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## 0D TO 1D CREATION THROUGH CAD TOOLS

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**Abstract**—This document gives an idea about 2D (two dimensional) and 3D (three dimensional) modeling and its different parameters using AutoCAD tool. Most likely approach about point creation and convert this 0D (point) geometry into 1D (line) geometry through CAD tool, which one is the stimulating part of this tool in current scenario.

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**Keywords**—Auto CAD; 0D, 1D, 2D and 3D geometries

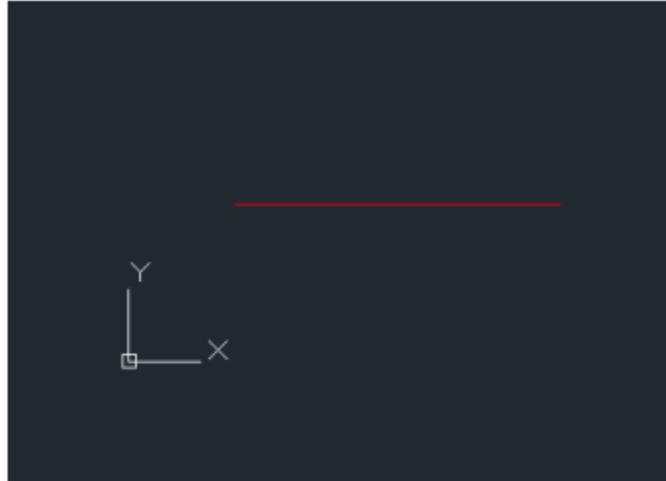
### I. INTRODUCTION

CAD tools are user-friendly for graphics design and conceptual understanding of engineering drawings. Nowadays, the emphasis is shifting. 3D modeling has been widely used in areas including computer graphics, virtual reality and communication, and there is more and more demand for 3D content for tissue engineering and heritage protection [1]. More widely usages of CAD tools like AutoCAD for 2D geometries; Pro-E, CATIA (Computer Aided Three-dimensional Interactive Application), UniGraphics for 3D geometries and ANSYS, HyperMesh for 4D analysis are going on. Ultimate task of all these software tools are to make better and more reliable design of any component or an assembly. And this list can more increasing day by day as in the market, designers and industrialist need much better and more comfort providing devices and mechanisms to fulfill customers requirement from resource which they have. Industrial designers facing problems to create more complicated geometries through CAD tools and to solve this kind of problems they are using “Reverse Engineering” concept.

### II. AUTOCAD GRAPHICS AND 1D GEOMETRY

If we look at to Auto CAD tool, it's basically developed for 2D (two dimensional) geometry creation in all kind of engineering works, and up to certain level creation of 3D (three dimensional) geometry is also possible through this tool. To focus on coordinate system of AutoCAD graphic area, we found 'X' and 'Y' axis which are horizontal and vertical respectively if your viewport is 'Top view'. Geometries are implements through command base and for any 'line' creation “Line” command used. Through this command we can create a line which is 1D (one dimensional) geometry. Same way we can make line through connecting two points, by directly selecting them.

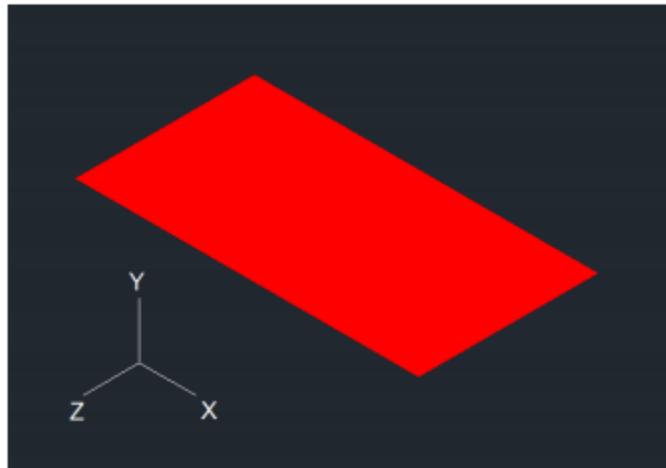
Fig1 shows 1D line in AutoCAD 2013, also represents coordinate system 'X' and 'Y' axis. 'Z' is perpendicular to paper and towards reader's direction is +ve.



*Fig1. 1D geometry-line*

### III. 1D TO 2D

Now suppose if we want to convert this line to 2D (two dimensional) by using 'Extrude' command, we get one flat surface as shown in Fig2. As we considered thickness of sheet is zero so it's 2D, and extruded path is towards +ve Z direction. (See Fig2)

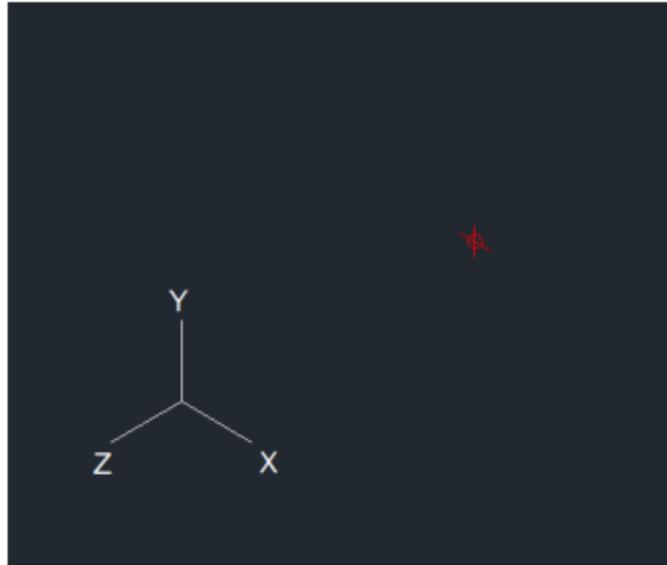


*Fig2. Surface from line*

This one is the simple creation of 1D to 2D conversion through Auto CAD tool, and it performs as easy as designer/draftsman wants. AutoCAD provides 'Extrude' command to develop such surfaces by easily picking 1D object (line) and give depth/height in Z-axis (+ve/-ve) direction. Strong part of this command is to allow 2D objects, either it may be in form of arc, circle, curve or even spline to convert surface as desired shapes which engineer needed. If we look at other tools rather than the AutoCAD, we may have freedom to develop this 'line'-1D sketch in user defined direction, It's not necessary to stretch it in only +ve Z or -ve Z axis. For this operation tool name probably called 'sweep' or 'blend', even some cases 'loft' also (Depends upon which tool engineer is using Pro-E, CATIA, UG, IDEA, etc.).

### IV. POINT-ZERO DIMENSIONAL ENTITY

Point is a 0D (zero dimensional) object in any environment of CAD tool. In AutoCAD we make it by applying 'Point' command, and click on graphic area where would like to appear. Another way is to give parameters in terms of (x,y,z) for any specific point.



***Fig3 shows graphical representation of a point.***

Fig3. A point in graphic area To understand this phenomenon of 0D to 1D concept first we have to go through how objects made in different phases. One of the definitions of 'Circle' is – It is a polygon which has infinite numbers of sides. Let it explain, if we making heptagon inscribed circle method, distance between any two points of its edges which are touching to circle, will laser then the pentagon making by same method (used on same diameter of circle). This distance becomes more and more narrow as the number of sides are incising of polygon and at the 'n' number of side polygon converts to circle. Same way a flat surface also called combination of infinite numbers of lines. As discussed in topic III we can extrude a line and convert it into surface, which is one kind of combination of lines switch to each other without any gap. This is one kind of stitching process applied on 1D to convert it to 2D. Unfortunately this logic is not applicable to 0D point element. AutoCAD not allow selecting any point entity during activation of 'Extrude' command. However it's not totally illogical, we can make 1D line through extrude command from 0D point datum. A huge question is....'In which direction?' Well to answer this question, again go back to topic III. We can convert 1D to 2D in +ve Z or -ve Z direction, so same way we can also make 0D (point) to 1D (line) in +ve Z or -ve Z direction. Ultimately line is also combination of points switch to each other without any gap. At least a straight line creation could be possible through 'Extrude' command in AutoCAD tool and this is one of the major challenge of current version of it.

## **V. CONCLUSION AND DISCUSSION**

A technology now more and more depends upon the CAD/CAM/CAE tools and the efficiency of final design is also sensitivity of these softwares approach. 0D to 1D is one of the very basic and initial level key solution, which helps in many more complicated parameters of further 3D creation. By promoting this kind of solutions new direction for the future work for flexible models will open.

## **REFERENCES**

- [1] Xi-Dao LUAN, Yu-Xiang XIE, Long YING and Ling-Da WU. Research and Development of 3D Modeling. IJCSNS International Journal of Computer Science and Network Security, VOL.8 No.1, January 2008.