System approach: apply laws of physics to a fixed mass.

\[ \frac{dM}{dt}_{\text{sys}} = 0 \]  

mass conservation.

\[ \frac{d(MV)}{dt}_{\text{sys}} = \Sigma F \]  

Newton's 2nd law.

CV approach: apply laws of physics to a fixed control volume.

Reynolds Transport Theorem:

\[ \frac{dN}{dt}_{\text{sys}} = \frac{\partial}{\partial t} \int_{cv} \rho \gamma dV + \oint_{cs} \rho \gamma \mathbf{V} \cdot d\mathbf{A} \]

Conservation of mass (CV form):

\[ \frac{dM}{dt}_{\text{sys}} = \frac{\partial}{\partial t} \int_{cv} \rho dV + \oint_{cs} \rho \mathbf{V} \cdot d\mathbf{A} = 0 \]