

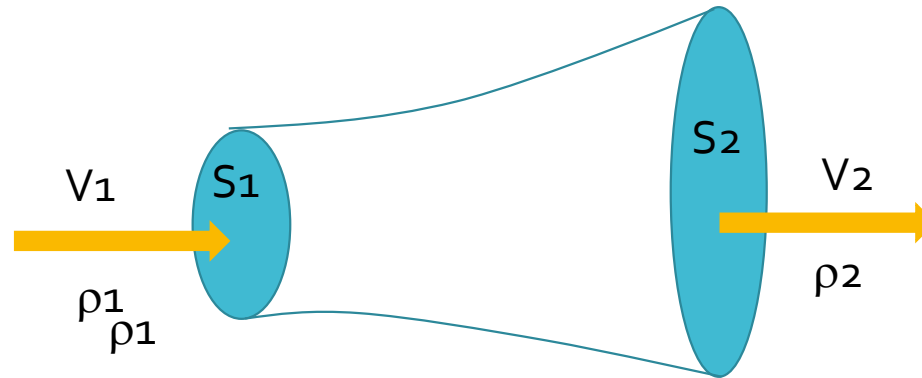
CEN 212 FLUID MECHANICS

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OVERALL MASS BALANCE and CONTINUITY EQUATION

- In fluid dynamics fluids are in motion. The principles of conservation of mass are applied to the system. Consider the flow through a conduit as below:



With a simple mass balance:

$$\dot{m} = \rho_1 V_1 S_1 = \rho_2 V_2 S_2$$

CONTINUITY EQUATION

FLOW OF COMPRESSIBLE FLUIDS MACH NUMBER

- Chemical engineering practice involves a relatively small area of compressible fluid flow.
- In compressible flow at ordinary densities and high velocities the basic parameter is MACH number.
- The Mach number is defined as the ratio of the speed of the fluid to the speed of the sound in the fluid under conditions of flow.
- Compressibility; is a measure of change in fluid density due to external forces.

FLOW SIMILARITY and MODEL STUDIES

- To be useful, a model test must yield data that can be scaled to obtain the forces, moments and dynamic loads that would exist on the full-scale proto-type.
- Geometric Similarity; requires that the model and prototype be the same shape.
- Kinematic Similarity; requires that the regimes of flow be the same for model and prototype.
- Dynamic Similarity; requires the forces acting are the same type of forces.