Cylindrical coordinates (r, θ, x)

- Continuity equation (for an incompressible fluid)

$$\frac{1}{r}\frac{\partial\left(ru_r\right)}{\partial r} + \frac{1}{r}\frac{\partial u_\theta}{\partial \theta} + \frac{\partial u_x}{\partial x} = 0$$

- Momentum equation (for an incompressible fluid)
  - r-component

$$\rho\left(\frac{\partial u_r}{\partial t} + u_r\frac{\partial u_r}{\partial r} + \frac{u_\theta}{r}\frac{\partial u_r}{\partial \theta} - \frac{u_\theta^2}{r} + u_x\frac{\partial u_r}{\partial x}\right)$$
$$= -\frac{\partial p}{\partial r} + \left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\tau_{rr}\right) + \frac{1}{r}\frac{\partial \tau_{\theta r}}{\partial \theta} - \frac{\tau_{\theta\theta}}{r} + \frac{\partial \tau_{xr}}{\partial x}\right) + \rho g_r$$

  - θ-component

$$\rho\left(\frac{\partial u_\theta}{\partial t} + u_r\frac{\partial u_\theta}{\partial r} + \frac{u_\theta}{r}\frac{\partial u_\theta}{\partial \theta} + \frac{u_r u_\theta}{r} + u_x\frac{\partial u_\theta}{\partial x}\right)$$
$$= -\frac{1}{r}\frac{\partial p}{\partial \theta} + \left(\frac{1}{r^2}\frac{\partial}{\partial r}\left(r^2\tau_{r\theta}\right) + \frac{1}{r}\frac{\partial \tau_{\theta\theta}}{\partial \theta} + \frac{\partial \tau_{\theta x}}{\partial x} + \frac{\tau_{\theta r} - \tau_{r\theta}}{r}\right) + \rho g_\theta$$

  - x-component

$$\rho\left(\frac{\partial u_x}{\partial t} + u_r\frac{\partial u_x}{\partial r} + \frac{u_\theta}{r}\frac{\partial u_x}{\partial \theta} + u_x\frac{\partial u_x}{\partial x}\right)$$
$$= -\frac{\partial p}{\partial x} + \left(\frac{1}{r}\frac{\partial}{\partial r}\left(r\tau_{rx}\right) + \frac{1}{r}\frac{\partial \tau_{\theta x}}{\partial \theta} + \frac{\partial \tau_{xx}}{\partial x}\right) + \rho g_x$$

In the above, ρ denotes the fluid density, $\vec{u} = (u_r, u_\theta, u_x)$ is the fluid velocity, t is time, p represents the pressure, τ_{ij} denotes the ij-component of the stress tensor, $\vec{g} = (g_r, g_\theta, g_x)$ represent external force densities.