Assignment

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Subject Differntial Equation

Application of ODES In Engineering:

a An equation which contains derivative of one or more dependent variabe of a single independent variab(e)

① Physical Application of ODE:

(1) It velocity $(v) = \frac{dx}{dy}$

(2) Its acceleration $(a) = \frac{dv}{dt}$ or d^2x/dt^2

however if a body is moving along a curve then

(1) its velocity $(v) = \frac{ds}{dt}$

(2) In Newton's second law.. The rate of change of momentum encountered by a moving Object equal to the Net force Applied to it in mathmatical.

$$F = \frac{d(mv)}{dt} \Rightarrow m\frac{dv}{dt} + v\frac{dm}{dt} \Rightarrow f = m\frac{dv}{dt}$$

$$= f = ma$$

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(3) Newton law of cooling:- The rate of change of the temprature of an object is proportional to the difference between its own temprature and the temprature of its sorroundings.

Therefore $d\theta/dt = \epsilon A(\theta - \theta r)$; ϵ - A constant that depends upon the object, A - surface area, θ - A certain temprature, θR - room/ambient temprature and tempretuire of the sorrounding

(4) Radiactive half life: A stochastic (random) process.

the rate of decay is depended upon the number of molecules/atoms that are there

- Negative because the number is decreasing
- K is the constant for proportionality

$dN/dt = KN$

(5) mcaulays method:

The differential equation of bending becomes. importantly without expanding the term into square brackets

$$EI_{yx} \frac{d^2 u_z}{dx^2} = -M_y = -R_A x + F_2[x-2]$$

this expression can b integrated twice.

6) No Daping

(7) Electrical circuits

(8) Light Damping

9) computer exercise

(10) Beam

11) modeling forced mech oscillation.

(4)

An equation contian partial derivatives of one or dependent variable of two or more indcpendent variable.

Application of PDEs in engineering

(1) Laplace equation:- Laplase equation is used to describe the steady state distribution of heat in body

- Also used to describe the steady state distribution of electric charge in body

$$\frac{\partial^2 u(x,y,z)}{\partial x^2} + \frac{\partial^2 u(x,y,z)}{\partial y^2} + \frac{\partial^2 u(x,y,z)}{\partial z^2} = 0$$

(2) heat equation:- The function $u(x,y,z,t)$ is used to represent the temprature at time t in a physical body at a point with cordinates (x,y,z)

α is the thermal diffusity it is sufficient to consider the case $\alpha = 1$.

$$\frac{\partial u(x,y,z,t)}{\partial t} = \alpha \left[\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2} \right]$$

(5) Wave equation:-

The function $u(x, y, z, t)$ is used to represent the displacement at time t of a particle whose position at rest is (x, y, z)

The constant c represent the propagation speed of the wave

$$\frac{\partial^2 u(x, y, z, t)}{\partial t^2} = c^2\left(\frac{\partial^2 u}{\partial x^2} + \frac{\partial^2 u}{\partial y^2} + \frac{\partial^2 u}{\partial z^2}\right)$$