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THE RAPID PROTOTYPING IN THE PRODUCT DEVELOPMENT

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Abstract: *Nowadays, at the beginning of the 21st century, we meet very often different, sometimes quite strange applications of various technologies, especially in the case of new technologies. This is true also in the case of RP technologies, that have a very large application in different fields, from industry to medicine. This work presents an industrial application of RP technologies related to the product development with its usage in diverse tests, evaluations, verifications and presentations.*

Key words: *rapid prototyping; product development; PDM, CAD/CAE/CAM.*

1. INTRODUCTION

It is well known the fact that nowadays, the producers, in order to maintain themselves on the market, have to launch a new product, or the improved alternative of an already existent product, in a time as short as possible, anyway, before competition. This fact obliges the producers to make use of new methods of products development and improving, which, besides the reduced time, to also ensure low costs. These methods are tightly connected to the computer, because nowadays, the designing work of an engineer can't be conceived anymore without the computer. This happens because, no matter of specialization, the virtual representations are becoming the current language of expression, being more suggestive than a drawing on a paper.

Regarding this fact, we can speak about *Product Developing Management* **(**PDM**),** which represents both a philosophy and a method, respectively a software package offering data about product, production etc., and which obliges the engineer not to ignore the general in favour of the particular details. Having in view the above mentioned things, some define *PDM* as *Product Data Management*, thus offering a larger meaning. At the same time, we have to mention that PDM makes a tight connection between the CAD/CAE/CAM techniques, these being the most important in the developing of a product. This connection is presented in Fig. 1, from which also results the division of the CAE module in sub modules, such as:

- modules for DFX techniques which, at their turn can be divided as shown in the figure;modules for analysis;
- with the finite element (FEA);
- rapid Prototyping (RP);
- rapid Tooling (RT).

Thus, we also reach the *Rapid Prototyping* (RP), an extremely important element in the developing of products. This happens due to the fact that according to the patterns made through these technologies, called RP patterns, various tests can be used, such as:

- functional tests;
- simulation tests;
- control tests;
- fabrication tests;

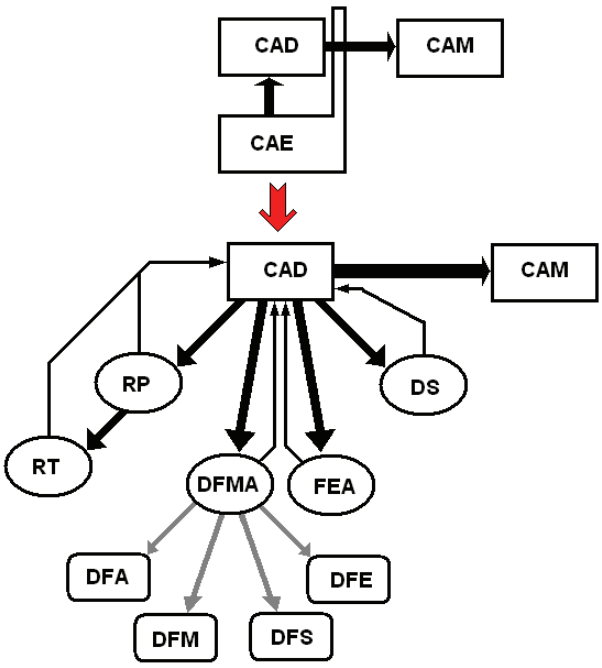


Fig. 1. Connection among CAD/CAE/CAM techniques.

- fixing and assembling tests;
- packing tests.

Most of the tests must lead to:

- the visual acceptance of the product;
- the understanding of its construction and functioning;
- the finishing of measuring elements.

Next, this work presents an example for the use of RP in the developing activity, regarding fixing and assembling tests for the finishing of forms and quotas.

2. SCREWING UP POST – EXAMPLE OF RAPID PROTOTYPINGP MODELS USE IN THE DESIGNING ACTIVITY

2.1. Generalities

We have the problem of the making of an automatic screwing up ensemble for the family of *client* pieces presented in Fig. 2. We have to mention that the pieces are symmetrical in their type-dimensional group. These pieces, during the screwing up operation, are set on the

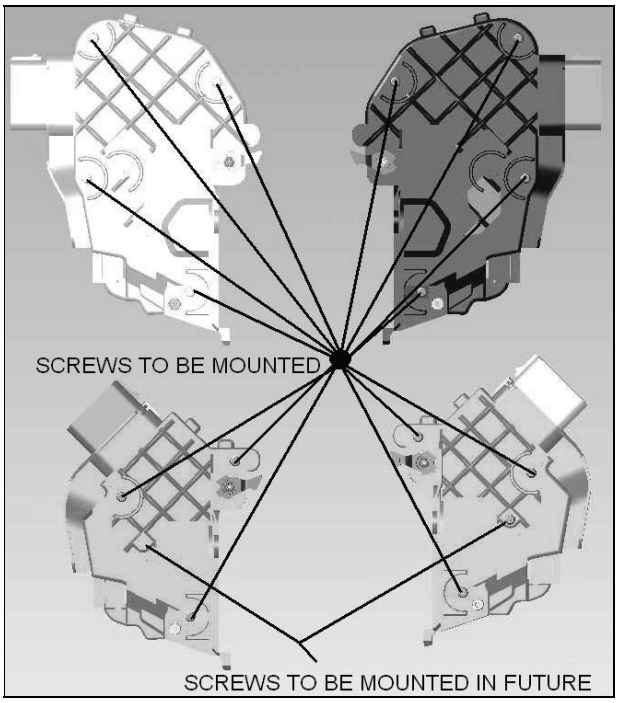


Fig. 2. The *client* pieces.

assembling plate, prepared as in Fig. 3. The *client* pieces are set on the assembling plate as in Fig. 4. The screwing up will be made with a pneumatic screwing device with automatic provisioning. At the same time, we must take into consideration that in future the number of the mounting screws will increase.

The fixing of the pieces is made with a stopper ensemble, made up of a stopper plate and centering and pressing elements. The drawing near of the two pieces with the *client* pieces between them is ensured by the pneumatic lifting device, presented in Fig. 5. The assembling plate is centered in this device, and the *client* pieces, in their turn, are centered in the assembling plate. Thus, the stopper plate must also be centered in the pneumatic device. The centering and pressing elements must be centered in the stopper plate.

In this case, the RP was used for the making of the RP pattern of the stopper ensemble, that is of the stopper

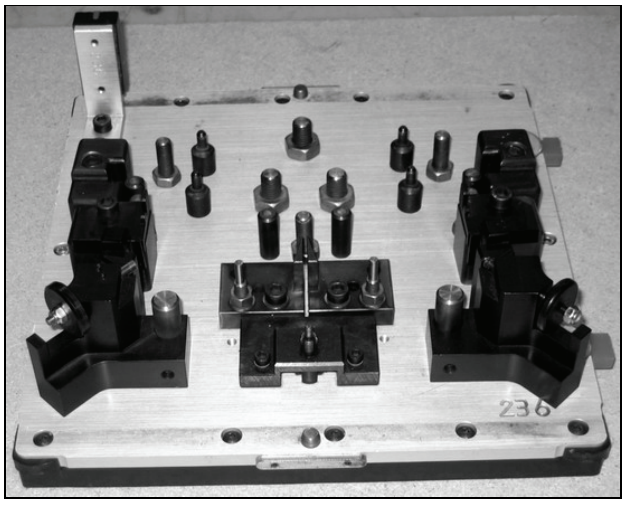


Fig. 3. The assembling plate.

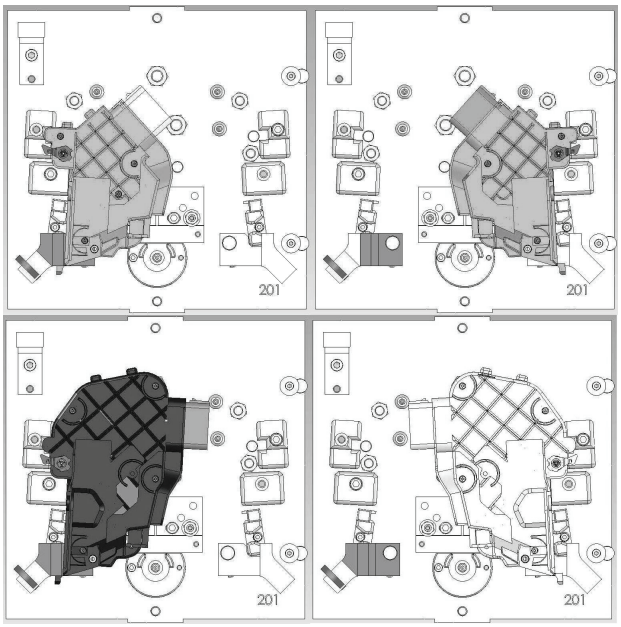


Fig. 4. The arrangement of the *client* pieces on the assembling plate.

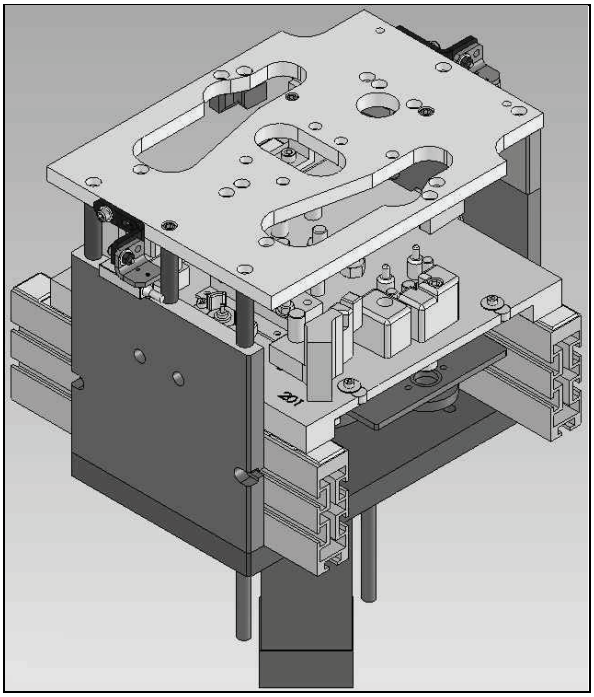
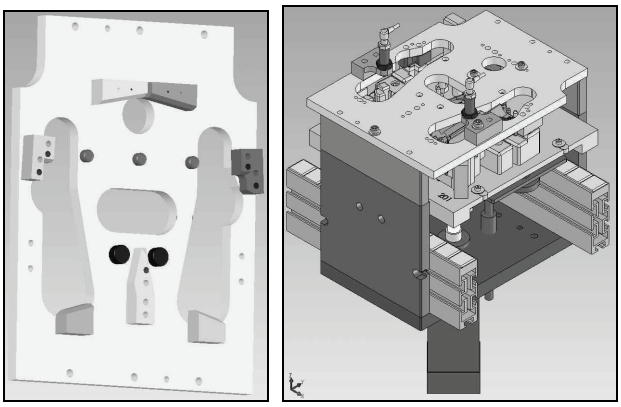


Fig. 5. Pneumatic lifting device.

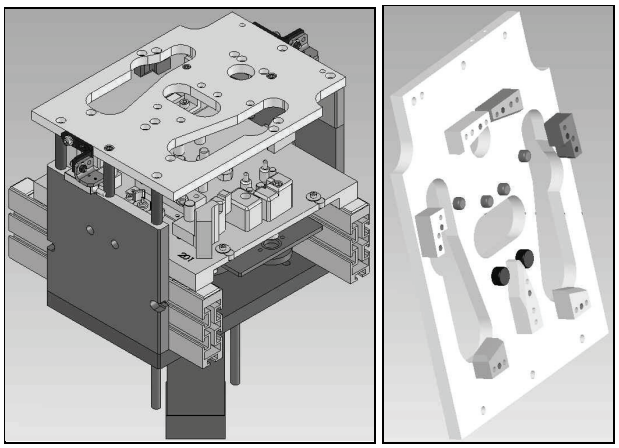
plate together with the centering and pressing elements mounted on it, for the checking of the joining with the client pieces, respectively with the assembling plate, and the correction of the possible errors, which we must admit to have existed.

The designing of the stopper ensemble. The designing of this ensemble was made with the modeling package 3D Solid Works 2005. Initially, it had the shape shown in Fig. 6.a, but integrated into the ensemble it looked as in Fig. 6.b. Having in view the necessity of the detections implementation and of the elimination of some errors, the post evolved up to the stage presented in Fig. 7.a, and the plate in Fig. 7.b. At this moment the RP pattern of the checking ensemble was performed.



a b

Fig. 6. The initial configuration: a) initial shape, b) ensemble.



a b

Fig. 7. The intermediary configuration: a) stage of the post, b) plate.

The RP model of the stopper ensemble. This model was performed through stereo-lithography, the first existing RP technology.

In this purpose, within SolidWorks 2005 program the file **.stl* was made, starting from the CAD model made in the same program. For a very good precision of the model, the quality of STL representation was highly set. This fact led to a longer making time. But in this case this fact wasn't disturbing, because a quality as high as possible was pursued.

The produced RP model is presented in Fig. 8 (already set in checking position).

The performing of the tests. The performed tests were visual and they pursued the discovery of some interferences, as well as the accuracy of the centering. The centering way was correct and consequently it was accepted, with the mentioning that the centering elements will be pinned to the stopper plate only after trials and small adjustments. On the other hand, two interferences were discovered between the centering elements and the *client* pieces (Fig. 9), respectively between the assembling plate and the stopper plate. At the same time it was noticed that the client pieces have the tendency of *butting* between the centering elements.

The definitization of the product. In the final stage, the deficiencies discovered according to the tests made with the RP model were removed. Thus, the plate reached the configuration seen in Fig. 10, and the whole ensemble reached to the configuration shown in Fig. 11.

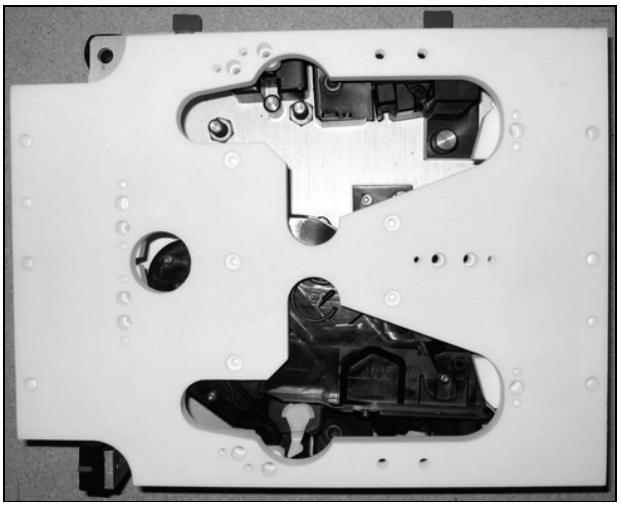


Fig. 8. The RP model.

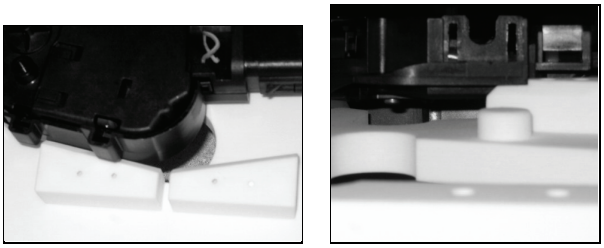


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Fig. 9. The detected interferences.

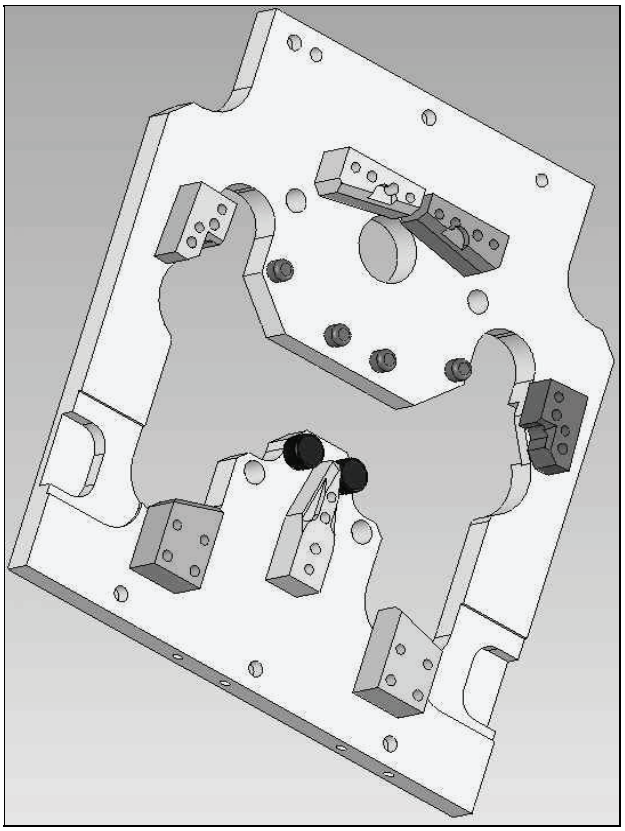

Fig. 10. The final configuration of the plate.

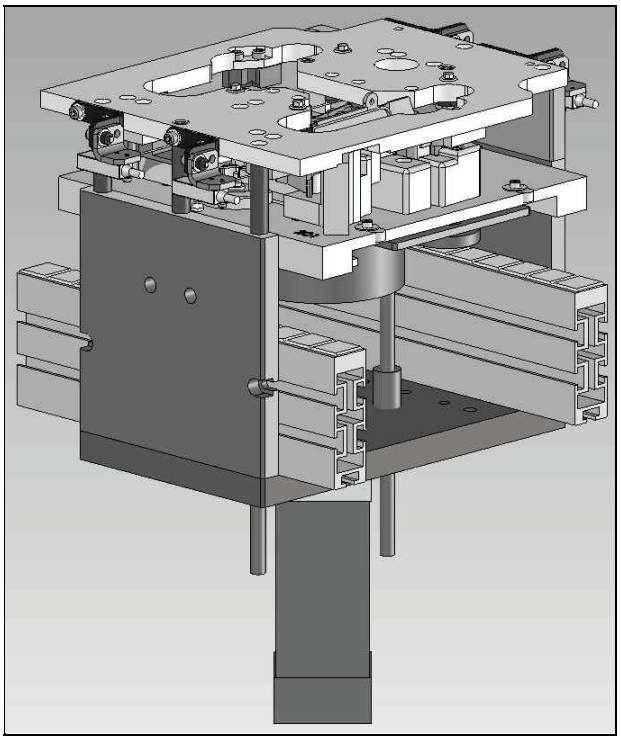

Fig. 11. The final configuration of the whole ensemble.

In order to avoid the *butting*, some extractors with spring were added.

3. CONCLUSIONS

As we can notice from this work, for the developing of a product, its early checking is very important, so that the possible designing errors could be detected and removed as soon as possible, with low costs. And this possibility is offered by the use of the Rapid Prototyping in the developing of products.

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