

Mandelbrot Set Computation (1)

Set of points in a complex plane that are quasi-stable (will increase and decrease, but not exceed some limit) when computed by iterating the function

$$z_{k+1} = z_k^2 + c$$

where z_{k+1} is the $(k + 1)$ th iteration of the complex number $z = a + bi$ and c is a complex number giving the position of the point in the complex plane.

The initial value for z is zero.

Iterations continued until magnitude of z is greater than 2 or number of iterations reaches arbitrary limit. Magnitude of z is the length of the vector given by

$$z_{\text{length}} = \sqrt{a^2 + b^2}$$

Mandelbrot Set Computation (2)

Computing the complex function, $z_{k+1} = z_k^2 + c$, is simplified by recognizing that

$$z^2 = a^2 + 2abi + bi^2 = a^2 - b^2 + 2abi$$

or a real part that is $a^2 - b^2$ and an imaginary part that is $2ab$.

The next iteration values can be produced by computing:

$$z_{\text{real}} = z_{\text{real}}^2 - z_{\text{imag}}^2 + c_{\text{real}}$$

$$z_{\text{imag}} = 2z_{\text{real}}z_{\text{imag}} + c_{\text{imag}}$$

Mandelbrot Set Computation (3)

