

# Clipping in Computer Graphics-A review

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## ABSTRACT

Computer graphics represent the image or picture in graphical form. As we know the image is organized in pixels form. Pixels are smallest unit on the screen that makes the image. When the image size is too large then to make it fit image is clipped according to window size. Computer graphics is responsible to display any image in meaningful way. Clipping identify which part of image is inside or outside of the specified region

**Keywords:** Window, Text Clipping, Line clipping, Polygon clipping

## I. INTRODUCTION

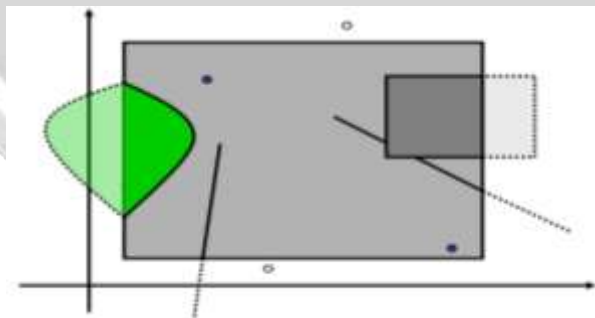
### A. Definition

Computer graphics is a field of computer science that manipulates the visual contents. It refers to 2D as well as 3D computer graphics which helps in image processing. Using computational techniques, computer graphics manipulate the geometric and visual information to represent the image in visualized form.

Clipping selectively enable or disable the rendering operations within the region. Various rendering operations draw pixels within the clip region. Pixels that can't be drawn are outside the clip region. Clipping defines which portion of image is inside or outside of the region,

### B. Clipping Types

Elimination of that object portion which is outside the viewing window is known as clipping. In 2D graphics, a clip region is defined by number of pixels which are drawn within the boundaries of the frame. In 2D viewing window is represented as rectangle window. 2D graphics clipping include Point, Line and Polygon clipping.



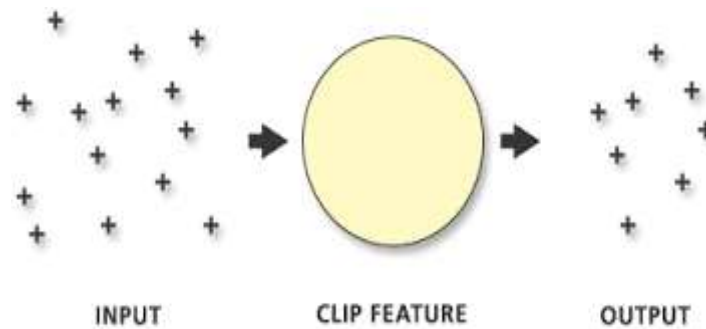
In 3D clipping it defines some operations that work with rectangular shapes and general methods to process the scene model.

### a. Point clipping

Point clipping identify whether to clip the given point or not. If any point (X, Y) is within the window, then it is visible means

Display P = (x, y) if

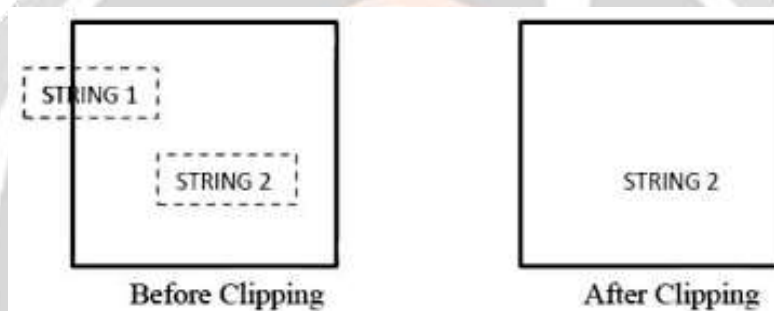
- $X_{W_{min}} \leq x \leq X_{W_{max}}$
- $y_{W_{min}} \leq y \leq y_{W_{max}}$



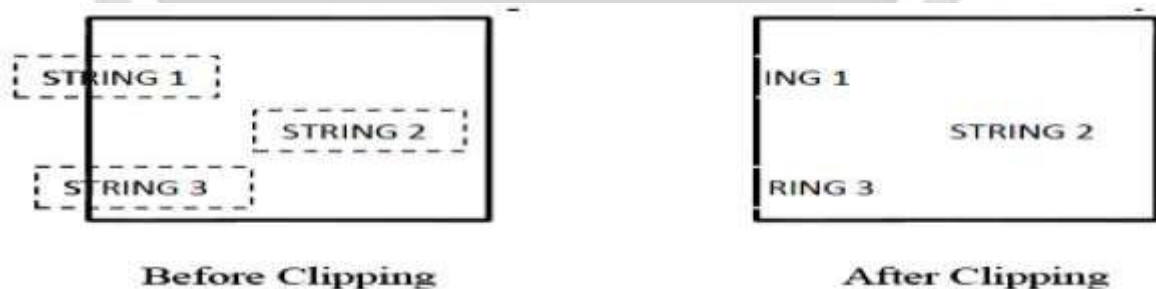
*b. Text clipping*

Text clipping generate the characters which are relative to a boundary window. Text clipping depends on the different strategy.

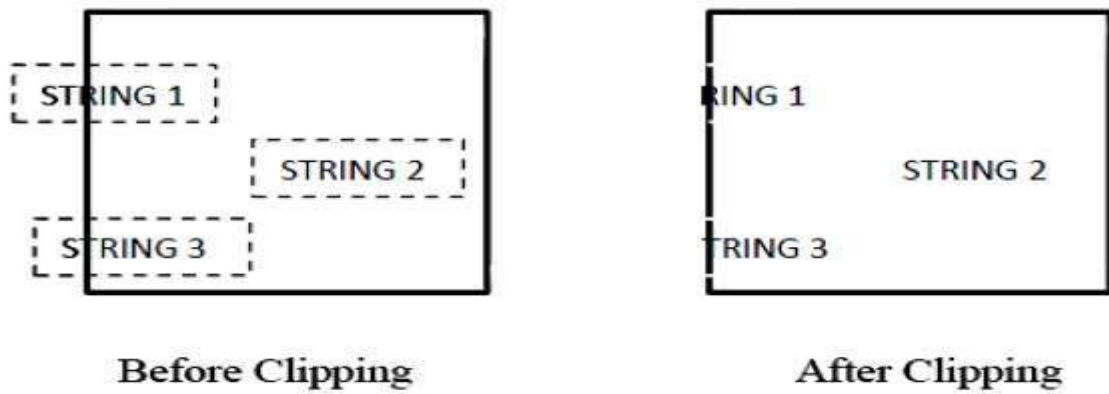
- All-or-none string clipping: It is the simplest method of text clipping. If complete string is inside the window keep it otherwise discards.



- All or none character clipping :if there is any string that overlap the window boundary then character which are outside the window are completely discarded.



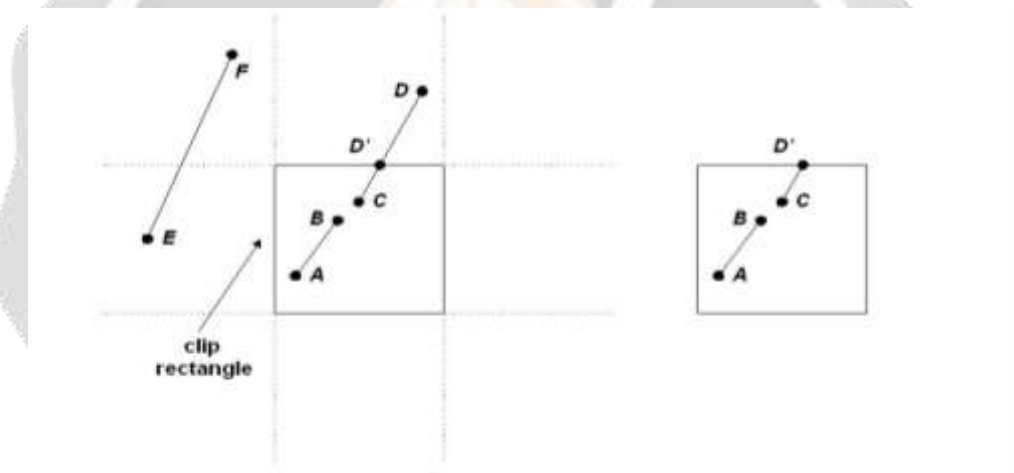
- Components of individual characters: if individual characters of the string are overlapping the window only that part is clipped which is outside of the window.



*c. Line Clipping*

In the line clipping we check if both endpoints are inside the window or not.

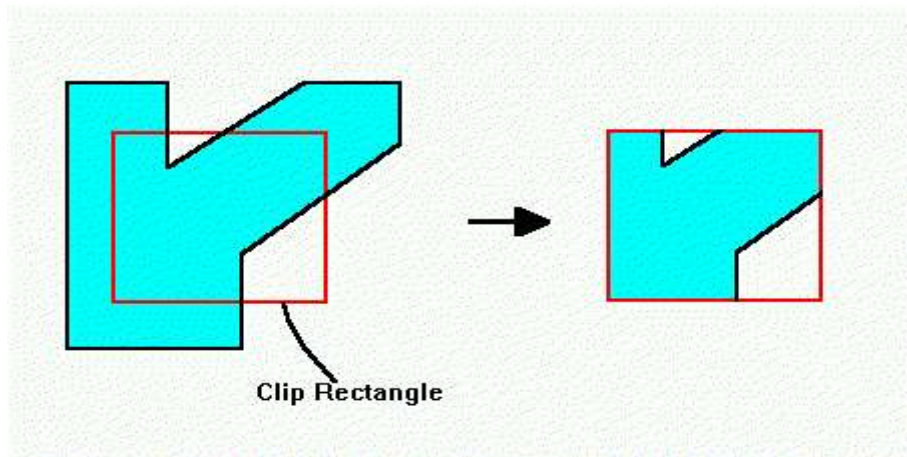
If one endpoint is inside and other is outside the window then outside endpoint is clipped. if both are outside the window we clip both points and don't draw the line



*d. Polygon clipping*

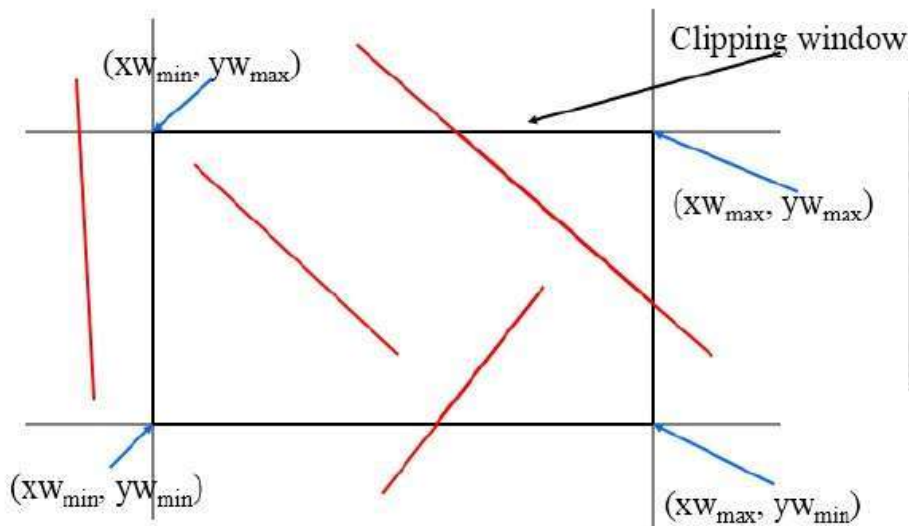
Polygon clipping indicates circle, ellipse and other curve shaped objects. If any part of the object is outside of the window is clipped. Polygon clipper takes as input the vertices and makes the polygon after clipping which are outside of the window.

A polygon can be convex and concave. If line is completely inside the polygon is called convex otherwise it is concave polygon.



## II. Cohen-Sutherland Line clipping

This algorithm uses the clipping window to clip the coordinates. The clipping window has minimum ( $XW_{min}$ ,  $YW_{min}$ ) and maximum coordinate ( $XW_{max}$ ,  $YW_{max}$ ) for the clipping.



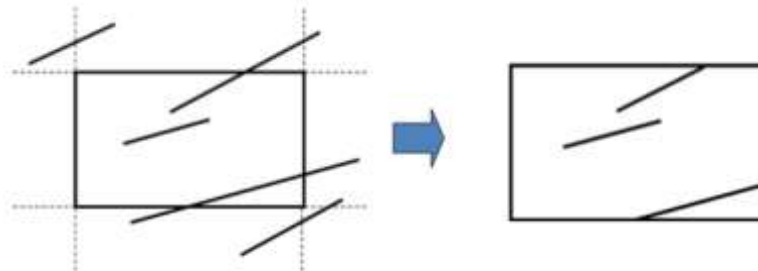
4-bits are used to divide the entire region that represents the Top, Bottom, left and Right of the Region.

<b>1001</b>	<b>0001</b>	<b>0101</b>
<b>1000</b>	<b>0000</b>	<b>0100</b>
	<b>Window</b>	
<b>1010</b>	<b>0010</b>	<b>0110</b>

### Cases in Cohen Sutherland clipping algorithm

- Case A: visibility, when both endpoints are inside the window.

- Case B: Partial Visibility, when one endpoint is inside and other outside the window.
- Case C: Non-Visibility, when both endpoints are outside the window.
- Case D: When both endpoints are outside the window but some part of line is visible.



### III. Sutherland Hodgeman Algorithm

Sutherland Hodgeman algorithm is polygon clipping algorithm. This algorithm clipped those vertices of polygon which are against each edge of the window.

Steps to clip the window:

1. Polygon is clipped against left edge of the window to get the new vertices.
2. Then polygon is clipped against right edge of the window.
3. Then top and bottom edge is clipped against the clipping window.



Clipping a polygon against successive window boundaries.

### IV. CONCLUSION

Clipping method is used to remove the unwanted region which is outside of the window region. Clipping depends on the visibility cases based on which lines are removed. In Sutherland Hodgeman left, right, top and bottom process is followed. Clipping defines window and viewing transformation. Window region clipped the objects which are visible within the region.

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