Newton's Method Fractals in Motion

Tomasz Malisiewicz
Robotics Institute
Carnegie Mellon University
Pittsburgh PA, 15232
tomasz@cmu.edu

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Abstract

Fractals generated via Newton's Method...

1 Newton's Method

Newton's method is an iterative update rule for finding the roots of an equation $f(x) = 0$.

$$x_{i+1} = x_i - \frac{f(x_i)}{f'(x_i)} \tag{1}$$

For an arbitrary equation where computing the derivative $f'(x)$ is difficult one can use the finite difference approximation

$$f'(x) = \frac{f(x+\epsilon) - f(x)}{\epsilon} \tag{2}$$

Polynomials can be expressed two ways. Directly encoding the zeros we write:

$$f(x) = \prod_{i=1}^{K}(x - z_i) \tag{3}$$

We can also use the more standard form

$$f(x) = \sum_{i=0}^{K} a_i x^i \tag{4}$$