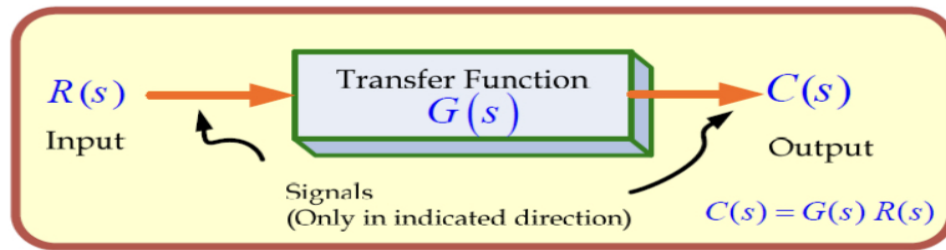Figure 1: Single block diagram representation

Block Diagram Reduction Technique

Because of their simplicity and versatility, block diagrams are often used by control engineers to describe all types of systems. A block diagram can be used simply to represent the composition and interconnection of a system. Also, it can be used, together with transfer functions, to represent the cause-and-effect relationships throughout the system. Transfer Function is defined as the relationship between an input signal and an output signal to a device.

Block diagram rules

Cascaded blocks

parallel subsystems
Feedback control

Procedure to solve Block Diagram Reduction Problems

Block Diagram Reduction Rules

Table 1: Block Diagram Reduction Rules

1.	Combine all cascade blocks
2.	Combine all parallel blocks
3.	Eliminate all minor (interior) feedback loops
4.	Shift summing points to left
5.	Shift takeoff points to the right
6.	Repeat Steps 1 to 5 until the canonical form is obtained

Definitions

- $G(s) \equiv$ Direct transfer function = Forward transfer function.
- $H(s) \equiv$ Feedback transfer function.
- $G(s)H(s) \equiv$ Open-loop transfer function.
- $C(s)/R(s) \equiv$ Closed-loop transfer function = Control ratio
- $C(s)/E(s) \equiv$ Feed-forward transfer function.