Constants and Basics

$g = 9.8$ m/s^2
$\rho_{water} = 998$ kg/m^3
$P_{atm} = 101.3$ kPa
$\boldsymbol{V} = u\boldsymbol{i} + v\boldsymbol{j} + w\boldsymbol{k}$
$\tau = \mu\, du/dy$
$\nu = \mu/\rho$
SG $= \rho/\rho_{H2O}$
Ideal gas: $P = \rho R_{gas} T$
$\vec{F} = -\int p \mathrm{d}\vec{A}$
$P_{gage} = P_{abs} - P_{atm}$
$\bar{x}F_{total} = \sum x_i F_i = \int x dF$
$\bar{x}F_p = \int xp(x)dA$
$\vec{F}_{weight} = \int \rho \vec{g} dV$
Re $= \rho UL/\mu$
$F_R = \dfrac{V^2}{gh}$

Hydrostatics

$\vec{\nabla} p = \rho \vec{g}$
$p_2 - p_1 = \rho g(z_1 - z_2)$ $p = p_0 - \rho g z + \dfrac{1}{2}\rho r^2 \Omega^2$
$F_{buoyant} = +\rho_w g V_{TOT}$
$W = +\rho_o g V_{TOT}$
$\rho_o/\rho_f = V_{submerged}/V_o$
$-\boldsymbol{\nabla} p + \rho(\boldsymbol{g} - \boldsymbol{a}) = 0$
$\boldsymbol{g}_{eff} = \boldsymbol{g} - \boldsymbol{a}$

Streamlines

$dy/dx = v/u$
$\psi = -\int v dx + f_1(y) = +\int u dy + f_2(x)$

Bernoulli

$\dfrac{p_1}{\rho} + \dfrac{V_1^2}{2} + g z_1 = \dfrac{p_2}{\rho} + \dfrac{V_2^2}{2} + g z_2$
$p_{dyn} = \frac{1}{2}\rho V^2$
$p_0 = p_{dyn} + p_{stat}$

Integral Conservation Laws

$M = \int_V \rho dV$
$\int_{CM} \vec{F}_{external} dt = \int \rho \vec{\mathbf{V}} dV$
$N = \int_{volume} \rho n dV$
$\dot{m} = -\int_A \rho \vec{V} \cdot d\vec{A}$
$Q = \int \vec{V} \cdot d\vec{A}$
$\dot{N} = -\int n \rho \vec{V} \cdot d\vec{A}$
$\left.\dfrac{dN}{dt}\right|_{CM} = \dfrac{d}{dt}\int_{CV} n\rho dV + \int n\rho \vec{V} \cdot d\vec{A}$
$0 = \dfrac{d}{dt}\int_{CV} \rho dV + \int \rho \vec{V} \cdot d\vec{A}$
$\Sigma F_{CV} = \dfrac{d}{dt}\int_{CV} \vec{V}_{xyz} \rho dV + \int \vec{V}_{xyz} \rho \vec{V}_{xyz} \cdot d\vec{A} + \int \vec{a}_{RF} \rho dV$
$\dot{Q}_{in} - \dot{W}_{net\ out} = \dfrac{\partial}{\partial t}\int_{CV} e\rho dV + \int_{CS}\left(u + pv + \dfrac{V^2}{2} + gz\right)\rho\left(\vec{V} \cdot d\vec{A}\right)$