Table 1: Continuity Equation for Incompressible Flow in Different Coordinate Systems

Coordinate System	Continuity Equation
Cartesian	$\dfrac{\partial u}{\partial x} + \dfrac{\partial v}{\partial y} + \dfrac{\partial w}{\partial z} = 0$
Cylindrical	$\dfrac{1}{r}\dfrac{\partial(ru_r)}{\partial r} + \dfrac{1}{r}\dfrac{\partial u_\theta}{\partial \theta} + \dfrac{\partial u_z}{\partial z} = 0$

Table 2: Momentum Equations for Incompressible Flow in Different Coordinate Systems

Direction	Momentum Equation
x	$\dfrac{\partial u}{\partial t} + u\dfrac{\partial u}{\partial x} + v\dfrac{\partial u}{\partial y} + w\dfrac{\partial u}{\partial z} = -\dfrac{1}{\rho}\dfrac{\partial P}{\partial x} + \dfrac{\mu}{\rho}\left(\dfrac{\partial^2 u}{\partial x^2} + \dfrac{\partial^2 u}{\partial y^2} + \dfrac{\partial^2 u}{\partial z^2}\right) + g_x$
y	$\dfrac{\partial v}{\partial t} + u\dfrac{\partial v}{\partial x} + v\dfrac{\partial v}{\partial y} + w\dfrac{\partial v}{\partial z} = -\dfrac{1}{\rho}\dfrac{\partial P}{\partial y} + \dfrac{\mu}{\rho}\left(\dfrac{\partial^2 v}{\partial x^2} + \dfrac{\partial^2 v}{\partial y^2} + \dfrac{\partial^2 v}{\partial z^2}\right) + g_y$
z	$\dfrac{\partial w}{\partial t} + u\dfrac{\partial w}{\partial x} + v\dfrac{\partial w}{\partial y} + w\dfrac{\partial w}{\partial z} = -\dfrac{1}{\rho}\dfrac{\partial P}{\partial z} + \dfrac{\mu}{\rho}\left(\dfrac{\partial^2 w}{\partial x^2} + \dfrac{\partial^2 w}{\partial y^2} + \dfrac{\partial^2 w}{\partial z^2}\right) + g_z$
r	$\dfrac{\partial u_r}{\partial t} + u_r\dfrac{\partial u_r}{\partial r} + \dfrac{u_\theta}{r}\dfrac{\partial u_r}{\partial \theta} - \dfrac{u_\theta^2}{r} + u_z\dfrac{\partial u_r}{\partial z} = -\dfrac{1}{\rho}\dfrac{\partial P}{\partial r} + g_r$ $+ \dfrac{\mu}{\rho}\left[\underbrace{\dfrac{1}{r}\dfrac{\partial}{\partial r}\left(r\dfrac{\partial u_r}{\partial r}\right) - \dfrac{u_r}{r^2}}_{\dfrac{\partial}{\partial r}\left(\dfrac{1}{r}\dfrac{\partial}{\partial r}(ru_r)\right)} + \dfrac{1}{r^2}\dfrac{\partial^2 u_r}{\partial \theta^2} - \dfrac{2}{r^2}\dfrac{\partial u_\theta}{\partial \theta} + \dfrac{\partial^2 u_r}{\partial z^2}\right]$
θ	$\dfrac{\partial u_\theta}{\partial t} + u_r\dfrac{\partial u_\theta}{\partial r} + \dfrac{u_\theta}{r}\dfrac{\partial u_\theta}{\partial \theta} + \dfrac{u_r u_\theta}{r} + u_z\dfrac{\partial u_\theta}{\partial z} = -\dfrac{1}{\rho r}\dfrac{\partial P}{\partial \theta} + g_\theta$ $+ \dfrac{\mu}{\rho}\left[\underbrace{\dfrac{1}{r}\dfrac{\partial}{\partial r}\left(r\dfrac{\partial u_\theta}{\partial r}\right) - \dfrac{u_\theta}{r^2}}_{\dfrac{\partial}{\partial r}\left(\dfrac{1}{r}\dfrac{\partial}{\partial r}(ru_\theta)\right)} + \dfrac{1}{r^2}\dfrac{\partial^2 u_\theta}{\partial \theta^2} + \dfrac{2}{r^2}\dfrac{\partial u_\theta}{\partial \theta} + \dfrac{\partial^2 u_\theta}{\partial z^2}\right]$
z	$\dfrac{\partial u_z}{\partial t} + u_r\dfrac{\partial u_z}{\partial r} + \dfrac{u_\theta}{r}\dfrac{\partial u_z}{\partial \theta} + u_z\dfrac{\partial u_z}{\partial z} = -\dfrac{1}{\rho}\dfrac{\partial P}{\partial z} + g_z$ $+ \dfrac{\mu}{\rho}\left[\dfrac{1}{r}\dfrac{\partial}{\partial r}\left(r\dfrac{\partial u_z}{\partial r}\right) + \dfrac{1}{r^2}\dfrac{\partial^2 u_z}{\partial \theta^2} + \dfrac{\partial^2 u_z}{\partial z^2}\right]$

Note that