PRODUCT CREATION DEVELOPMENT FROM INNOVATIVE SIMULATION METHODS TO PRODUCT LIFE MANAGEMENT SYSTEM

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Abstract: Starting from product vision, identifying preliminary alternatives, during confirmation of the product and process design phase, rapid prototyping (along with rapid tooling and rapid manufacturing technologies), are disjunctive from the PLM systems: at this moment no applications are offered on the market to integrate RP into a company development system. It is almost certainly that in the proximate time RP will be part of the PLM strategy. This paper is approaching the key principles, directions and possible solutions based on a case of study, starting from design from ideation, product creation and continuous improvement of the manufacturing process with the help of rapid prototyping system.

Key words: design for RP/ RM, industrial design, PLM, CAD/CAM/CAE applications

1. INTRODUCTION

Industrial design is characterized by certain conditions involving – at the outset a certain design – a method of manufacturing, based on the use of high technology and equipment improved (especially the rapid prototyping). Generally, the industrial design requires the followings (***, 2010):

- construction the shape to justify the design only by reference to product quality cover with a specific use;
- parts components linked to geometric shape according to the purpose for the entitle assembly to be manufactured;
- materials and shape structures to be chosen with regard to the requests arising from the functions or uses of the assembly;
- development and procurement of the parts does not involve excessive economic efforts;
- general assembly made so, to be as easy to use, handle and manipulate;
- the design will provides maximum comfort and efficiency possible at that time of creation;
- the general assembly subject to a minimum need for maintenance or operating expenses;
- the design activity will give the interrelationship between environment and development process: the product must meet the mandatory safety requirements and environmental protection.

What is the problem statement? PLM systems are key applications, usually developed by large software vendors and adapted to the requirements of end users. From what we know so far (Batenburg et al., 2007; Ni et al., 2008), no developer of PLM systems does not include software applications for rapid prototyping. An example of a PLM system that we developed at the Polytechnic University of Timisoara, Romania in 2009, is one whose functions are presented in Figure 1 (a custom PLM system).

At that time, we do not put the issue of integration functions of rapid prototyping in the PLM system, but only to create another type of PLM system – in our university –, an innovative system, which contained only data packets of the

CAD, CAM and CAE applications (***, 2009b; ***, 2009c; ***, 2009d). With the development of rapid prototyping departments, both in our university, and especially in industrial practice, we considered it appropriate to include the function of rapid prototyping.

Fig. 1. The Custom PLM functions (***,2009a)

2. RESEARCH COURSE AND TEHNICAL SOLUTIONS FOR THE PLM SYSTEM WITH RAPID PROTOTYPING FUNCTIONS EMBEDDED

When designing a new PLM system, we started from the following requirement: what do engineer need in design and manufacturing automation.
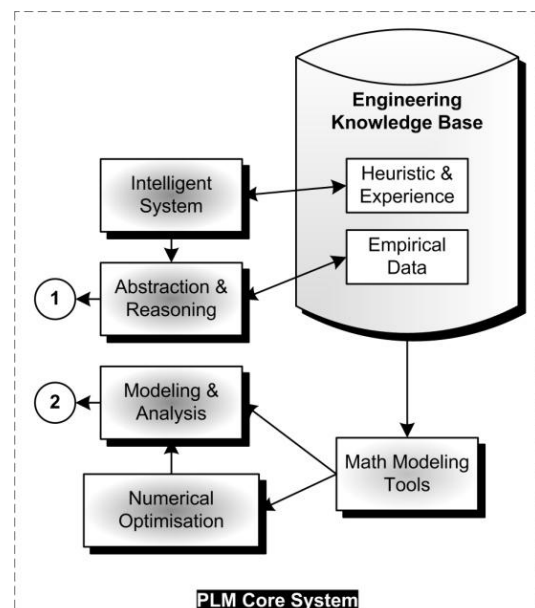

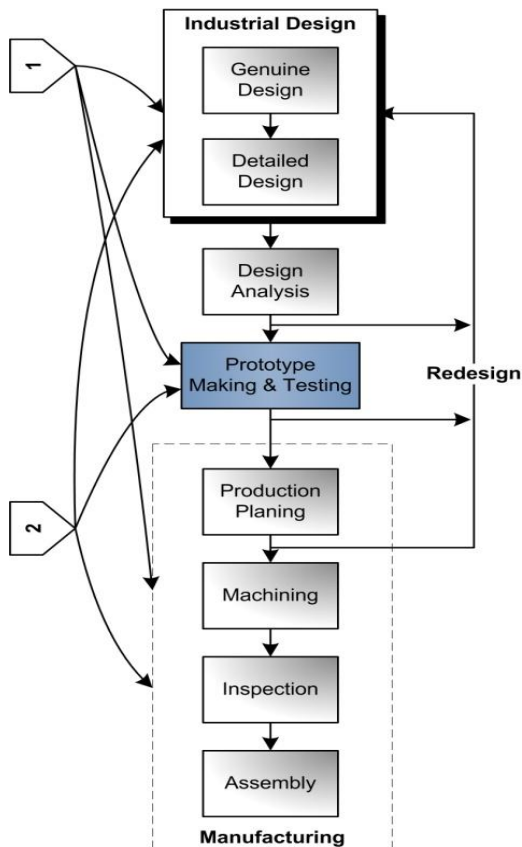Fig. 2. PLM core system used to develop the Custom system (Dong, 2010)

Fig. 3. Product development activities and PLM corresponding functions

The aim of the new PLM system is: better results, high efficiency and lower costs for the products and for the processes. A PLM system that includes rapid prototyping applications is able to process graphic and non-graphical information (symbolic – like Artificial Intelligence and intelligent systems; numerical – FEA, numerical optimisation; and fuzzy). The PLM's tools to realize these objectives in Rapid Prototyping domain are:
- qualitative reasoning – possible alternatives;
- quantitative analysis – best solution.

Traditional practice of industrial activities in new product development, is shown in Figure 3. Note that this figure contains steps shown in Figure 2.
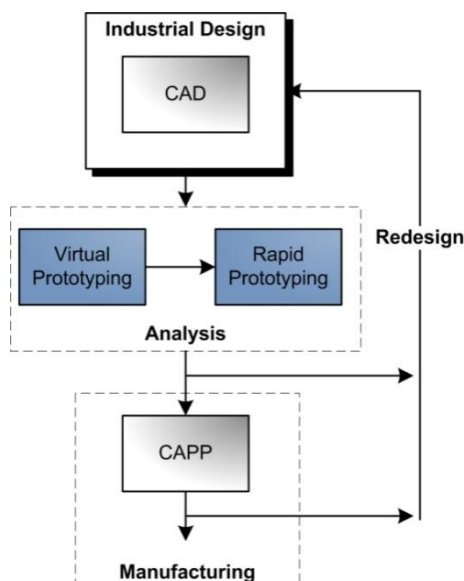

Fig. 4. Rapid Prototyping functions included in PLM system

Figure 4 is a schematic functional block for the new built PLM system. Note the Rapid Prototyping position among the analysis of new product in the concurrent engineering development.

For the operating system we adopted the *Linux* distribution *openSUSE*, supported on an *x86-64* platform. For the relational database management system we adopted *MySQL* version 5.1. This cross-platform software application runs as a server providing multi-user access, and it was easy to interconnect with RP simulation tools. At this stage, the new PLM system is not fully functional. It was designed only to test the functions of RP in a concurrent engineering environment and is not yet available for industrial use.

3. CONCLUSIONS

In 2009 we developed in our university a PLM system, conceived to expand concurrent engineering techniques. Largely, this new PLM is based on software available shareware. Although not all the functionality of a state of the art PLM, our PLM can be adapted easily to research activities, being an open system.

As is known, does not include any PLM system simulation Rapid Prototyping process. We have tried to introduce the possibility of RP simulation into the PLM system, by various methods available in our university. We believe that this is the direction to be followed by industrial enterprises, because we could have this method (Dong, 2010):
- generation of the **all feasible solutions** (reasoning);
- parameter optimisation for **each feasible solution**;
- identification of the **best solution** (exact –comparing all; or fuzzy – using the most likely case);

Although it is premature to launch a line of reasoning – in our estimates – including the Rapid Prototyping into PLM system will result in a shorter R&D time about 10 ... 20% and eliminating errors in the design stage up to 30%.

4. REFERENCES

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