

Chapter 9 : Ordinary Differential Equations

How to solve an IVP

1. Eulers Method
2. Taylor's Method of Order 2
3. Taylor's Method of Order 3
4. Taylor's Method of Order 4
5. Heun's Method
6. Runge-Kutta of order 4

Eulers Method

$$y_{k+1} = y_k + hf(t_k, y_k) \quad , E_n = \frac{h^2}{2} y''(c) \quad , E[y(b), h] = \frac{(b-a)h}{2} y''(c) \quad , k = 0, \dots, n$$

Taylor's Method of Order 2

$$y_{k+1} = y_k + hf(t_k, y_k) \quad , E_n = \frac{h^2}{2} y'(c) \quad , E[y(b), h] = \frac{(b-a)h}{2} y'(c) \quad , k = 0, \dots, n$$

Heun's Method

$$y_{k+1} = y_k + \frac{h}{2} [f(t_k, y_k) + f(t_{k+1}, y_k + hf(t_k, y_k))]$$

Runge-Kutta of Order 4

$$f_1 = f(t_k, y_k)$$

$$f_2 = f(t_k + \frac{h}{2}, y_k + \frac{h}{2} f_1)$$

$$f_3 = f(t_k + \frac{h}{2}, y_k + \frac{h}{2} f_2)$$

$$f_4 = f(t_{k+1}, y_k + hf_3)$$

$$y_{k+1} = y_k + \frac{h}{6} [f_1 + 2f_2 + 2f_3 + f_4]$$