Dimensions and units

Dimension:

Physical quantity (length, velocity, temperature, etc.)

Unit:

Standard for **measuring** dimensions (m for length, °C for temp, etc.)

Arbitrary! (Somewhat)

Fundamental vs. derived dimensions:

- Fundamental
  - Can **not** be derived from other dimensions
- Derived
  - **Can** be derived from other dimensions

Base vs. derived units:

- Base
  - Correspond to fundamental dimensions
- Derived
  - Correspond to derived dimensions

Example: Base units of different units systems

Dimension	AES (American Eng. Sys.)	BGS (British Gravitational Sys.)	SI (Système International)
Length	ft	ft	m
Mass	lbm	slug (derived)	kg
Time	s	s	s
Force	Lbf (derived)	lbf	N (derived)

Some derived units:

SI: $N = kg\text{-}m/s^2$

BGS: $slug = lbf\text{-}s^2/ft$

Some unit conversions:

$1\ ft = 12\ in$

$N = kg\text{-}m/s^2$

$lbf = slug\text{-}ft/s^2$

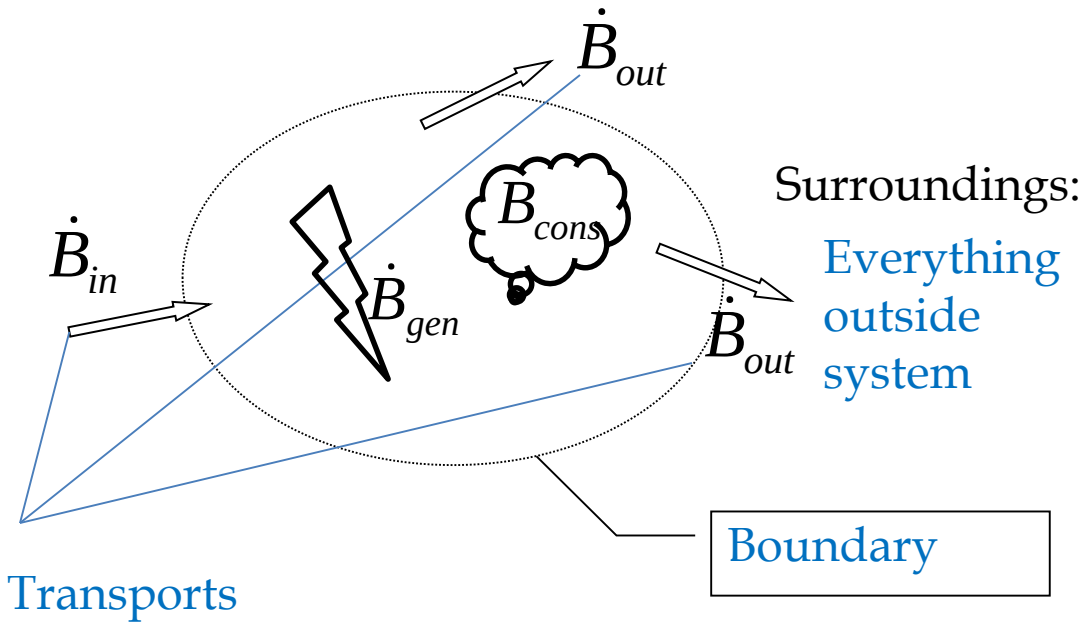
$lbf = 32.2\ lbm\text{-}ft/s^2$

lbf ≠ lbm !!!!

Some definitions

System

A region of space set aside for analysis



- Closed system:

  No **mass** crosses the boundary

- Open system:

  Mass can cross the boundary

- Isolated system:

  No interactions with surroundings. **Nothing** crosses boundary

Property:

Any quantity that can be assigned a numerical value

Property:

- Extensive property
  - Depends on the extent (size) of the system
  - Is **additive**
- Intensive property
  - Does **not** depend on the extent (size) of the system
  - Has a "value at a point"
  - Is not additive

State:

Description of a system in terms of its properties

We will apply the Accounting Principle to **extensive** properties.