# DESIGNING A SPHERICAL TAP USING SOLID WORKS- A DIDACTIC APPROACH

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**Keywords**: spherical tap, Solid Works

**Abstract:** This paper presents the designing of a spherical tap using some of the most commonly used features of the Solid Works mechanical design automation system, which allows the user to create parts in a highly productive and intuitive environment, to enrich existing mechanical part design and basic surface features and then easily establish mechanical assembly constraints, automatically positions parts and check assembly consistency.

## 1. INTRODUCTION

In all stages of production the use of modern design tools is required, from early design and computer simulation of product behaviour in practice to numerical control machine tools and production line aided design. Training modern engineers should include knowledge of software packages like Catia, Solid Works (Dassault Systems) or Inventor (Autodesk). Aided design software packages using parametric modelling, have all one common feature that is working with blocks of graphic design.

One of the major differences between 2D and 3D solid modelling is to create accurate three-dimensional model. In Solid Works design software these models can be viewed, analyzed and modified as real objects would be.

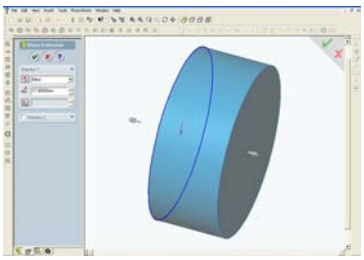
Designers usually own dimensional thinking and the use of Solid Works platform allows them to express their views and ideas to a real model, while mentally trying to reproduce a 3D model in 2D becomes difficult.

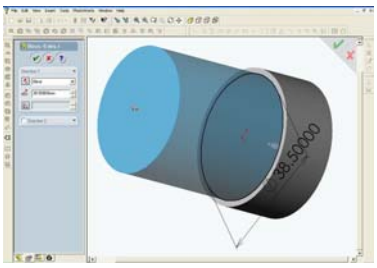
Solid Works platform allows improving the visualization of a set that can easily explode into elements, and could thus create a clear picture of what the future product will be.

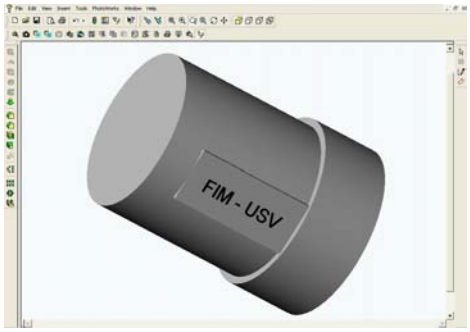
This paper aims to present as a didactical example a valve ball body design and its assembly using the application from company Dassault Systems, Solid Works.

## 2. DESIGNING SPHERICAL TAP BODY

Construction of the geometrical model of tap body starts with the basic element of a cylinder, which will be linked to all other items, plus material by extrusion. After performing the basic body add a material extrusion achieving rough body of the tap. By removing material from the rough body, through a succession of steps, one obtains the spherical tap body, Figure 1.



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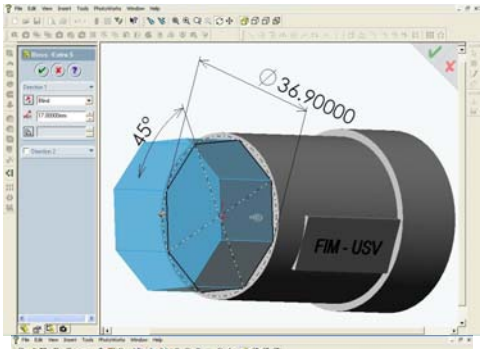
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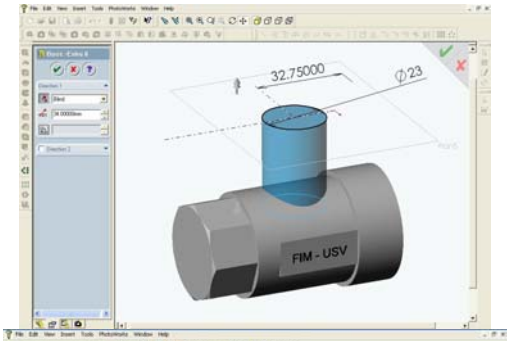
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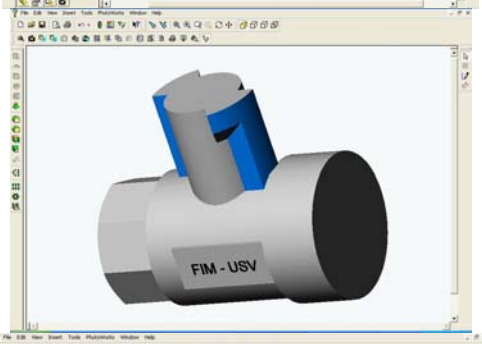
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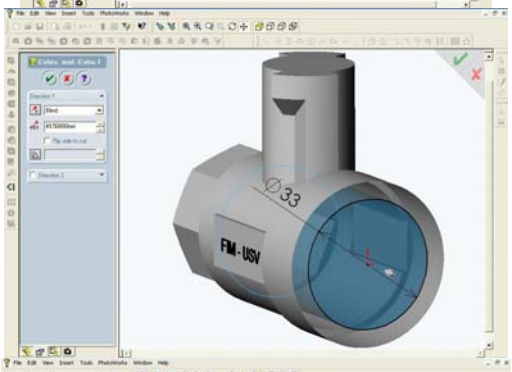
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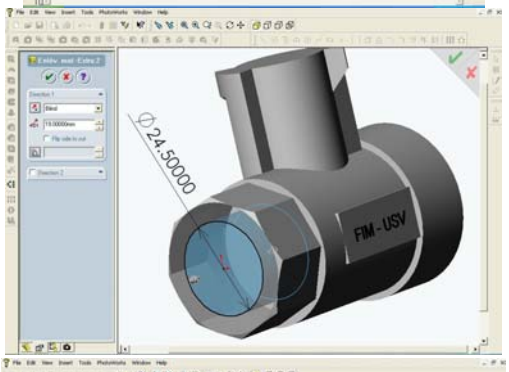
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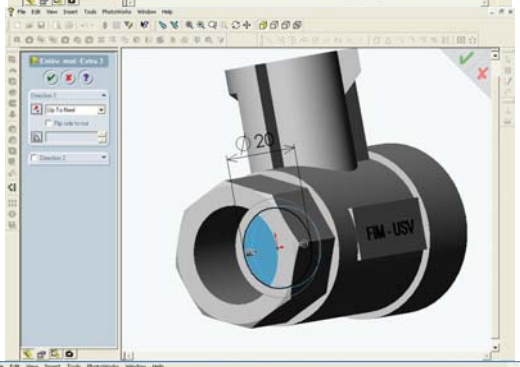
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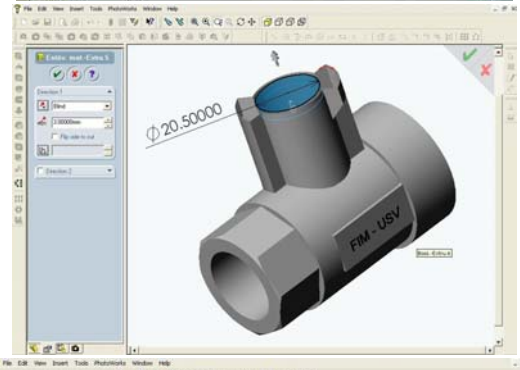
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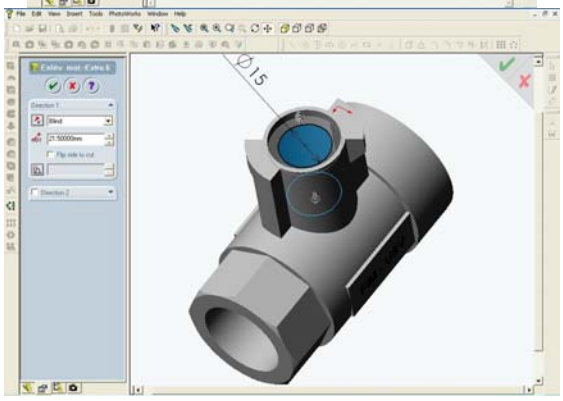
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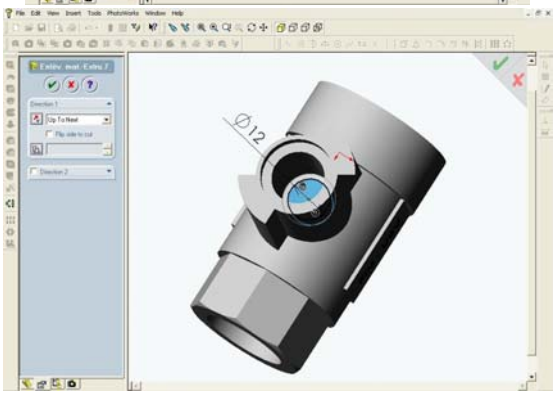
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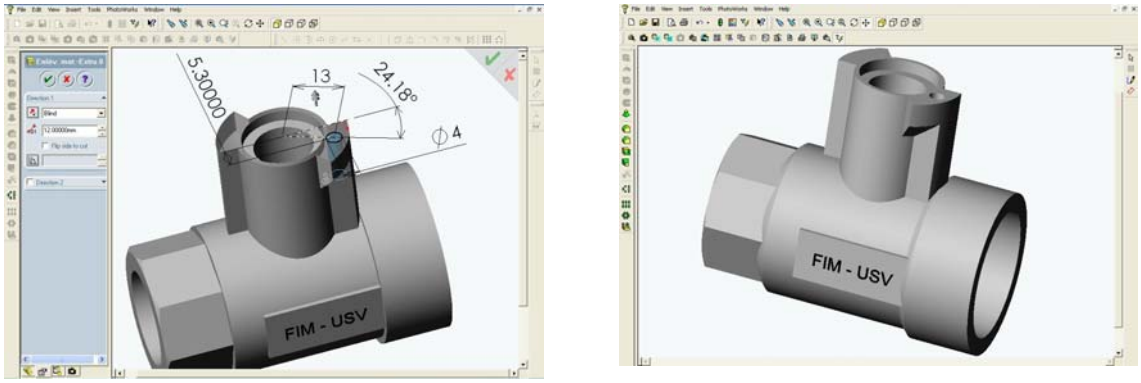



*Fig.1. Body of spherical tap*

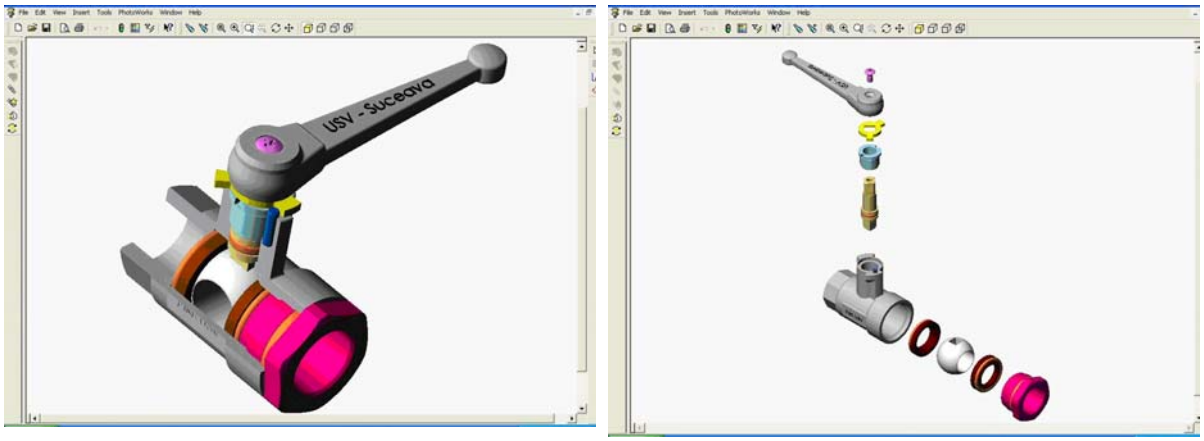
## 3. DESIGNING SPHERICAL TAP

The design of the spherical tap can be achieved by two methods:

• designing so-called "bottom up" or classic, that involves designing the parts of spherical tap assembly as independent entities and then performing the assembly operation;

• designing via "top down" approach, which means creating the assembly and afterwards shaping all the parts.

The present paper presents the design of "top down" for the spherical tap. The method assumes starting from the spherical tap assembly, Figure 2a, and then creating individual parts, Figure 2b, making references to faces, edges or other parts that already exists.




a b

*Fig.2. Assembly of spherical tap*

For example, in designing the spherical pill, Figure 3, it must be taken into account that the rod enters the tap, Figure 4, but in turn, the pill enters into the spherical tap body, Figure 5.

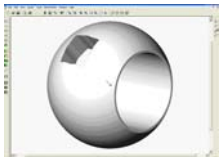


*Fig.3. Pill*

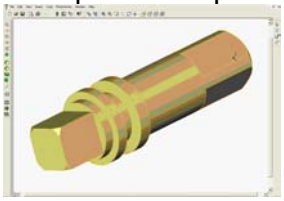


*Fig.4. Rod*

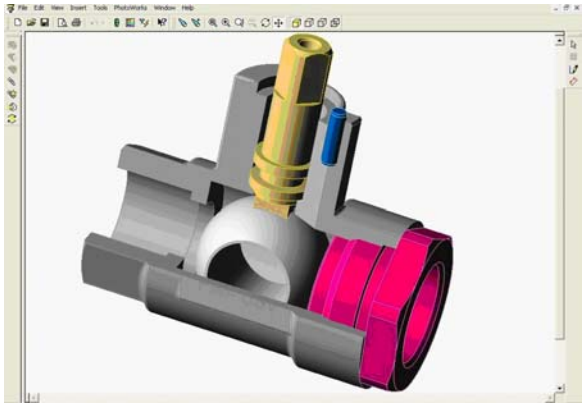


***Fig.5. Partial assembly***

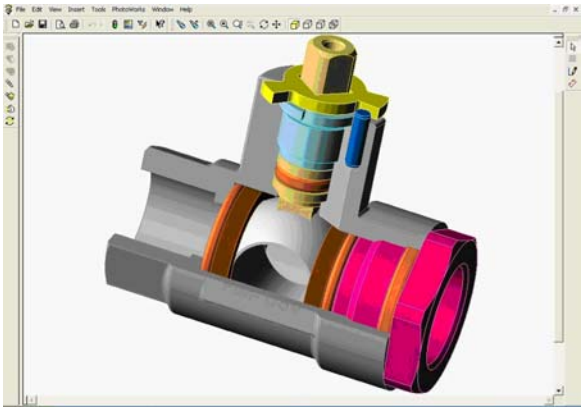


***Fig.6. Assembly spherical tap***

Any change in three-dimensional model of spherical tap, Figure 6, is reflected in drawings of the parts of the tap, as a change in dimensions from drawings will lead to changes into 3D model.

## 5. CONCLUSIONS

An important advantage of 3D modelling is the ability to automatically extract required 2D representation views of the spherical tap, representation which helps manufacturing process. Creating 2D views following the 3D model of the tap is faster than in traditional manner of drawing. The necessary views can be created with up to 75% fewer steps and more than three times faster compared to traditional 2D design.

Another advantage of solid modelling of spherical tap is the ability to make changes directly on the 3D model and / or structure, changing the tap is properly in accordance with the machining and technological requirements.

The parameterization possibilities allow changing the dimensions of spherical tap, to create logical connections between elements defining the solution and thus the revision process becomes extremely easy.

Bi-directional associativity between 3D model and created 2D views improves the design process, especially when it is in elaboration stage but also in the final stage when a single change can affect several views.

Solid modelling has created benefits to many users by drastically reducing the execution time. In Solid Works, the spherical tap is a virtual product, whose performance can be simulated. Implementation involves a series of operations such as casting, stamping, injection, milling, grinding, drilling, etc. If problems occur in the simulation process, the spherical valve possibly will support changes after having a fresh simulation.

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