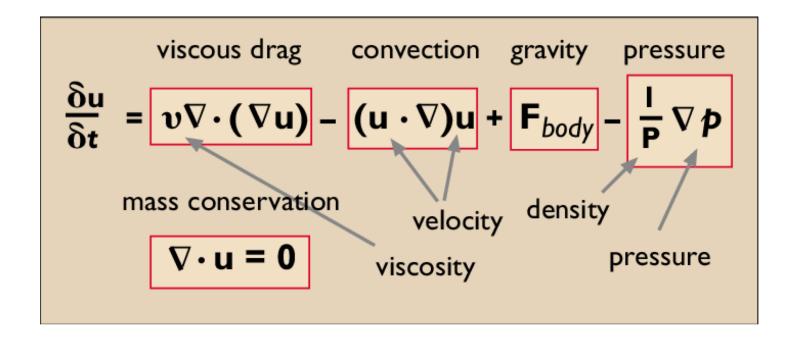
Partial Differential Equations

- Equations that contain derivatives with respect to more than one variable
- Derivatives can be with respect to position in multiple dimensions of space
- Derivatives can be with respect to both space and time

Navier-Stokes Equations



The Navier-Stokes equations describe the flow of a fluid like air or water.

Maxwell's Equations

$$\nabla \cdot \mathbf{E} = \frac{\rho_{v}}{\varepsilon}$$
 (Gauss' Law)
$$\nabla \cdot \mathbf{H} = 0$$
 (Gauss' Law for Magnetism)
$$\nabla \times \mathbf{E} = -\mu \frac{\partial \mathbf{H}}{\partial t}$$
 (Faraday's Law)
$$\nabla \times \mathbf{H} = \mathbf{J} + \varepsilon \frac{\partial \mathbf{E}}{\partial t}$$
 (Ampere's Law)

Maxwell's equations describe the behavior of an electromagnetic field.

Linear Elasticity Equations

$$\begin{split} &\frac{\partial \sigma_{rr}}{\partial r} + \frac{1}{r} \frac{\partial \sigma_{r\theta}}{\partial \theta} + \frac{\partial \sigma_{rz}}{\partial z} + \frac{1}{r} (\sigma_{rr} - \sigma_{\theta\theta}) + F_r = \rho \frac{\partial^2 u_r}{\partial t^2} \\ &\frac{\partial \sigma_{r\theta}}{\partial r} + \frac{1}{r} \frac{\partial \sigma_{\theta\theta}}{\partial \theta} + \frac{\partial \sigma_{\thetaz}}{\partial z} + \frac{2}{r} \sigma_{r\theta} + F_{\theta} = \rho \frac{\partial^2 u_{\theta}}{\partial t^2} \\ &\frac{\partial \sigma_{rz}}{\partial r} + \frac{1}{r} \frac{\partial \sigma_{\thetaz}}{\partial \theta} + \frac{\partial \sigma_{zz}}{\partial z} + \frac{1}{r} \sigma_{rz} + F_z = \rho \frac{\partial^2 u_z}{\partial t^2} \end{split}$$

The linear elasticity equations describe vibration, stress, and strain in an elastic solid.

Schrödinger's Equation

Schrödinger's Equation

$$i\hbar \frac{\partial}{\partial t} \psi(\mathbf{r}, t) = -\frac{\hbar^2}{2m} \nabla^2 \psi(\mathbf{r}, t) + V(\mathbf{r}, t) \psi(\mathbf{r}, t)$$

i is the imaginary number, $\sqrt{-1}$.

 \hbar is Planck's constant divided by 2π : 1.05459 × 10⁻³⁴ joule-second. ψ (**r**,t) is the wave function, defined over space and time. m is the mass of the particle.

$$\nabla^2$$
 is the Laplacian operator, $\frac{\partial^2}{\partial x^2} + \frac{\partial^2}{\partial y^2} + \frac{\partial^2}{\partial z^2}$.

V(r,t) is the potential energy influencing the particle.

Schrödinger's equation of quantum dynamics describes the wave function of a particle.