**ZSDraw**

Das Subsystem *ZSDraw* ist eine C++ Klassenbibliothek, um Zeichnungen bestehend aus zweidimensionalen, grafischen Objekten zu erstellen. Die einzelnen Objekte können im Simulationsmodus untereinander Daten austauschen und ihre Zustände zur Laufzeit ändern.

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# Einführung

# Graphical Objects (Class CGraphObj)

## Coorindate Systems

### Transformation Instructions

The item’s shape points (and it’s bounding rectangle) are defined relative to the item’s coordinate system with the coordinate origin point at (0/0). The coordinate origin point corresponds to the top left corner of the item’s bounding rectangle. This is the starting point of any edit sessions using mouse events.

(0/0)

x

y

An item may be moved and rotated within the diagram scene’s coordinate system. Changing the size of an item does not change the scale factors but the real size of the item.

Transformations from the item’s coordinate system to the scene’s coordinate system is processed in two steps – first moving the object by changing it’s scene position and afterwards rotation the object around it’s bounding rectangles center point. To rotate the item three steps are needed – translating the item by the center point, rotating the item by the rotation angle and translating the item again back by the center point.

1. Move (GraphicsItem.setPos)

(0/0)

x

y

scenePos.x

scenePos.y

(0/0)

x

y

ptRotOrigin

1. Rotation

transform.translate( -ptRotOrigin )

(0/0)

x

y

(0/0)

scenePos.x

scenePos.y

transform.rotate( rotAngle\_deg )

(0/0)

x

y

(0/0)

scenePos.x

scenePos.y

transform.translate( ptRotOrigin )

(0/0)

x

y

(0/0)

scenePos.x

scenePos.y

ptRotOrigin

### Mouse Events

#### Resizing Bounding Rectangle

The graphics item receives mouse press, mouse move and mouse release events. The mouse position is provided in scene coordinates, relative to the parent object (if any) and in item coordinates.

(0/0)

x

y

(0/0)

Item.

scenePos.x

Item

scenePos.y

mouseEv.scenePos

We use the mouse position in item coordinates to resize the bounding rectangle of the item. The shape points will be adjusted correspondingly within the item’s coordinate system. On pressing the mouse the current size, the rotation point and the shape points are temporarily stored.

As long as the item receives mouse move events the item’s bounding rectangle and shape points will be adjusted relative to the coordinates captured while pressing the mouse. The transformation values (“setPos”, “ptRotOrigin”, “rotAngle\_deg”) will not be changed (but newly applied for each move event).

1. Calculating Bounding Rectangle and Shape Points on Move Events

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

mouseEv.pos

ptRotOrigin

1. Move (GraphicsItem.setPos)

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

(0/0)

ptRotOrigin

1. Rotation

transform.translate( -ptRotOrigin )

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

(0/0)

ptRotOrigin

transform.rotate( rotAngle\_deg )

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

(0/0)

ptRotOrigin

transform.translate( -ptRotOrigin )

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

mouseEv.scenePos

(0/0)

ptRotOrigin

1. On releasing the mouse the new transformation values will be adjusted.

(0/0)

x

y

Item.

scenePos.x

Item.

scenePos.y

mouseEv.scenePos

(0/0)

ptRotOrigin

The origin point for rotating the item (ptRotOrigin) and the scene position (Item.ScenePos) got to be newly calculated and adjusted. The new rotation origin point is simply the center point of the bounding rectangle of the item (in item coordinates). To get the new scene position:

* 1. the old scene position will be rotated using the previous rotation point as captured on pressing the mouse and
  2. the rotated scene position will then be rotated using the newly calculated rotation point.