

EQUATION OF CONTINUITY $\rightarrow$

The equation of continuity is a fundamental principle in fluid mechanics that expresses the conservation of mass in a flowing fluid.

The mass of fluid entering a system must equal the mass of fluid leaving the system, assuming there is no accumulation of mass inside.

Simple form (For incompressible and steady flow) $\Rightarrow$

$$A_1 V_1 = A_2 V_2$$

where

A_1, A_2 = cross-sectional area at two different points in a pipe.

V_1, V_2 = Fluid velocities at those points

This says that the volume flow rate is constant along a streamline - if the area decreases, velocity increases, and vice versa.

* General Form (For compressible flow) $\Rightarrow$

$$\frac{\partial \rho}{\partial t} + \nabla \cdot (\rho \vec{V}) = 0$$

where

ρ = Fluid density

$\vec{V}$ = velocity vector

∇ = divergence operator

This differential form expresses mass conservation in all general cases, including compressible and unsteady flows.

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