Midpoint Ellipse Drawing Algorithm

Step 1: Input radii r_x, r_y and ellipse centre (x_c,y_c). Initialize the first point as:

$$(x_o,y_o) = (0,r_y)$$

Step 2: Calculate the initial decision parameter for region 1 as:

$$p1= r_y^2- r_x^2 r_y +0.25 r_x^2$$

Step 3: For each x-position in region 1(starting at k=0), perform the following:

If $p1 < 0$, the next point is $(x_k +1, y_k)$ and update:

$$p1= p1+2 r_y^2 xk + r_y^2$$

Otherwise, the next point is $(x_k +1, y_k - 1)$ and update:

$$p1= p1+2 r_y^2 x_k-2 r_x^2 y_k+ r_y^2$$

Calculate until: $2r_y^2 x <= 2r_x^2 y$

Step 4: Calculate the initial decision parameter for region 2:

$$p2= r_y^2 (x_p+0.5)^2 + r_x^2(y_p-1)^2 – r_x^2 r_y^2$$

Step 5: For each y-position in region 2 (starting at k =0) perform the following:

If $p2 < 0$, the next point is $(x_k, y_k -1)$ and update:

$$p2 = p2- r_y^2 y_k+ r_x^2$$

Otherwise, the next point is $(x_k +1, y_k - 1)$ and update:

$$p2= p2+2 r_y^2 x_k – 2 r_x^2 y_k + r_x^2$$

Step 6: For each calculated pixel position (x,y) determine the symmetric points in the other three quadrants.

Step 7: Translate each pixel position to the ellipse centered at (x_c,y_c):

$$(x',y') = (x+x_c,y+y_c)$$

Step 8: Plot the points for both regions until the stopping condition $2 r_y^2 x = 2 r_x^2 y$ is satisfied.