ME 3001 - Forward Integration Techniques

- **Euler's Method (Forward Euler's)**

$$y(x + \Delta x) = y(x) + f(x, y)\Delta x$$

or with subscript notation shown below

$$y_{i+1} = y_i + f(x_i, y_i)\Delta x$$

- **Second Order Runge-Kutta Method (RK2)**

$$y_{i+1} = y_i + \frac{1}{2}k_1 + \frac{1}{2}k_2$$

with

$$k_1 = f(x_i, y_i)\Delta x$$

$$k_2 = f(x_i + \Delta x, y_i + k_1)\Delta x$$

- **Fourth Order Runge-Kutta Method (RK4)**

$$y_{i+1} = y_i + \frac{1}{6}(k_1 + 2k_2 + 2k_3 + k_4)$$

with

$$k_1 = f(x_i, y_i)\Delta x$$

$$k_2 = f(x_i + \frac{1}{2}\Delta x, y_i + \frac{1}{2}k_1)\Delta x$$

$$k_3 = f(x_i + \frac{1}{2}\Delta x, y_i + \frac{1}{2}k_2)\Delta x$$

$$k_4 = f(x_i + \Delta x, y_i + k_3)\Delta x$$