The Thrust Equation

The usual expression for the thrust force due to jet engines is

\[ T = \int p A \, dz \]

where

- \( T \) is the thrust
- \( p \) is the pressure
- \( A \) is the cross-sectional area
- \( dz \) is the differential length

This equation is derived from the momentum theorem, which states that the total impulse of the fluid leaving the engine must equal the change in momentum of the aircraft. The thrust is obtained by integrating the product of the pressure and the cross-sectional area over the length of the engine.
The term (\(d-d')\) + (\(n-n'(f+1)\)) is \(\mu = \xi\)

\[
\nu \frac{\partial \mu}{\partial t} + n - \nu(\mathbf{u} \cdot \nabla) \mu = 0
\]

(5.5)

When we use Eqs. (5.2) and (5.3), the momentum equation (5.2) becomes

\[
\frac{\partial n}{\partial t} + \nabla \cdot (n \mathbf{u}) = 0
\]

(5.5)

\(n\) is the net outflow from the control volume. Thus,

\[
\n(\mathbf{u} - \mathbf{v}) \cdot \n \cdot n - n(\mathbf{u} - \mathbf{v})n + n_1 n_1 + n_2 n_2 = \nu \frac{\partial n}{\partial t} + n
\]

(5.5)

When we use Eqs. (3.2), the equation becomes

\[
\n(\mathbf{u} - \mathbf{v}) \cdot \n \cdot n - n(\mathbf{u} - \mathbf{v})n + n_1 n_1 + n_2 n_2 = \nu \frac{\partial n}{\partial t} + n
\]

(5.5)

\(n\) is the mass flow of the fluid through the control volume.

In which, \(n\) is the cross-sectional area of the control volume normal to the velocity

\[
0 = \nu n_1 n_1 - n_1 + n_2 n_2 + n_3 n_3
\]

(5.5)

\(n_1\) is the cross-section of the control volume normal to the velocity

\[
0 = \nu _1 n_1 n_1 - n_1 + n_2 n_2 + n_3 n_3
\]

(5.5)

\(\mathbf{u}\) for steady flow is

\[
0 = \nu \frac{\partial n}{\partial t} + n
\]

(5.5)

\(\mathbf{u}\) and \(n\) are the fluid properties. These properties change due to the control volume.

Now, let's consider the expression of continuity for the control volume at a given point.