CVEN 2501 Notes

Week 1, 26/2/18

Fluid Statics

Fluid Properties

Types of fluids and their properties

- **Solids**
  - Resist shear stresses by static deformation
  - Rigid, fixed shape, fixed volume
- **Liquids**
  - Any applied shear stress will result in motion
  - Composed of closely packed molecules with strong cohesive forces
  - Retain their volume
  - Not rigid – no fixed shape
  - Maintain a free surface
- **Gases**
  - Any applied shear stress will result in motion
  - Composed of widely spaced molecules with negligible cohesive forces
  - Expand until they encounter walls (no definite volume)
  - Not rigid – no fixed shape
  - Cannot form a free surface

Mass, weight and density

- **Mass** (m) (kg)**:** the amount of matter an object contains
- **Weight** (W) (N)**:** the force due to gravitational attraction
  - Changes depending on the strength of gravitational field
- **Density** (ρ) (kg/m^3)**:** mass per unit volume
  - Freshwater, 20˚C: 1000 kg/m^3
- **Unit weight** (γ) (N/m^3)**:** weight per unit volume
  - $\gamma = \rho g$
    - Freshwater, 20˚C: 9810 N/m^3
- **Relative density / specific gravity** (sg)**:** ratio of a specific material's density to that of pure water at 20˚C
  - $s = \frac{\gamma_f}{\gamma_w}$
- **Specific volume** (v_s) (m^3/kg)**:** volume per unit mass

Pressure and compressibility

- **Pressure** (p) (Pa, N/mm^2)**:** the force exerted by a fluid per unit area
  - At a point in the fluid, it is the normal force applied to a surface element, divided by its element
    - $P = \frac{F}{A}$