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MECHANICAL DESKTOP CAPABILITY IN DESIGNING 3D PLASTIC PIECES

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ABSTRACT

The paper attempts to show the abilities of a 3D –Mechanical Desktop 6 in the field of plastics materials, particularly for parametric modeling of an euro-bin cover to finally obtain the whole euro-bin by attaching its body as extreme reference. Defining the geometry is based on both the sketches of 'profile' type the values of which are either numerical or mathematical, and on the cutting surfaces characterized by different curve radii on two perpendicular directions.

1. Introduction

Based on AutoCAD more design applications have been developed including various related facilities. Each AutoCAD – based software package has an additional set of commands which is also reflected in the marketing price. Most software users, by working in AutoCAD imply only the basic package from Fig 1, there are, however, other packages which are much more advanced.

The third level of the Autodesk pyramid contains the high performance products while the pyramid top (Mechanical Applications Initiative) is a unique initiative of exploring a possible cooperation between Autodesk and its partners in developing AutoCAD and Mechanical Desktop – based applications so as to reach an integrated solution in mechanical design.

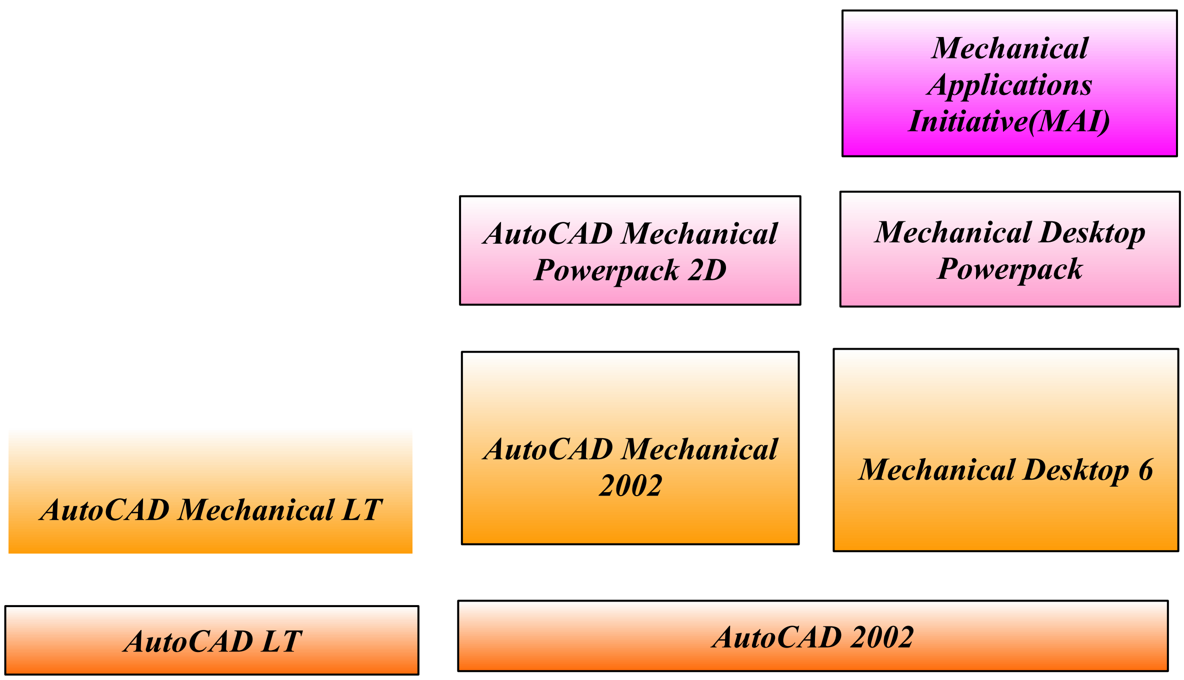

Fig. 1. AutoCAD software packages

2. Theoretical considerations on parametric modeling

The geometry used in Mechanical Desktop contais intelligent elements capabale of understanding its own functions, operations and modifications. Shapes are also modelled using a mechanical-oriented language and one command is enough to obtain informaton on mass, volume, center of gravity and inertia moments.

Mechanical Desktop is developed according to the ACIS standard for solid-bodies modelling which is used in over 45 applications of design, analysis and manufactuirng all over the world.

In addition to the pieces modelling possibilities, Mechanical Desktop also provides poweful facilities for the design of pieces assemblies.

The option Component Manager can be used to include the existing assemblies into other drawings AutoCAD (support Xref), to further assembly them with the pieces from the current drawing and thus the component and subassemblies hierarchy can be obtained at any time.

By using the parametrically modelled solid pieces, the user can see the implications over the piece assembly as a result of having modified the size of one piece.

To design assemblies the user can use a system able to deal with the total or partial contraints of the pieces. The analysis of the mass properties enables the user to get information on volume, mass, center of gravity and inertia moments both for the assembly and each part, each piece having its own materials set. The Mechanical Desktop makes it possible to analyze the collisions among the assembly pieces, to provide the component tables and the blown up views of the assemblies, plot the cross sections of the assemblies and find the information about asembling by a single command for each operation.

Automatic generation of the executon drawing and their two-direction association between them and the 3D model represents one of the most important facilities of this software.

The drawings are made in "Paper Space" and it can be generated views having the following characteristics: base, orthographic, full sectional, offset sectional, iso-sectional, detail, user-defined.Any modification inside the 3D model is to be found in the execution drawing the same as any modified size would result in a modified model.

Mechanical Desktop makes use of the NURBS geometry (non-uniform relational B-splines) for modeling quite complex surfaces both by using basic methods (planar, extrusion, revolved, ruled) and predefined primitives (spheres, cylinders, cones, torus), and also by means of a editing command packages which enable cutting, connecting and joining surfaces, etc.

Also, Mechanical Desktop makes it possible to edit solid pieces by cutting them with surfaces of complicated geometries.

3. Description of the method applied

To obtain the geometry of the eurobin cover the parametric drawings in Fig 2 are used, which extruded as in variant "Base" and "Join" respectively result in solid pieces of the type "part" which are to be cut with surfaces defined in variant "Sweep" by scanning a certain curve arc as shown in Fig 3.

The cutting surfaces defined above are given in the final variant in Fig.4. Enlarging the cutting surface to a scale of about 150% is recommended in order to make covers 1,5 times bigger than the initial one.

If larger euro-bins will be required in future projects, the scale used will be larger too.

Both drawings are constrained on two directions with respect to Work Point 1. After making the connections required by the partial geometry of the cover, the euro-bin obtained at this level is illustrated in Fig 5a. Mention must be made that at this level, the details of the geometry illustrated in fig. 7a,b are not modeled.

In order to make the join arm first a Work Plain is defined inclined at 6^0 with respect to Work Plain 3, then a parallel one at 10 mm where the join arm is parametrized and extruded under the option "Join".

The arm obtained is associated with the 3D geometry, and the thin-wall cover is finally made with the "Shell" command. Mention must be made that when calling "Shell", different cover thickness has been applied. By extrusion of "Join" type and using drawings of open profile type, the geometric entities to catch the cover were made.

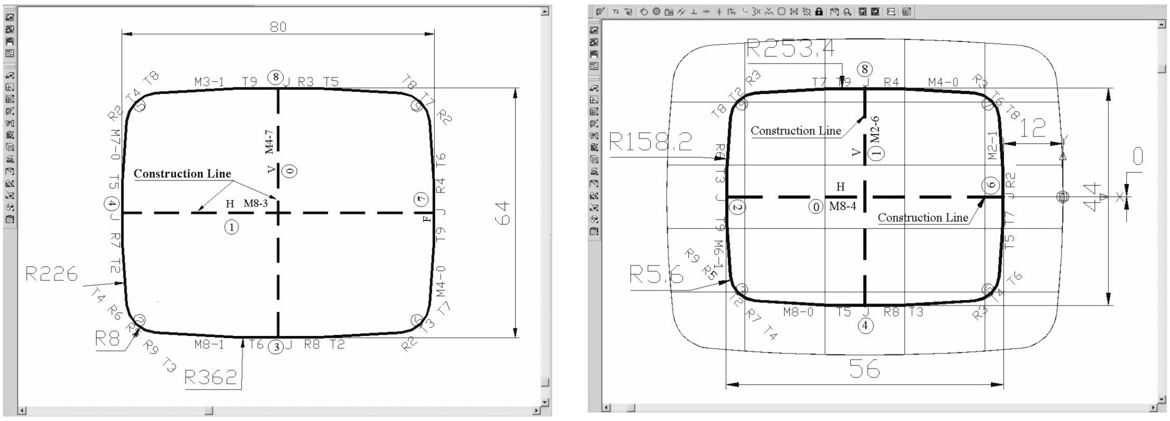

Fig. 2. Parametric drawing of the euro-bin cover

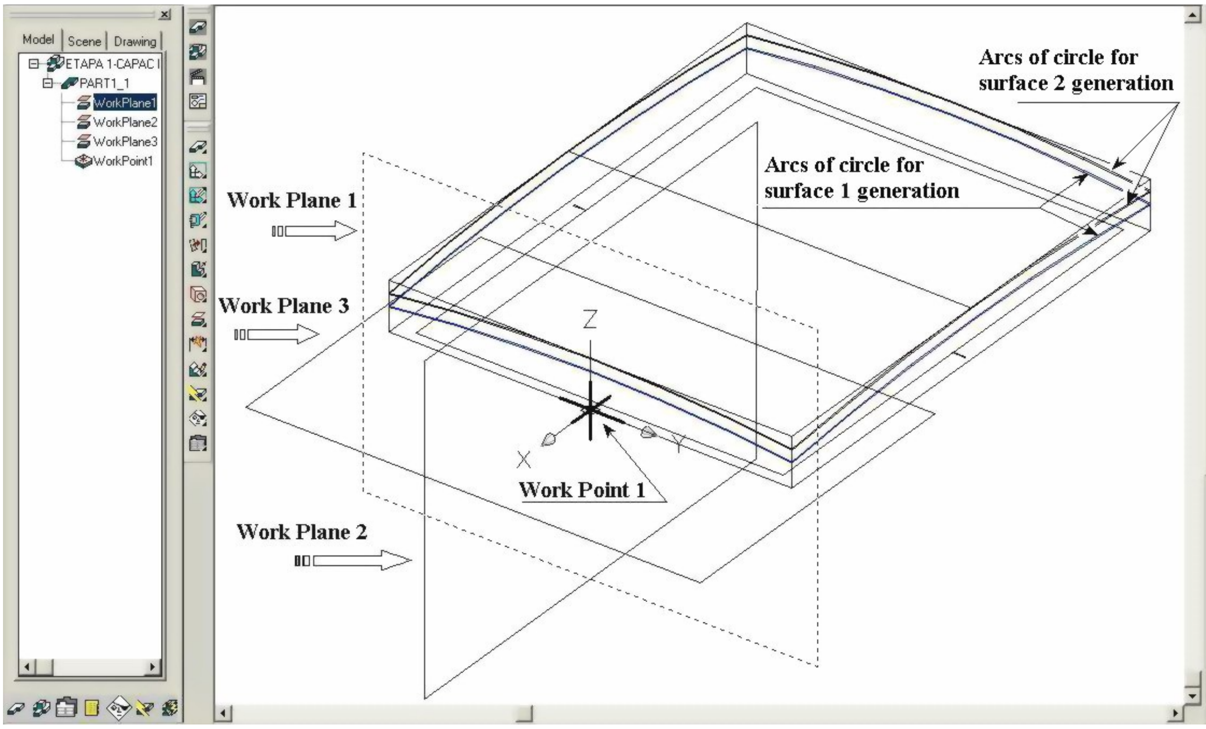

Fig. 3. Arcs defining the cutting surfaces

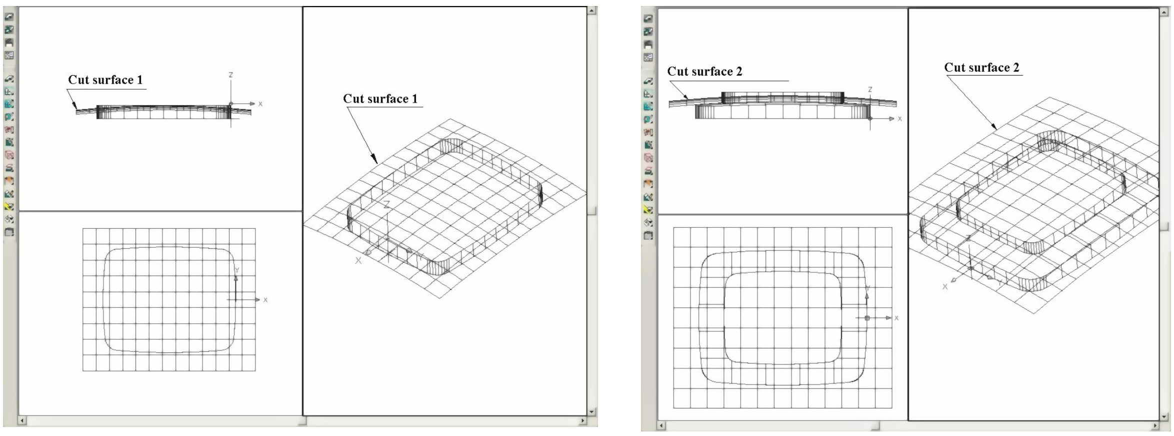

Fig. 4. Cutting surfaces obtained from the arcs in fig. 2

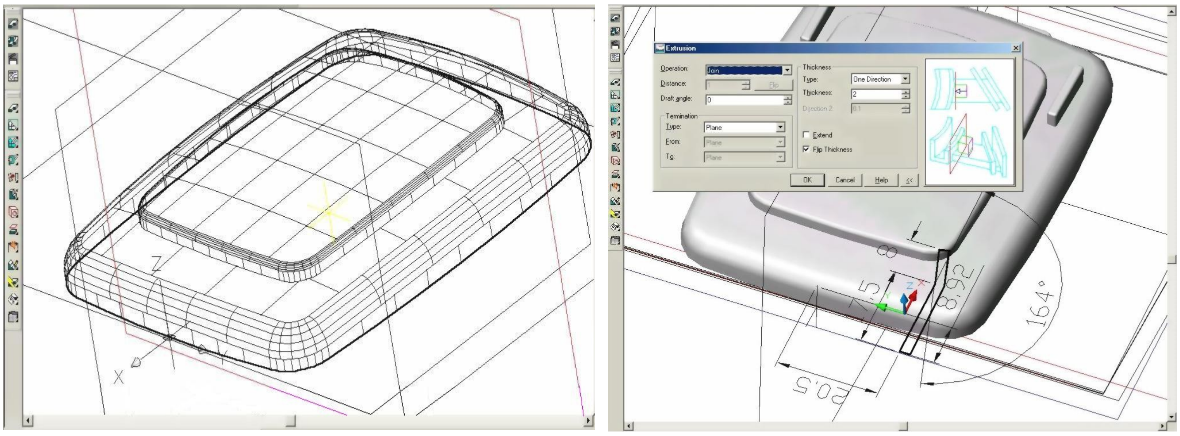

Fig. 5. a) basic shape of the euro-bin cover; b) parametric drawing of the join arm

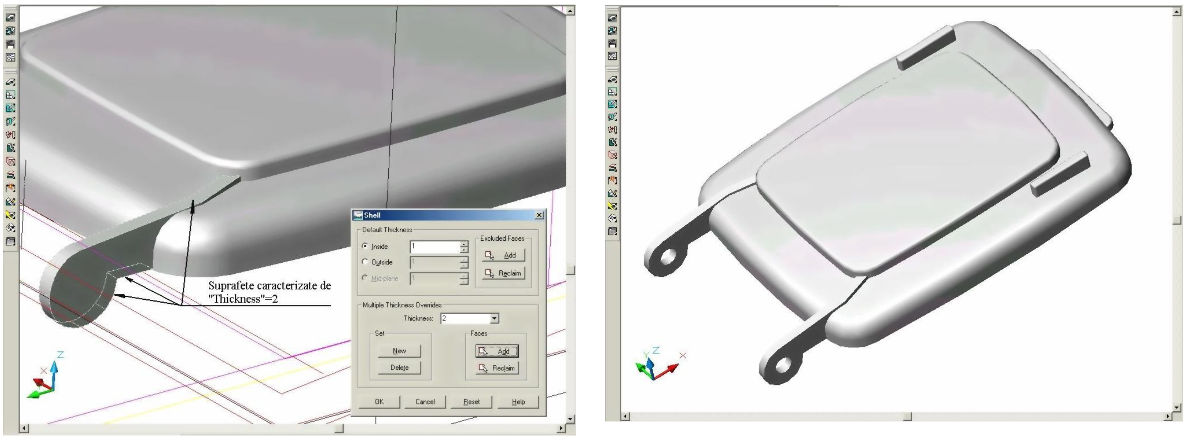

Fig. 6. a) Viewing the join arm and achieving "Shell" b) Final cover

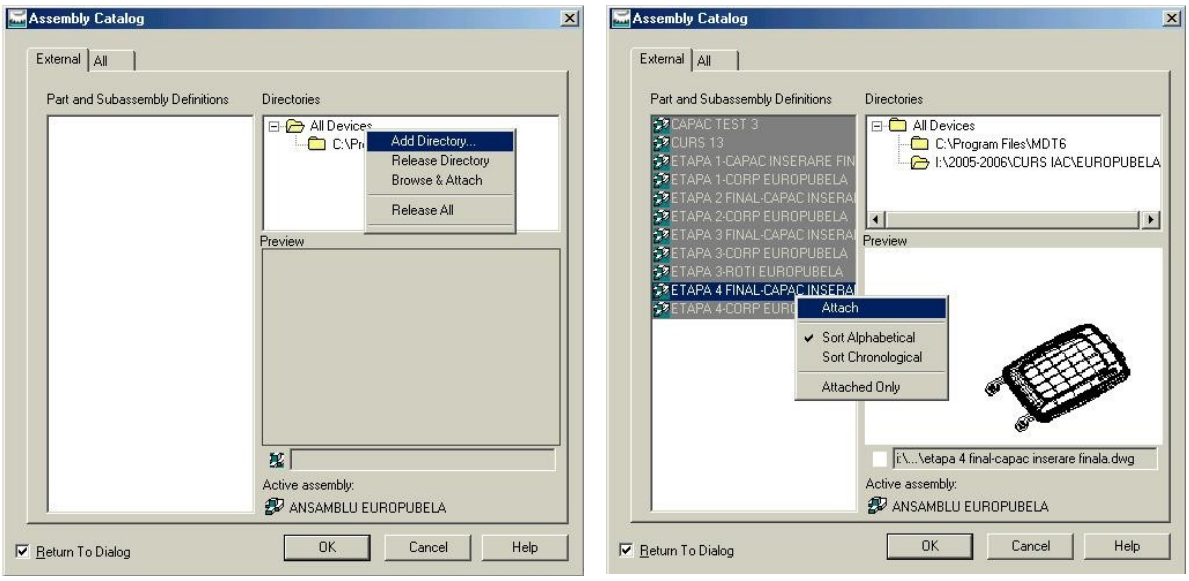

Fig. 7. a) Attaching a directory for the external files b) Attaching external files

4. Results obtained

The results obtained after parametric modeling are given in fig.6a and b.

The features of Mechanical Desktop also allow for the insertion of some external references from individual files while strictly meeting the 3D geometric restrictions, leading to a parametric geometrical assembly whose execution drawings are obtained automatically. Any of the editing carried out at any level of the "parts" achieved are transmitted automatically to the associated drawings as well. The window for inserting the external reference command is given in fig. 7a and b. Similarly is inserted the item from the file "Roti europubela.dwg" file

If it found that the inserted element cannot be assembled, then Mechanical Desktop allows for geometry modifications at the level of each and every item which will be further transmitted to the inserted file itself.

Positioning of the geometric elements introduced by attaching the above mentioned files is performed by powerful commands such are those from the set "3D Assembly Constraints", which imposes 3D restrictions. The sample of the euro-bin is illustrated in fig. 8, and the related model 3D can be seen in fig. 9.

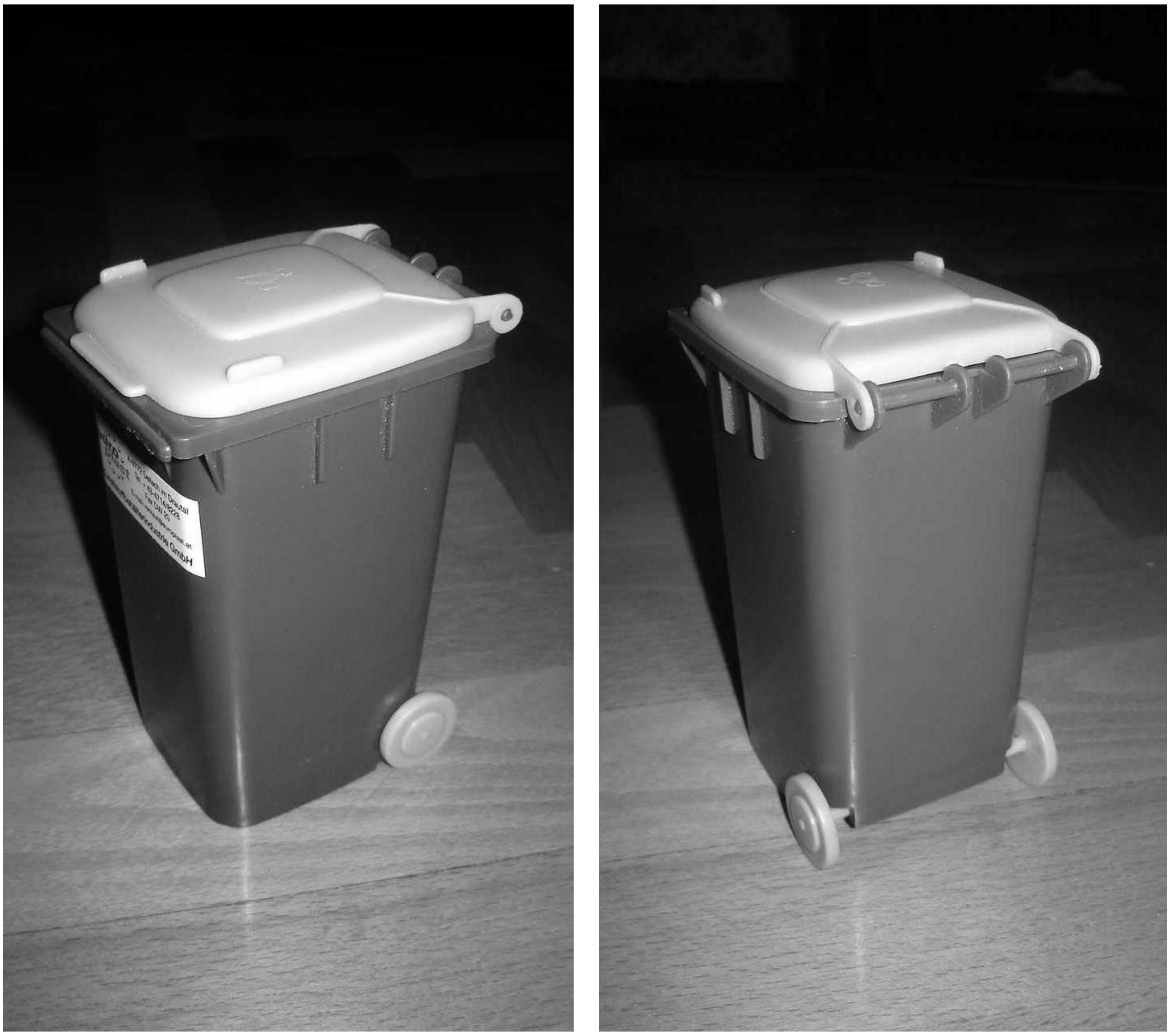

Fig. 8. Euro-bin sample

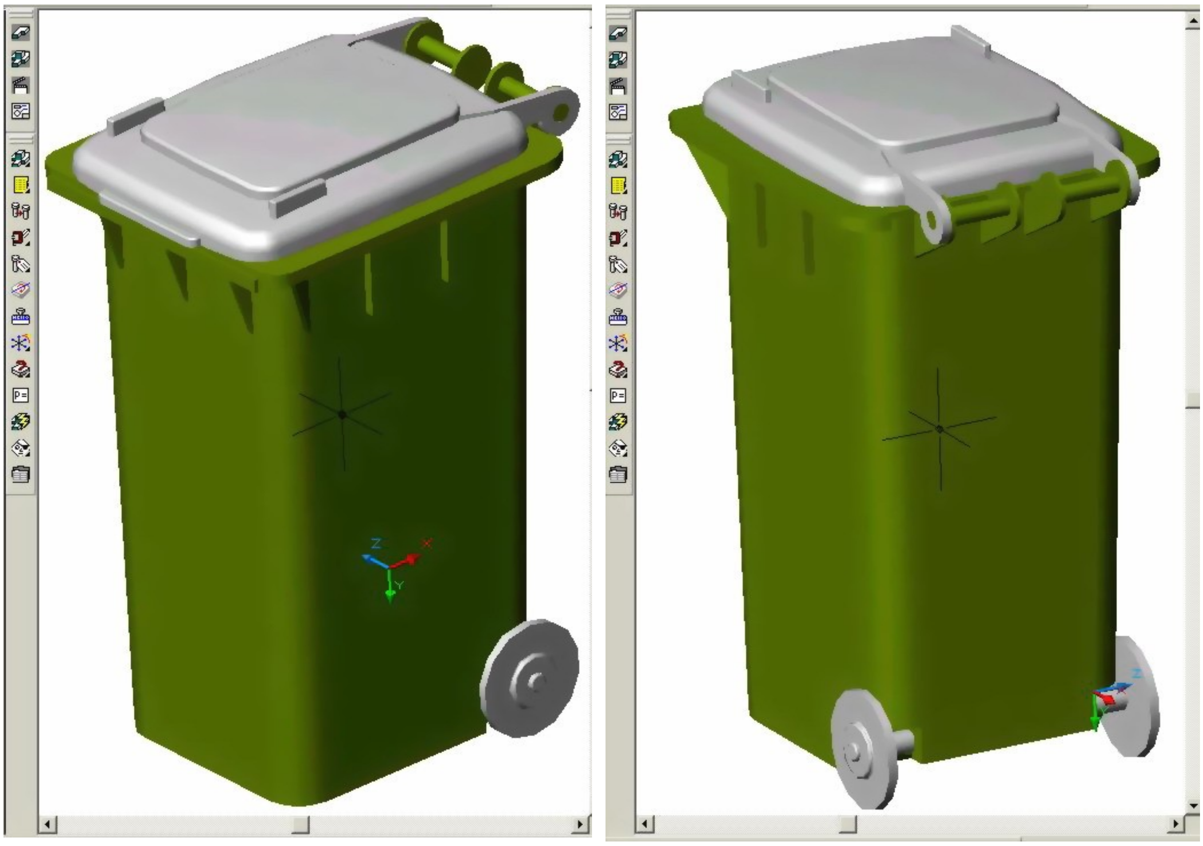

Fig. 9. Parameter ensemble of sample from fig. 8.

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