

## PRODUCT DATA MANAGEMENT SYSTEMS (PDMS) AS A SUPPORT IN STUDENT ENGINEERING DESIGN ACTIVITIES

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### ABSTRACT

*Technical Information Systems / Product Data Management Systems (PDMS) have proved justification of their use in practice, among rest, in support of new product and company development. At the same time, there is a fact that PDMS technologies are not exploited enough, neither in practice nor at technical universities.*

*This paper presents results of PDM system usage in support of student engineering design projects realisation. Introduction of PDM system was a planned activity. Each of the process phases have been defined as well as the most important parameters for process interconnection. Structure of the product was also defined and specific concepts were introduced as a functionality of PDMS technologies. The projects were developed to the level of data management through the product lifecycle.*

**Keywords:** PDMS, student engineering support, data management, team work

### 1. INTRODUCTION

The field of engineering graphics is under major influence of fast changes in fields of computer graphics and graphics tools software. Although the principles on which geometrical models are based are not changed, means of student education and context in which these principles are placed are by all means changed. With the goal of ensuring that future engineers and technologists have the ability to implement these principles in their place of work, as well as future studies, it is important to present engineering graphics through different tools and practice used in industry and research activities. Advances in development of modelers based on parameterization like Pro/ENGINEER and SolidWorks caused apprehension of potential power of these tools as well as potential of geometrical models representation in dynamic databases. In these modelers the need for model modification is presumed at the beginning of the modeling process and the model is constructed in such a way that key geometrical properties are controlled through parameters [4].

PDM has become the metaphor and operational technology for management of this kind of database at the same time. Today's papers on the subject of modeling are giving extra space for discussion about PDM and similar technologies. Having this in mind, those who see broader perspective of PDM technology usage in organization, are looking at PDM as a strategic partner in creating more responsible and more agile engineering and production environment.

All of the above is not negligible having in mind that new generations of students at most cases do not have the opportunity to get the information about PDM software and even less to work in such environment.

## 2. GEOMETRICAL MODEL AS A CENTRE OF DATABASE

Created geometrical models should be thought of as a centre of a dynamic database and not as a restricted entity. The model should not be only a concept of final product but it must also be structured in such a way that supports future redesign [4], analysis and production. Favorite term in literature used for describing this is design intent. Basically this means that the way in which the model is designed and determined must reflect engineering solution of the final product.

The most common example is modeling of 400mm in length bar with a hole in the middle. Position of this hole should be defined in such a way that the hole resides in the middle of the bar and not 200mm in length from one of the sides. The main reason for this kind of approach is that eventual change in the length of the bar will not influence the position of the hole. In this way position of the hole will remain in the middle of the bar.

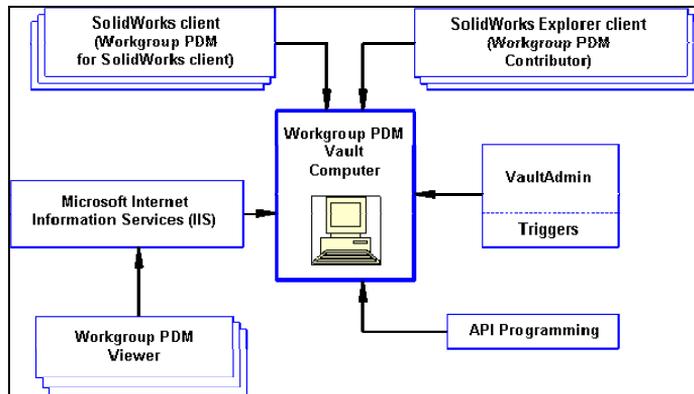
Behavior of model characteristics regarding design intent is critical, because there is a possibility that different individuals, besides the creator of model, access the model design and change it. In this way every new modification and model usage will not disturb relations between geometrical characteristics of model. Unfortunately, traditional methods do not support step by step adoption of this kind of concept with students.

Combination of modeler, PDM software and computer operation system provides tools for manipulating products database. Among other, these tools provide following: defining different levels of data access privileges, creating of user hierarchy and groups and defining of ownership on files and folders. In operational environment, many products are subjected to numerous design revisions, which need to be carefully documented. PDM systems typically provide sophisticated tools for historical tracking of changes during the design phase. This applies not only to the changes in geometry, but also to the results of analysis, written comments and information about expenditures and costs. All of these concepts are similar to administering of computer system, but students rarely comprehend the power of these tools [4].

## 3. PUMP DESIGN USING SOLIDWORKS WORKGROUP PDM SOFTWARE

### 3.1. SolidWorks Workgroup PDM Structure

Workgroup PDM and SolidWorks Explorer work in conjunction and in that way enable the user to manipulate the data. Workgroup PDM is an application that can work under SolidWorks or as a separate, individual application through SolidWorks Explorer in which case it controls the projects through procedures and administrative tasks [1].



Picture 1. Structure of Workgroup PDM application

The structure of Workgroup PDM application is shown in Picture 1. Central server can hold only one Workgroup PDM Vault in which case that folder cannot be hidden or proclaimed as read-only. Every file in the Vault has its own metadata that describe this particular file.

Workgroup PDM Vault is installed on server and is controlled by administrator through VaultAdmin application. SolidWorks client and SolidWorks Explorer client are installed on user (client) computers. Workgroup PDM Viewer can reside on any computer and it offers only the possibility of reading the documents stored in Vault without the permission of changing [5].

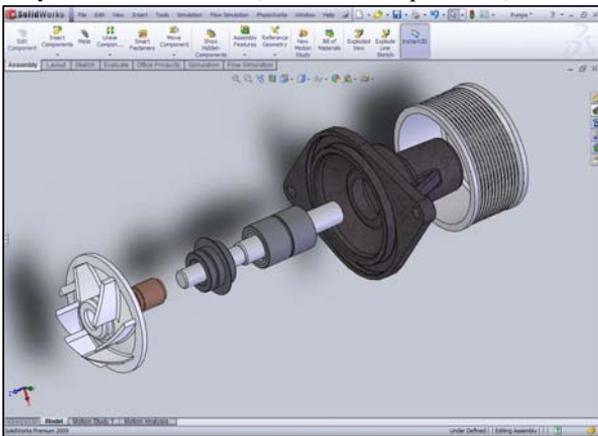
### 3.2. Water pump design

In the former chapter we described the structure that with SolidWorks offers complete working environment for completing simple design tasks, as well as completing complex design tasks that include manipulation over larger number of files that describe components, analysis results, reports and so on. Functionalities and benefits of PDM software are very well known, but what this really means to students?

Let us presume that the engineering team of students working on simple water pump design project is composed of five students (Student 1, Student 2, ..., Student 5). Student 1 is the project leader and at the same time Vault administrator. Other students in the team are Vault clients. Each of the students has access to all the data related to project in the Vault, but each of them has changing permissions only on the documents (3D models, reports, etc) that he or she created. Project leader is the only

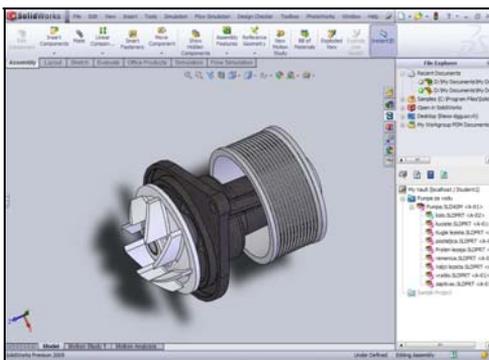
exception of this rule and he can change every document related to project. Now, let us assume that the calculations for the water pump are finished, parameters for the 3D model are calculated, and the phases of modeling, 2D documentation creation and analysis are in progress.

In the first phase Student 1 was given task of modeling the disc, Student 2 pump housing, Student 3 wheel and shim, Student 4 shaft and bearing brass and Student 5 task of choosing the correct bearing from Toolbox or modeling one if the correct bearing does not exist in the database.

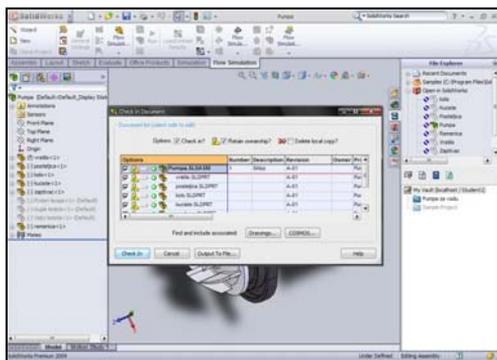


Picture 2. Pump assembly – Exploded view

After the completion of the first phase, pump assembly is completed (Picture 2.). All of the components in assembly and assembly itself are stored in the Vault and all team members are able to see and analyze the assembly through the SolidWorks application (Picture 3.).



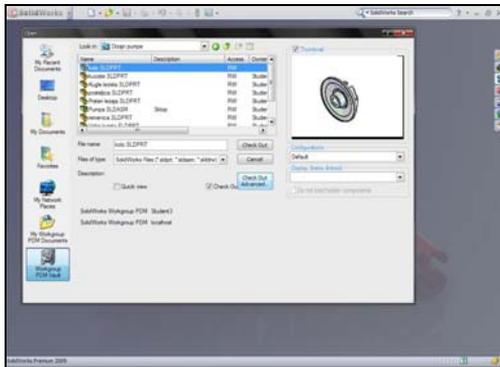
Picture 3. Pump assembly on client computer



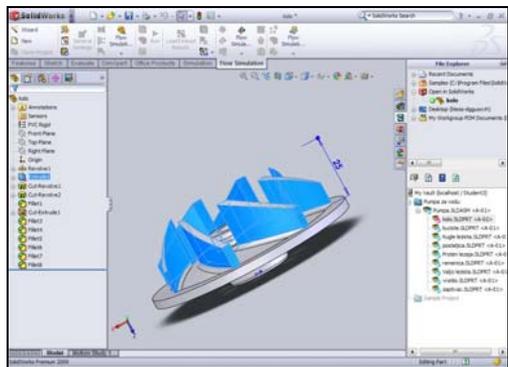
Picture 4. Check in

Moving the changed documents from local hard disk to the Vault is done simply with Check in option (Picture 4.), and document withdrawal with option Check out (Picture 5.).

After the second phase of pump assembly analysis, it was found that the height of wheel blades defined at 22mm does not match the requested criteria and it must be changed to a new height of 25mm. now Student 3 withdraws wheel model from the Vault, makes changes and stores changed model back to the Vault (Picture 6).



Picture 5. Check out



Picture 6. Change of wheel blade height

At this moment PDM software recognizes a new version of wheel model and with the versioning system does not allow overwriting of the existing document. In this way all of the documents related to project are kept safe, and the history of changes is maintained.

It is possible to create reports that contain all of the information about the specific project phases and all aspects of project as a whole, in each phase of the project. It is very important to stress that the team members do not have to physically be at the same place in the same time. The main advantage of PDM is this working from distance. A client computer with installed client software, a network connection and access to Vault is everything a team member needs to successfully take part in the project.

This example looks simple, but manipulation of projects through use of PDM software is simple without restrictions on number, type or quantity of data.

#### 4. CONCLUSION

Group activities help prepare the students for future work in team environment and that is the thing that most commonly students miss. These kinds of activities demand coordination of information flow which on the other hand provides access to PDM concept research. Students can comprehend concept of shared data in network environment even without sophisticated PDM tools if they demonstrate sharing and data manipulation over computer network.

Having in mind recent experiences, it can be said that teachers and students of technical faculties do not use PDM software and do not appreciate fully its concepts, functionalities and advantages. Manipulation and control of CAD data demands a new perspective of this data and a new way of working with it. Storing and withdrawal of documents in presented PDM system is not something intuitively done, but demands experience and that experience cannot be collected without full understanding and using of PDM software.

#### 5. REFERENCES

- [1] R. O. Buchal, The Use of Product Data Management (PDM) Software to Support Student Design Projects, The University of Western Ontario, [www.cden2006.utoronto.ca/data/10037.pdf](http://www.cden2006.utoronto.ca/data/10037.pdf)
- [2] P. Manson and D. Nyberg, Implementing Product Data Management in Product Development Projects, Chalmers University of Technology, Goteborg, Sweden, 2002.
- [3] F. Pampreen, Data Solutions Manager (Product Data Solutions Manager), <http://www.capinc.com/pages/support/downloads.cfm>
- [4] E. N. Wiebe, Impact of Product Data Management (PDM) trends on Engineering Graphics
- [5] SolidWorks Premium 2009 (Help)