

# THE BOOLEAN OPERATIONS WITH CAD SYSTEMS

Lecturer Dr. Eng. HARAGA Georgeta<sup>1</sup>  
Assoc. Prof. Dr. Eng. GHELASE Daniela<sup>2</sup>  
<sup>1</sup>"Politehnica" University of Bucharest  
<sup>2</sup>"Dunarea de Jos" University of Galati

## ABSTRACT

*The AutoCAD software is a power computer-aided design (CAD) system that can offers all users of graphics, 2D and 3D objects representation. In this paper, we present the basic Boolean operations that allow adding, subtracting or intersecting solid objects in AutoCAD.*

KEYWORDS: AutoCAD, Union, Subtract, Intersect, Interfere .

## 1. Introduction

The AutoCAD system is a powerful drawing and projecting assisted program which allows object representation on computer both in bi-dimensional space, 2D, and in tridimensional space, 3D [1].

Working in 3D, usually, involves the use of solid objects. The solid generation with complex architecture composed of two or more solids or regions is made up by using Boolean operations of union, subtract and intersect.

## 2. The Boolean operations

The Boolean commands work only on solids or regions. The first stage in a solid model creation consists in obtaining one or more primitives. The next stage consists in using Boolean operations of Union, Subtract or Intersect in order to create the solid model [3].

### 2.1 The UNION command

The UNION command generates a tridimensional object made up of the mathematical union of two or more solids. The solids obtained this way act as a single object (see figure 1 -a, b, c).

The UNION syntax

**Command: UNION**

**Select objects:** 1 found (the first solid of union will be selected)

**Select objects:** 1 found, 2 total (the second solid of union will be selected)

**Select objects:** <Enter> (the operations of selecting will be closed).

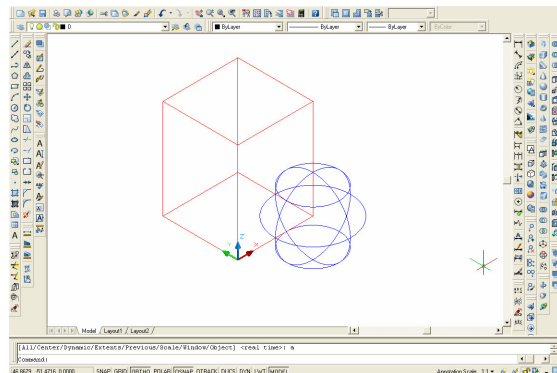


Figure 1.a. Solids before Union

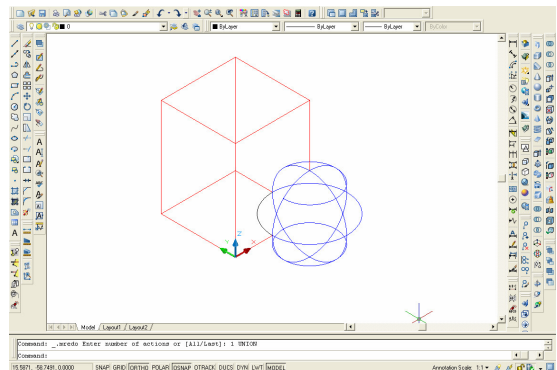


Figure 1.b. Solids after Union

For a realistic image, we used the Conceptual Visual Style command as shown in figure 1.c.

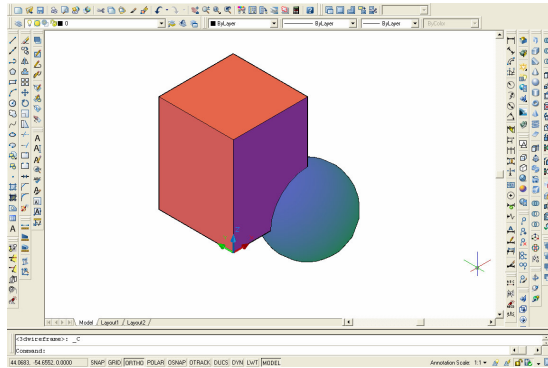


Figure 1.c. The Conceptual Visual Style command

## 2.2 The SUBTRACT command

The **SUBTRACT** command allows the obtaining of a single tridimensional solid composed by mathematical subtracting of the common part of two or more solids (see figure 2 -a, b, c) [8].

The SUBTRACT syntax:

**Command:** SUBTRACT

*Select solids and regions to subtract from ..*

*Select objects:* 1 found (the solid/solids from which the subtract is made will be selected)

*Select objects:* <Enter>

*Select solids and regions to subtract ..*

*Select objects:* 1 found (the solid/solids which are subtracted will be selected)

*Select objects:* <Enter> (the operations of selecting will be closed).

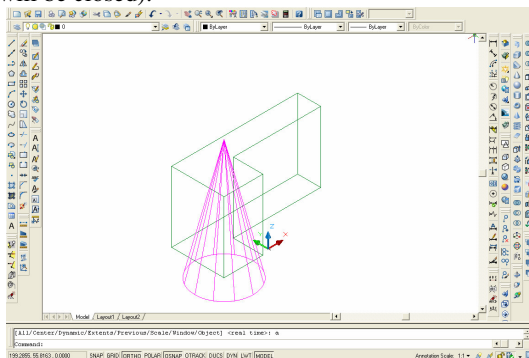


Figure 2.a. Solids before Subtract

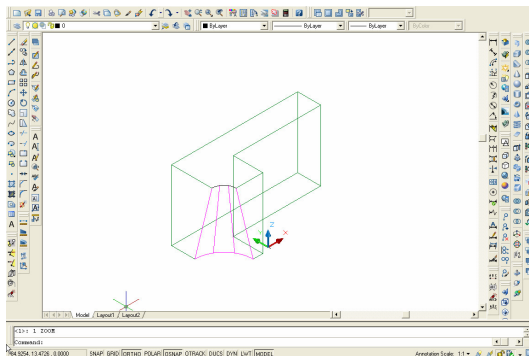


Figure 2. b. Solids after Subtract  
For a realistic image we used the Conceptual Visual Style command as shown in figure 2.c.

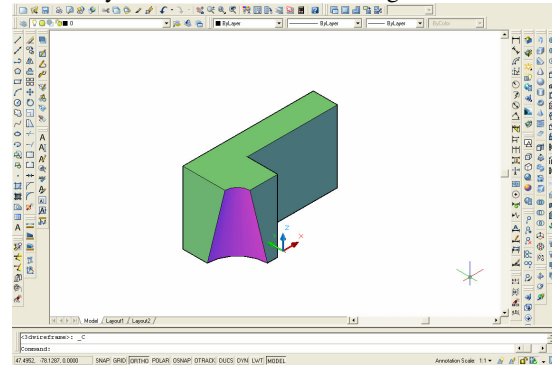


Figure 2.c. The Conceptual Visual Style command

## 2.3 The INTERSECT command

The **INTERSECT** command allows the obtaining of a solid composed from the common part of two or more solids (see figure 3 -a, b, c).

The INTERSECT syntax:

**Command:** INTERSECT

*Select objects:* 1 found

*Select objects:* 1 found, 2 total (the solid/solids which are to be intersected will be selected)

*Select objects:* <Enter> (the selection is closed and the left regions will be removed from around the obtained solid).

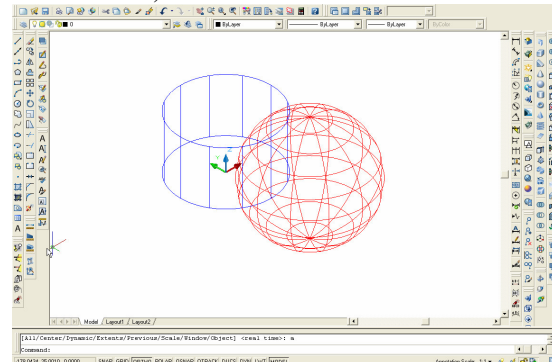


Figure 3. a. Solids before Intersect

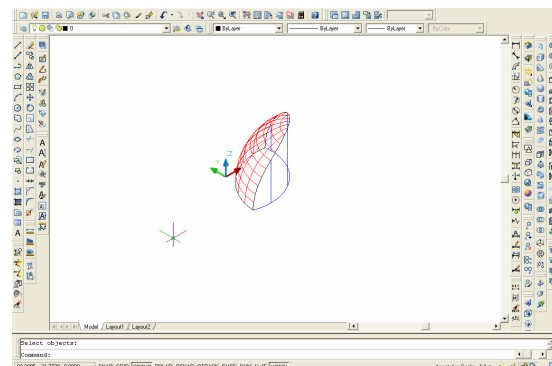


Figure 3. b. Solids after Intersect

For a realistic image we are used the Conceptual Visual Style command as shown in figure 3.c.

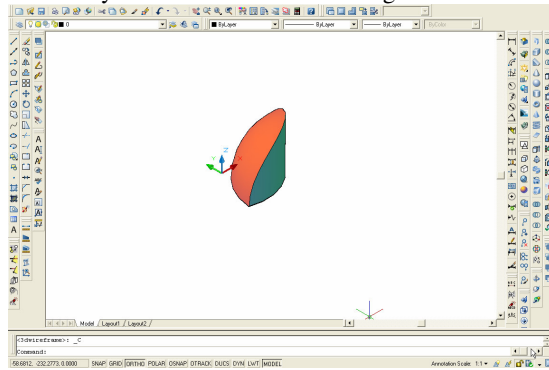


Figure 3.c. The Conceptual Visual Style command

## 2.4 The INTERFERE command

The **INTERFERE** command allows the creation of a solid composed from the intersection part of two or more solids (as in **INTERSECT** command) but with initial solids intact keeping, as shown in figure 5.

The INTERSECT syntax:

**Command: INTERFERE**

*Select first set of objects or [Nested selection/Settings]:* the first set of solids will be selected

*Select first set of objects or [Nested selection/Settings]:*

*Select first set of objects or [Nested selection/Settings]:* **<Enter>** (the selection is closed)

*Select second set of objects or [Nested selection/cheK first set] <cheK>:* the second set of solids will be selected after which access **<Enter>**.

When accessing **<Enter>**, an Interactive dialog box appears named **Interference Checking** (Figure 4) and the drawing moves into in a form similar to figure 5.

*Select second set of objects or [Nested selection/cheK first set] <cheK>:* **<Enter>** (AutoCAD program displays all the solids which Interfere and points out their number and the reference pairs).

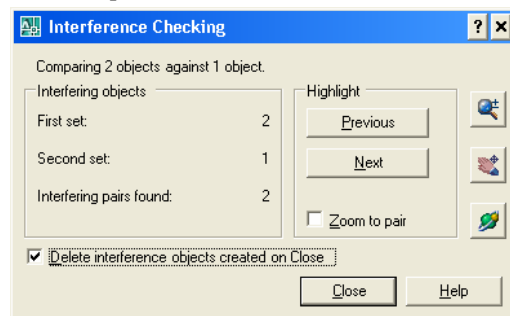


Figure 4. The dialog box Interference Checking

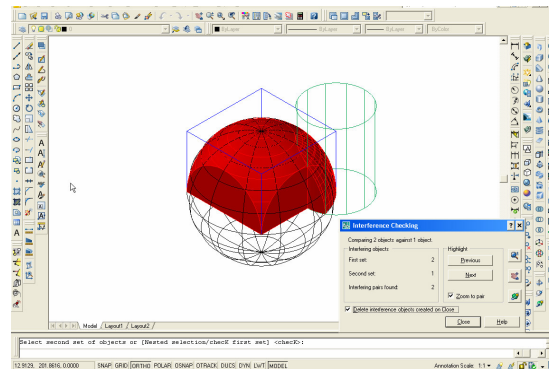


Figure 5. The Interfere command

Thus, in the Interference Checking dialog box (figure 5), we will click the Next button, as can be seen in figure 6 (the first application of the Next button) and figure 7 (the second application of the Next button).

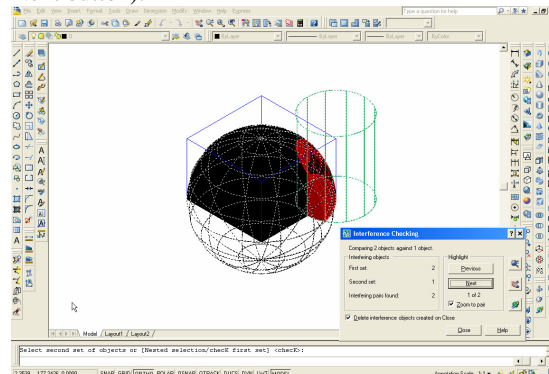


Figure 6. The first application of the button Next from the Interference Checking dialog box

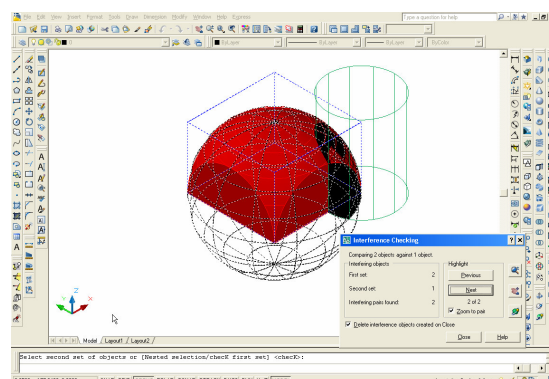


Figure 7. The second application of the button Next from the Interference Checking dialog box

In figure 8, three solids before the Interfere command are presented.

After not marking, *Delete Interference objects created on Close* option in the Interference Checking dialog box, the drawing will appear in the final form in figure 9.

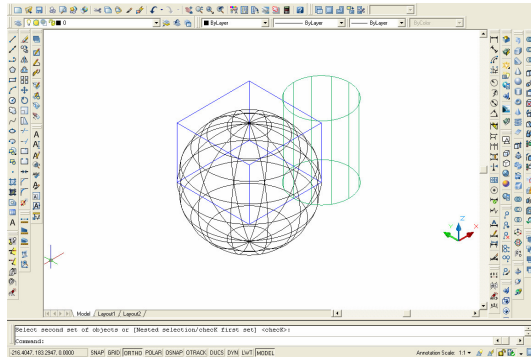


Figure 8. Solids before Interfere

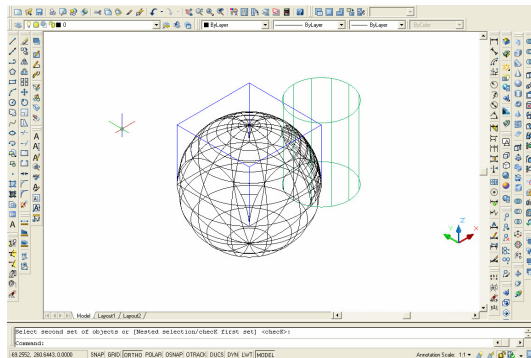


Figure 9. Solids after Interfere

For a realistic image we are used the Conceptual Visual Style command as shown in figure 10.a, and in figure 10.b, we change the colors at the solids [7].

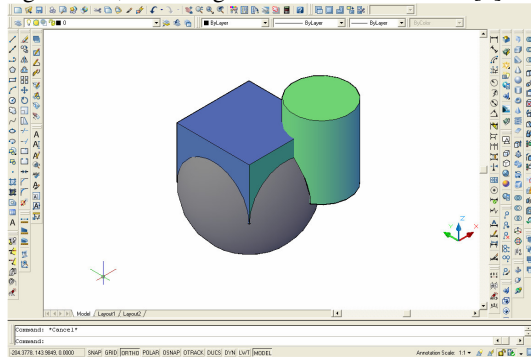


Figure 10.a. The Conceptual Visual Style command

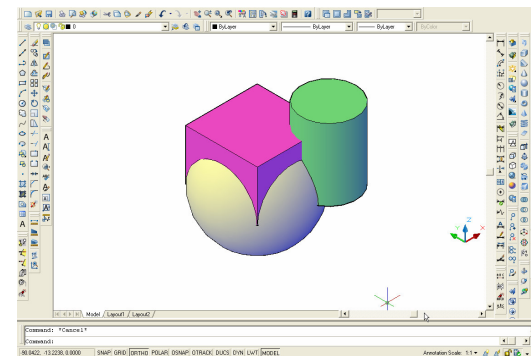


Figure 10.b. The Conceptual Visual Style command

## 4. Conclusions

AutoCAD - computer aided design is the most popular program of graphics and design aided by computer used in domains as: architecture, geography, astronomy, techniques, etc. At times you may need to combine multiple parts into one, or remove sections from a solid [5, 6].

The use of Boolean operations as modeling instruments lead to many of the performances realized by the AutoCAD program users in solid modeling. The Boolean operations are found both in bi-dimensional space in working with regions and in tridimensional space when complex objects can be created starting from simple primitive ones. In this paper, we present the basic Boolean operations that allow adding, subtracting or intersecting solid objects in AutoCAD [2, 4].

The solid modeling force in AutoCAD consists only in using these Boolean operations. Complex solid objects can be created through combinations generating solid primitives. These complex solids can be combined with other primitives or even with other complex solids.

## References

- [1] **Goanță A. M.** *The fast to obtain graphic documentation using specialiyed software of design*, International Conference on Engineering Graphics and Design, Series Applied Mathematics and Mechanics 52, Vol.Ia, ISSN 1221-5872, pp.287-290, Technical University of Cluj-Napoca, Acta Technica Napocensis, 12-13 June 2009.
- [2] **Haraga G.** *The visualization in tridimensional space with AutoCAD system*, ICEGD 2009 - International Conference on Engineering Graphics and Design, Series Applied Mathematics and Mechanics 52, Vol.Ia, ISSN 1221-5872, pp.295-298, Technical University of Cluj-Napoca, Acta Technica Napocensis, 12-13 June 2009.
- [3] **Haraga G.** *Applications of CAD systems*, ICEGD 2009 - International Conference on Engineering Graphics and Design, Series Applied Mathematics and Mechanics 52, Vol.Ia, ISSN 1221-5872, pp.291-294, Technical University of Cluj-Napoca, Acta Technica Napocensis, 12-13 June 2009.
- [4] **Haraga G., Ghelase D., Daschievici L.,** *Geometrical shapes with CAD systems*, The Annals of "Dunarea de Jos" University of Galati, Fascicle XIV, Mechanical Engineering, (nivel B+, BDI, CSA- Cambridge Scientific Abstracts), ISSN 1224-5615, pp. 59-62, 2008.
- [5] **Haraga G.** *Modeling in Draft and Part modules with the Solid Edge soft*, The 2nd International Conference on Engineering Graphics and Design, Graphics, Mechanisms and Tolerances Department "Dunarea de Jos" University, Galati, Roumania, 2007.
- [6] **Haraga G., Ion. E.E.,** *The decorative design used in AutoCAD*, Simpozion național cu participare internațională PROiectare ASIstată de Calculator PRASIC' 06, Vol. Nr.3, Design de Produs, Ed. Univ. "Transilvania" pp.161-164, ISBN (10) 973-635-826-7; (13) 978-973-635-826-5, pp. 161-164, Brașov, Romania, 2006.
- [7] **Ion, E.E., Haraga, G. Ioniță E.,** *Elemente de grafică computerizată*, Ed. MATRIX ROM, ISBN 973-685-645-3, București, 2003.
- [8] [http://www.we-r-here.com/cad\\_07/tutorials](http://www.we-r-here.com/cad_07/tutorials)