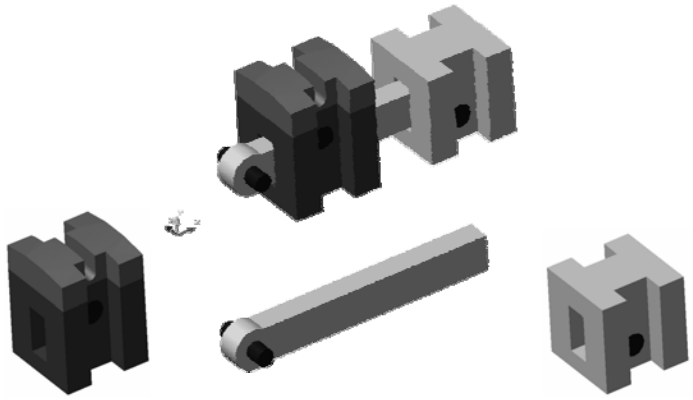

Fig. 3. The parts and group of parts of a driving mechanism

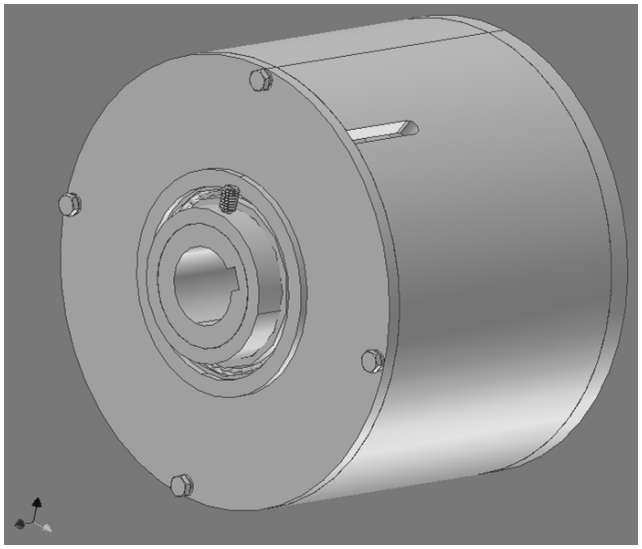

Fig. 4. Exterior view of the coupling

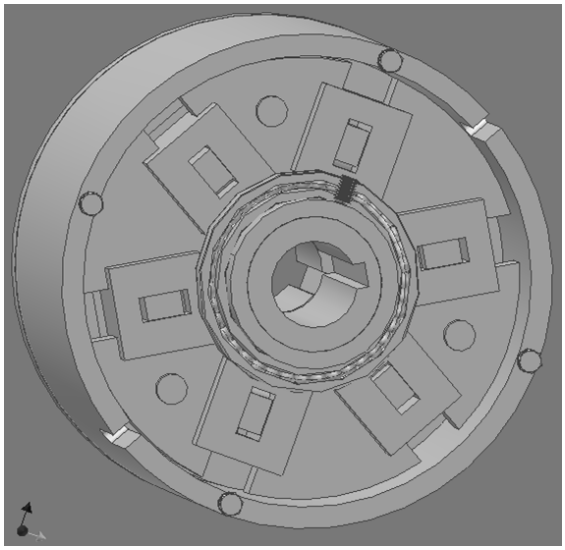

Fig. 5. Internal view of the coupling

The CAD model, in the previous stages to effective practical execution of the prototype, was very useful in solving some aspects linked to the research activity, allowing:

- A 3D high resolution views to every part of the coupling, to the subassemblies or groups of components and to entire assembly.
- The checking of the dimensional, assembling and proximity/contact/overlap compatibilities of the coupling's parts.

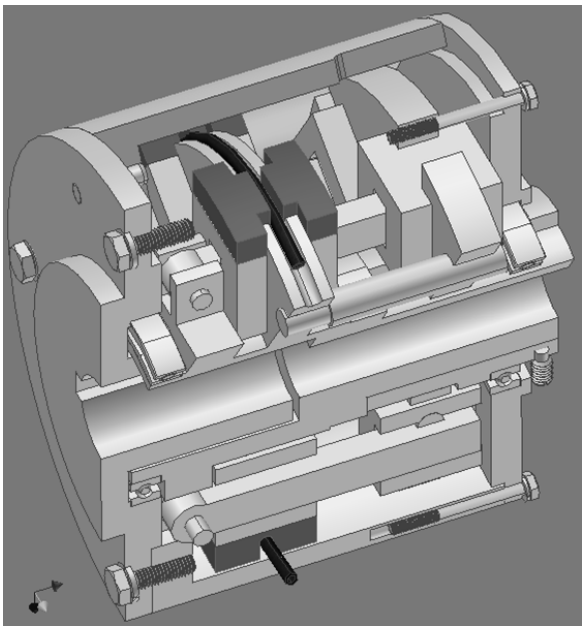

Fig. 6. Partial section

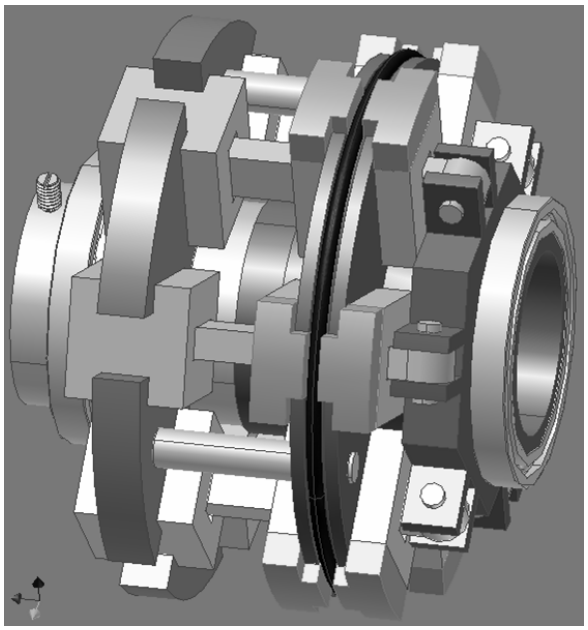

Fig. 7. The driving semi-coupling subassembly

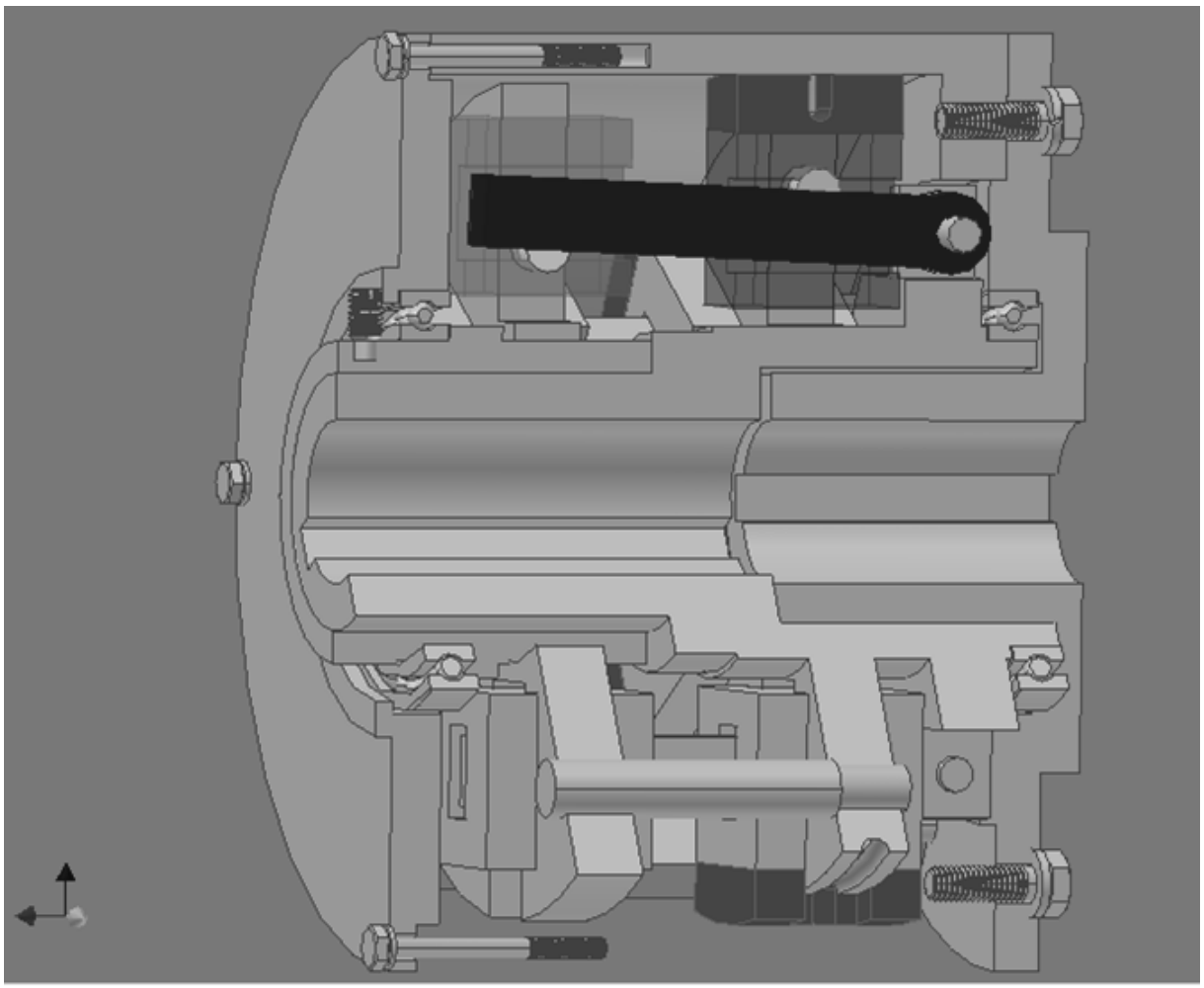

Fig. 8. A driving mechanism into its operational position

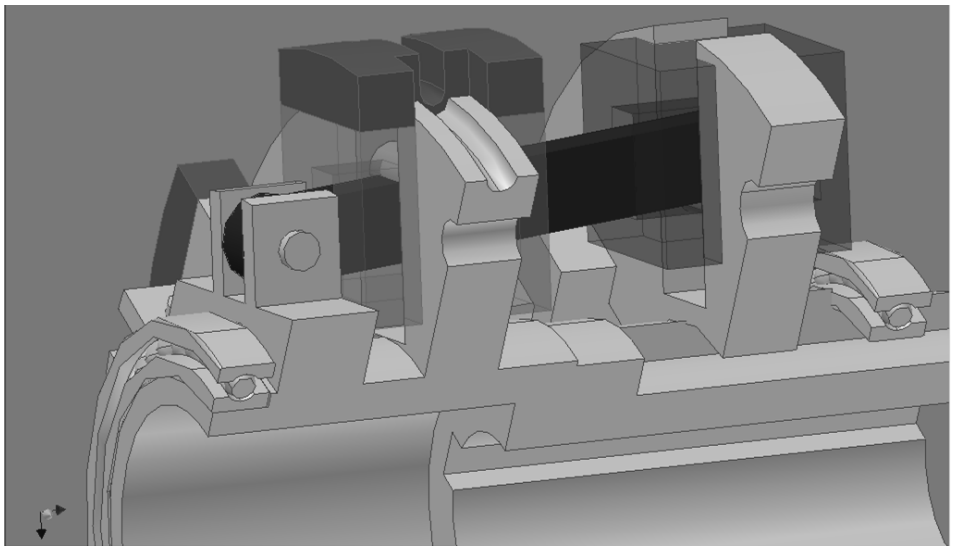

Fig. 9. A driving mechanism into its operating position

- Video simulations of the driving mechanisms' working way, of the movement of main parts and groups of parts which have an active role in the coupling's running (see figure 8 and figure 9).
- The calculation of the mass characteristics of all parts and subassemblies of the coupling.

All these aspects and many more, was helpfully to realise a correct mathematical model of the coupling's operation. Based on, it could be created a dynamic model of the coupling's operation and also a model for numerical simulations of operating performances.

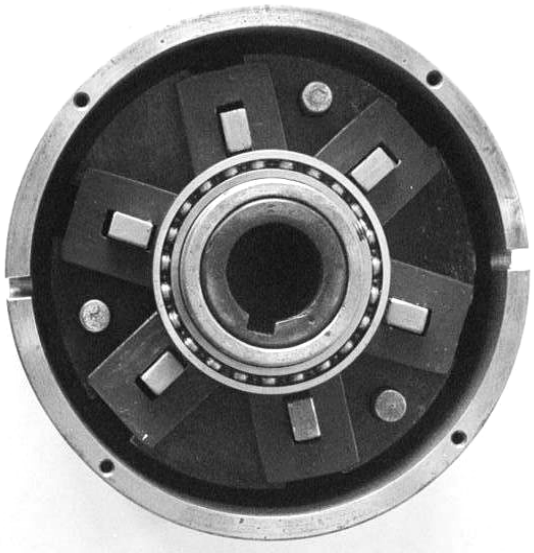

Fig. 10. Internal view of the prototype

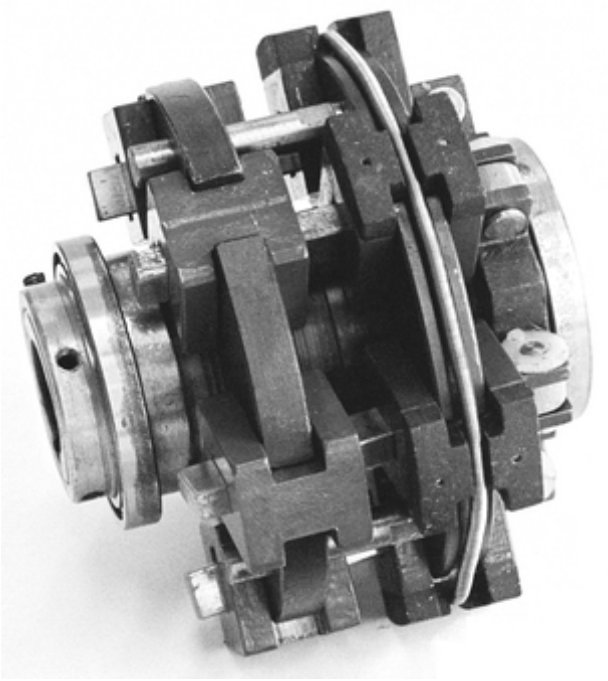

Fig. 11. The driving semi-coupling subassembly

In respect to the mentioned aspects, some of the most important numerical results were the mass, the position of the mass centre (centroid) and the mass moments of inertia for the parts, group of parts and subassemblies of the coupling. An example of this kind of results is presented in the table 1. These results were also used into the comparison with the experimental results provided by the analyses of the coupling's prototype (see figures 10 and 11). Thus, few examples are shown in the table 2 as an example of the accuracy of the CAD results. Very appropriate values and minimal differences between the mass values obtained by measuring the prototype's parts and the values provided by the CAD model can be observed.

Table 1. Mass properties' numerical results for the driving semi-coupling subassembly

Part/Subassembly: **SHOE + FRICTION LID + BOLT**			
File: ...\Saboti_000.dwg			
Mass properties for multiple components			
Input / Output units: Metric (mm, kg)/ Metric (mm, kg)			
Coordinate system: User coordinate system (UCS)			
Summary:	Mass	6.13343351 kg	
	Volume	773391.75900390 mm^3	
	Surface area	281449.39859445 mm^2	
Centroid		Mass products of inertia	
X	0.00000000 mm	XY	0.00000000 kg mm^2
Y	47.93697810 mm	XZ	-0.00000000 kg mm^2
Z	-87.00000000 mm	YZ	-655.34991327 kg mm^2
Mass moments of inertia		Radii of gyration	
X	1580.01406867 kg mm^2	X	100.27410784 mm
Y	1215.13763888 kg mm^2	Y	87.93688275 mm
Z	387.45601869 kg mm^2	Z	49.65574881 mm

Table 2. Mass values for the main coupling parts and group of parts

Part		Part weight			Difference relative to nominal weight	Error to nominal weight
		Real	Nominal (Theoretical)	Provided by the CAD software		
Type	Mechanism index	10^{-3} [kg]			10^{-3} [kg]	[%]
Shoe (with bolt)	1	158.2969	157	0.15713877	1.2969	0.8260
	2	157.2051			0.2051	0.1306
	3	156.8978			-0.1022	-0.0650
	4	157.3069			0.3069	0.1954
	5	157.4591			0.4591	0.2924
	6	156.4247			-0.5753	-0.3664

3. CONCLUSIONS

The CAD model realised for the designed, made and studied coupling allowed important ways and aspects of research, few of them being mentioned above:

- First of all, the study and the check of many aspects linked, for example, to the constructive principle, dimensions, operational properties and capabilities obtaining very valuable information before to start the execution of the prototype.
- In the same time, the CAD model helped us to estimate the mass values of the coupling's parts, group of parts and subassemblies, before to realise the prototype. These information were extremely useful into the process of estimating the performances of the designed and studied coupling.
- The CAD model analyse permitted the measuring of many dimensions too, dimensions confirmed by the prototype.
- Another valuable way for using the CAD model was the 2D drawings used for the prototype execution.
- Finally, one of the most spectacular advantages offered by the CAD model was the possibilities of creating video simulations in which the coupling's way of operating could by seen and analysed, aspect almost impossible to be observed on the prototype.

4. REFERENCES

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[4] Autodesk®, Inc. Autodesk® Mechanical Desktop® 6 Power Pack. Copyright© 1982-2001.

[5] Autodesk®, Inc. Autodesk® Inventor™ 5. Copyright© 1996-2001.