

Differential equation

The equation which contains the differential operator with respect to unknown function is called differential equation.

Mass inertia

$$m\ddot{y}(t) = mg$$

Difference equation

The equation which contains the difference operator with respect to unknown sequence is called difference equation.

$$y_{n+1} - y_n = 0, n = 0, 1, 2, 3, \dots$$

Integral equation

The equation which contains the integral operator with respect to unknown function is called integral equation.

Material inertia

$$\int_0^t (t - \tau)y(\tau)d\tau = p(t)$$

Integral-differential equation

The equation which contains the integral and differential operators with respect to unknown function is called integral-differential equation.

Mass and material inertia

$$m\ddot{y}(t) + \int_0^t (t - \tau)y(\tau)d\tau = p(t)$$

ODE, PDE

Order

$$\dot{y} = \alpha y \text{ (first order)}$$

$$\ddot{r} = -gR^2/r^2 \text{ (second order)}$$

$$\ddot{x}(t) - 3\dot{x}(t) + x(t) = \cos(t), \text{ (second order)}$$

$$[y''''x]^{5/2} - 2y'' = \cos(x), \text{ (Fourth order)}$$

$$F(x, y, y', \dots, y^n(x)) = 0 \text{ (nth order)}$$

Linearity(linear or nonlinear)

$y_1, y_2$  satisfy homo. linear ODE  $\rightarrow y_1 + y_2$  satisfy homo. linear ODE

Homogeneity(homogeneous or nonhomogeneous)