

Linear momentum equation

Engineering Fluid Mechanics

Dr. Kelly Kibler

Department of Civil, Environmental &
Construction Engineering

University of Central Florida



MOMENTUM FLUX $\dot{m} \vec{V}$ MOMENTUM FLUX $\dot{m} \vec{V}$

$$\sum \vec{F} = \frac{d}{dt} \int_{CV} \rho \vec{V} dV + \int_{CS} \rho \vec{V} (\vec{V}_r \cdot \hat{n}) dA$$

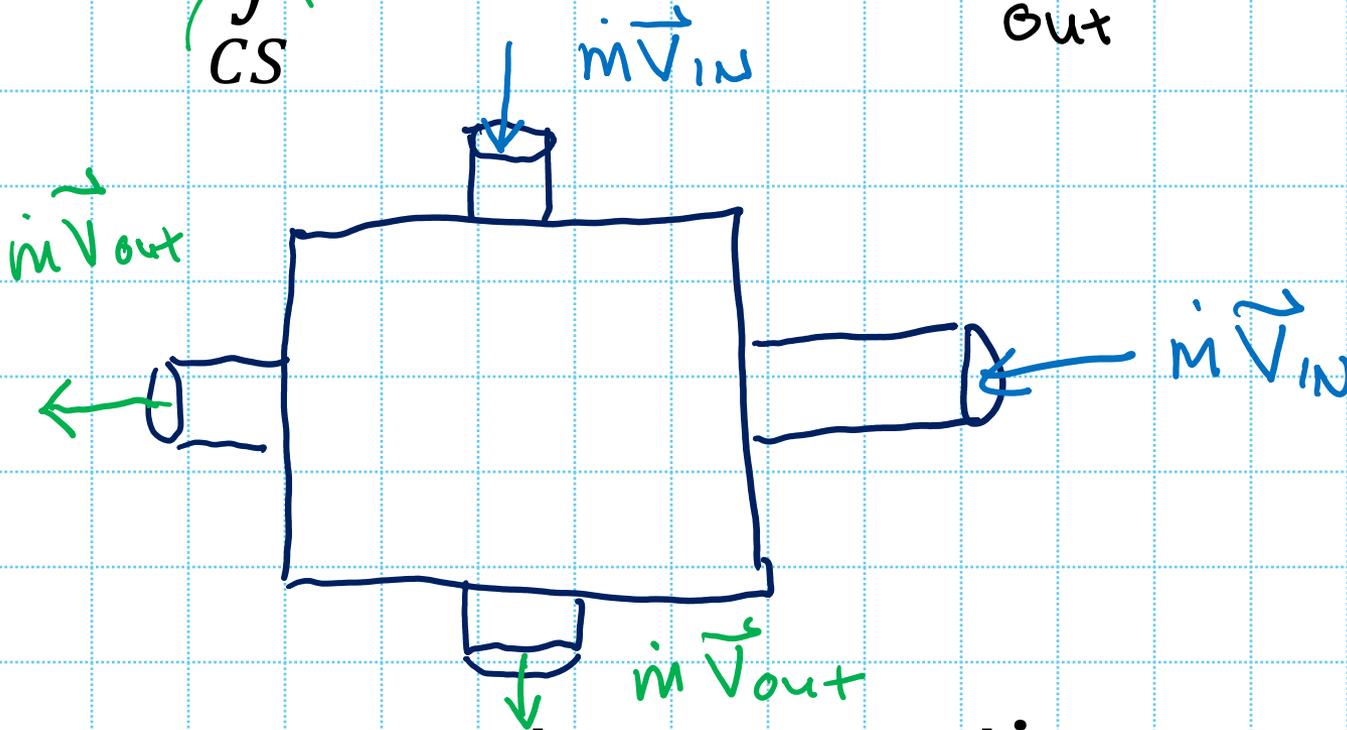
$$\dot{m} \vec{V} = \dot{m} - \frac{M}{T} \quad \vec{V} - \frac{L}{T} = \frac{M \cdot L}{T^2}$$

$$\text{FORCE} = \frac{M \cdot L}{T^2} \quad N = \frac{kg \cdot m}{s^2}$$

Linear momentum equation



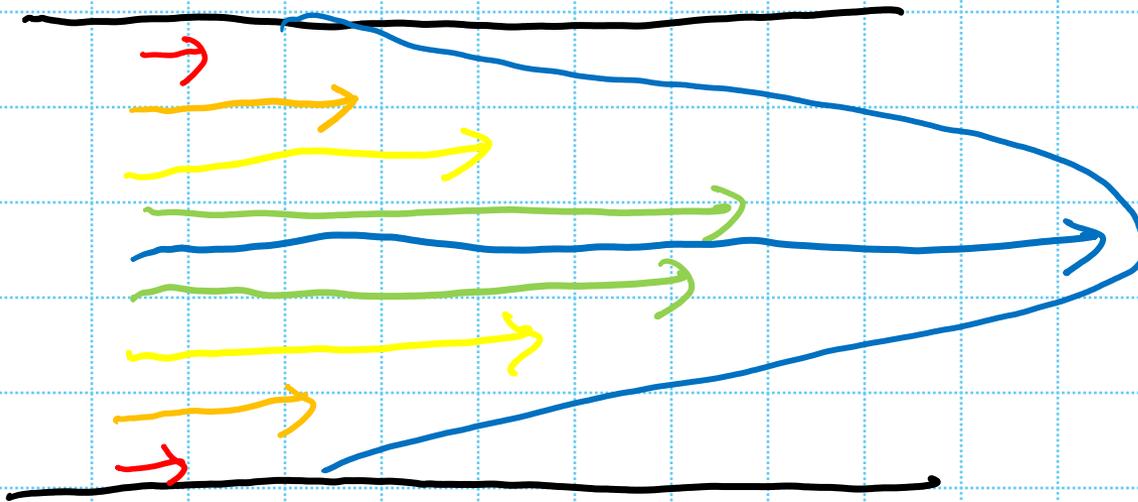
$$\sum \vec{F} = \int_{CS} \rho \vec{V} (\vec{V}_r \cdot \hat{n}) dA = \sum_{out} \dot{m} \vec{V} - \sum_{in} \dot{m} \vec{V}$$



Linear momentum equation
in steady flow



$$\sum \vec{F} = \sum_{out} \beta \dot{m} \vec{V}_{avg} - \sum_{in} \beta \dot{m} \vec{V}_{avg}$$



$V_{avg} < V_{center}$

β - MOMENTUM
FLUX
CORRECTION

α - KINETIC
CORRECTION
FACTOR

Linear momentum equation in
steady flow, fixed inlets/outlets



Acknowledgement

This material is based upon work partially supported by the National Science Foundation under Grant# 2335802. Any opinions, findings, and conclusions, or recommendations expressed in this material are those of the author(s) and do not necessarily reflect the views of the National Science Foundation.





You are free

- to **Share** – to copy, distribute, display and perform the work
- to **Remix** – to make derivative works

Under the following conditions

- **Attribution** — You must attribute the work in the manner specified by the author or licensor (but not in any way that suggests that they endorse you or your use of the work).
- **Noncommercial** — You may not use this work for commercial purposes.
- **Share Alike** — If you alter, transform, or build upon this work, you may distribute the resulting work only under the same or similar license to this one.





**College of Engineering
and Computer Science**

UNIVERSITY OF CENTRAL FLORIDA

THE END



Photo credit: Kelly Kibler, Palm Beach County, Florida