

6.5.9

EE24BTECH11015 - Dhawal

Question:

Find the maximum value of the function $f(x) = \sin x + \cos x$

Theoretical Solution

For maxima $f'(x) = 0$ and $f''(x) \leq 0$

$$f'(x) = \cos x - \sin x = 0 \quad (1)$$

$$\sin x = \cos x \quad (2)$$

We get $x = \frac{\pi}{4}$ and $x = \frac{5\pi}{4}$

Lets check $f''(x) \leq 0$

$$f''(x) = -\sin x - \cos x \quad (3)$$

For $x = \frac{\pi}{4}$

$$f''(x) = -\sqrt{2} \leq 0 \quad (4)$$

We get,

$$x_{max} = \frac{\pi}{4} = 0.785392, \quad y_{max} = \sqrt{2} = 1.414214 \quad (5)$$

Computational Solution

$$f'(x_n) = \cos x_n - \sin x_n \quad (6)$$

Gradient ascent to find local maximum,

$$x_{n+1} = x_n + \eta f'(x_n) \quad (7)$$

$$x_{n+1} = x_n + \eta (\cos(x_n) - \sin(x_n)) \quad (8)$$

Where η is the learning rate.

Assuming,

$$\eta = 0.1 \quad (9)$$

$$\text{tolerance} = 1e-6 \quad (10)$$

$$x_0 = 0.0 \quad (11)$$

We get,

$$x_{max} = 0.785392, \quad y_{max} = 1.414214 \quad (12)$$

