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Steady-State, Steady-Flow Process (SSSF)

The following assumptions lead to a useful model called the steady-state, steady-flow process (SSSF).

- The control volume is stationary relative to some coordinate frame.
- The state of the mass at every point within the control volume (CV) does not vary with time.
- The mass flow rate into and out of the control volume does not vary with time.
- The rates at which heat $\dot{Q}$ and work $\dot{W}_{\text{shaft}}$ cross the control surface (CS) remain constant.

For this type of process we can write:

Continuity Equation

$$\dot{M}_{\text{in}} = \dot{M}_{\text{out}} = \dot{M}$$

First Law of Thermodynamics for Control Volume

$$\dot{Q}_{\text{CV}} + \dot{W}_{\text{CV}} = [(e + P\,v)]_{\text{out}} - [(e + P\,v)]_{\text{in}}$$

where

$$e = u + \frac{1}{2}\bar{V}^2 + g\,z$$