**ABE 307**

**Simplifications of Equation of Motion**

1. Navier-Stokes Equation

For constant ρ and μ

From Chapter 1, General Viscosity: 𝛕 = -μ(⛛v + (⛛v)T) + 2/3 \* μ(~~⛛v~~)δ

Dρ/Dt = -ρ(⛛ \* **v**) (from the continuity equation)

0 = -ρ(⛛ \* **v**) (constant density assumption

⛛ \* **v** = 0 (incompressible fluid)

**New equation of motion:**

ρ \* D**v**/Dt = -⛛p - ⛛ \* 𝛕 + ρ**g** (evaluating for constant ρ and μ)

⛛ \* (-μ(⛛v + (⛛v)T)) = -μ(⛛\* ⛛\* **v** + 0) = -μ(⛛2 \* **v**)

ρ \* D**v**/Dt = -⛛p + μ(⛛2 \* **v**) + ρ**g** = -⛛P + μ(⛛2 \* **v**)

-⛛P = ⛛(p + ρ**g**δ)

1. Stokes’ Equation

Neglect the acceleration term, “creeping flow”

-⛛P + μ(⛛2 \* **v**) = 0 (μ, ρ, ωΠ)

Useful for particles in suspension flow through porous media

Isothermal, incompressible flow

1. Euler’s Equation

Inviscid flow --> neglect viscous forces (high velocity flow)

ρ \* D**v**/Dt = -⛛p + ρ**g**

There are no truly non-viscous fluids

It is the flow situation that results in no effect on viscosity