Dimensional Analysis – Dimensionless Governing Equations

https://en.wikipedia.org/wiki/Mississippi_River_Basin_Model

Dimensional Analysis – Dimensionless Governing Equations

Continuity Equation (conservation of mass)

$$\nabla \cdot \mathbf{u} = 0$$

Navier-Stokes Equations (momentum equations for a Newtonian fluid)

$$\rho\left[\frac{\partial \mathbf{u}}{\partial t} + \left(\mathbf{u}\cdot\nabla\right)\mathbf{u}\right] = -\nabla p + \mu\nabla^2\mathbf{u} + \rho\mathbf{g}$$

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Common Dimensionless Parameters in Fluid Mechanics

Name	Definition	Meaning
Reynolds number, Re	$\frac{\rho V L}{\mu}$	ratio of a characteristic (convective) inertial force to a characteristic viscous force
Froude number, Fr	$\frac{V}{\sqrt{gL}}$	ratio of a characteristic (convective) inertial force to a characteristic gravitational force
Euler number, Eu	$\frac{p}{\rho V^2}$	ratio of a characteristic pressure force to a characteristic (convective) inertial force
Strouhal number, St	$\frac{L}{UT}$	ratio of a characteristic unsteady inertial force to a characteristic convective inertial force
pressure coefficient, c_p	$\frac{p - p_0}{\frac{1}{2}\rho V^2}$	a type of Euler number
drag and lift coefficients, c_D and c_L	$\frac{D}{\frac{1}{2}\rho V^2 A}$ or $\frac{L}{\frac{1}{2}\rho V^2 A}$	ratio of drag and lift forces to a characteristic dynamic pressure force (a type of Euler number)
Mach number, Ma	$\frac{V}{c}$	ratio of flow speed to the speed of sound in the flow
relative roughness, e/D	$\frac{e}{D}$	ratio of the pipe wall roughness to the pipe diameter
(Darcy) friction factor, f_D	$\frac{4\tau_w}{\frac{1}{2}\rho \bar{V}^2}$	ratio of the wall shear stress to the dynamic pressure

There are many more. Check out:
https://en.wikipedia.org/wiki/Dimensionless_numbers_in_fluid_mechanics