SNS COLLEGE OF TECHNOLOGY

(An Autonomous Institution)

COIMBATORE-35

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DEPARTMENT OF ELECTRICAL AND ELECTRONICS ENGINEERING

COURSE NAME: 19EEB301/ CONTROL SYSTEMS

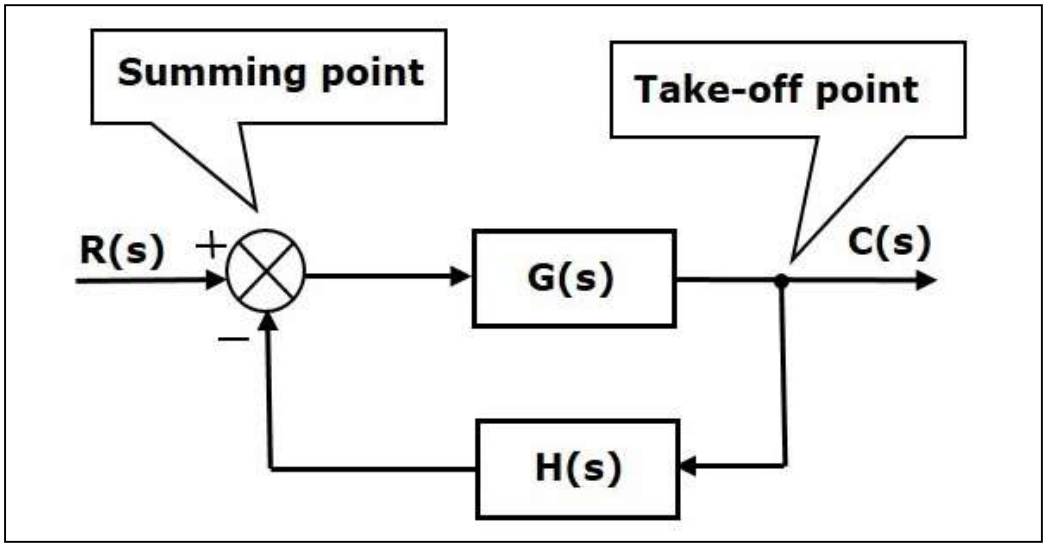
III YEAR / V SEMESTER

Unit I – SYSTEMS AND THEIR REPRESENTATIONS

Topic : Block Diagram Reduction Rules

Block Diagram

- Block diagrams consist of a single block or combination of blocks.
- These are used to represent the control systems in pictorial form.
- Basic elements of a block diagram
  - Block
  - The summing point
  - The take-off point
  - Arrows indicate the direction of the flow of signals.



Block

- The transfer function of a component is represented by a block.
- Block has single input and single output.

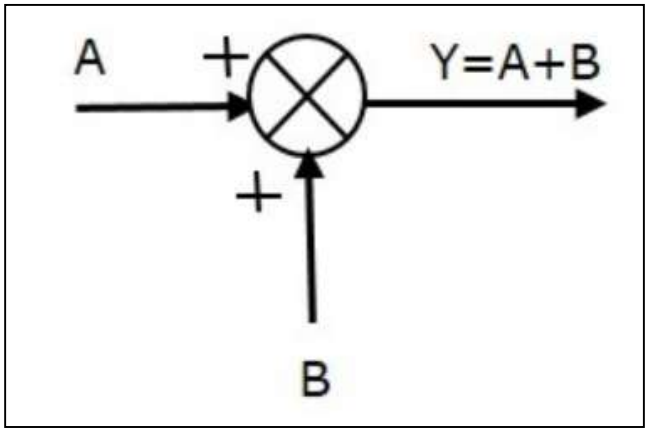
The following figure shows a block having input X(s), output Y(s) and the transfer function G(s).

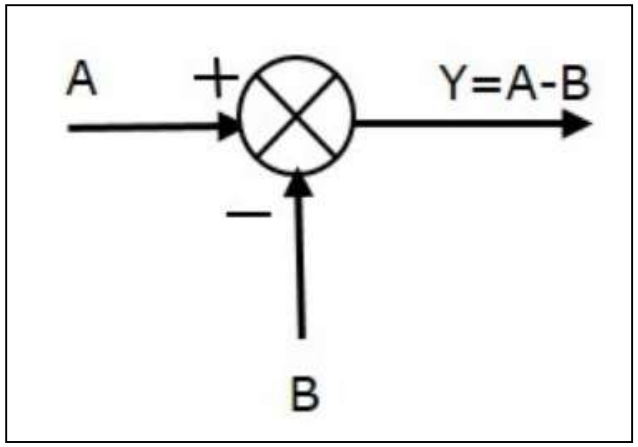
Transfer Function, $G(s) = \frac{Y(s)}{X(s)}$

$$\Rightarrow Y(s) = G(s)X(s)$$

Summing Point

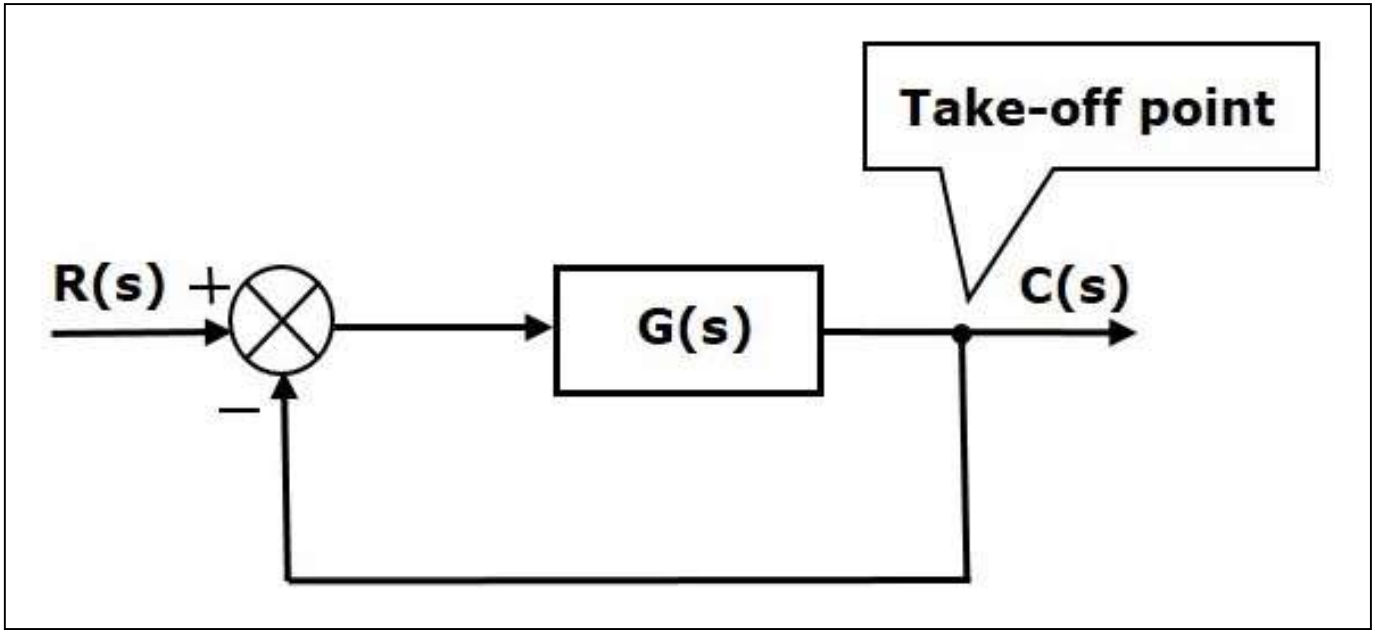
- The summing point is represented with a circle having cross (X) inside it.
- It has two or more inputs and single output.
- It produces the algebraic sum of the inputs.
- The following figure shows the summing point with two inputs (A, B) and one output (Y).





Take-off Point

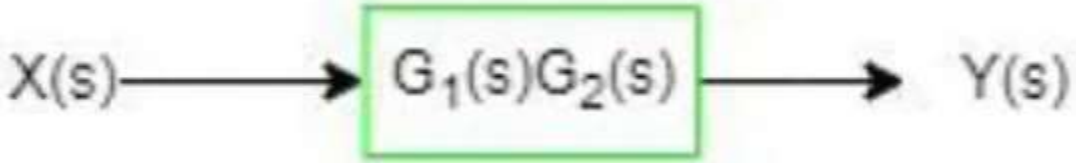
- The take-off point is a point from which the same input signal can be passed through more than one branch.



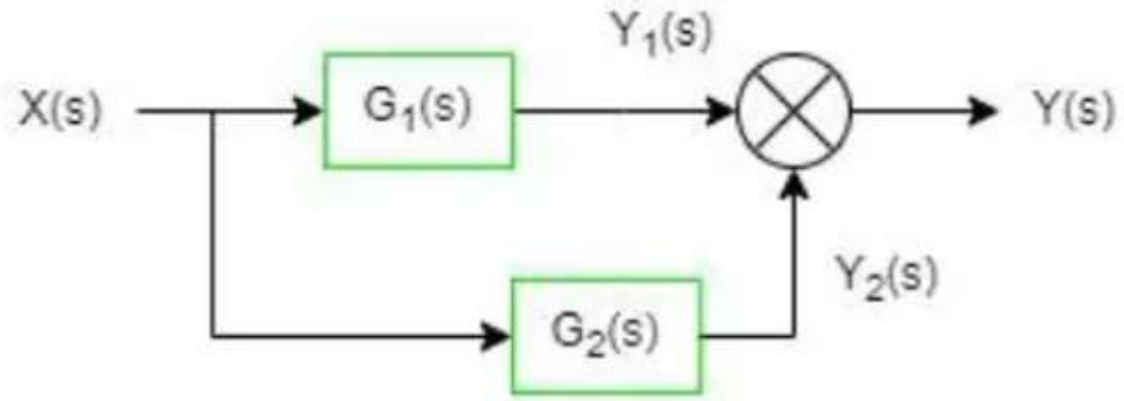
Series Connection

- also known as cascade connection

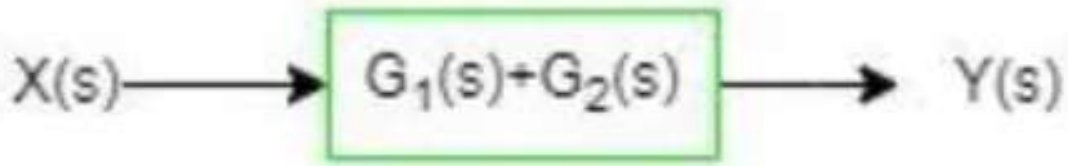
- Two block in series can be replaced by a single block whose transfer function is the product of the transfer function of the two blocks in series.



Parallel Connection

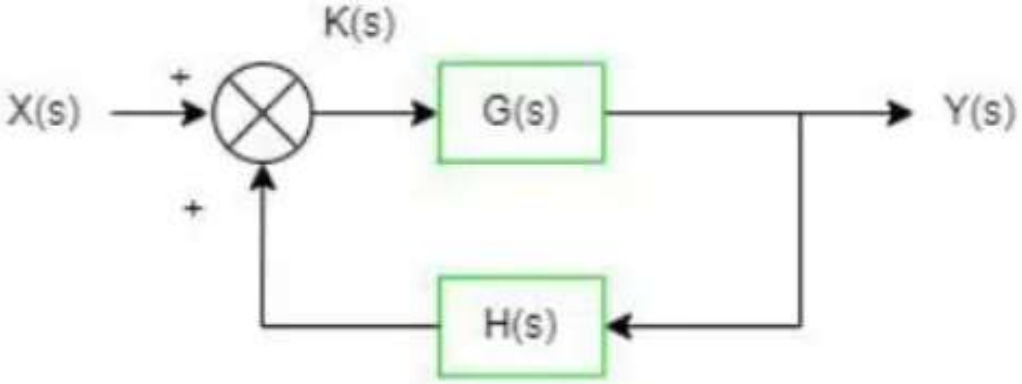


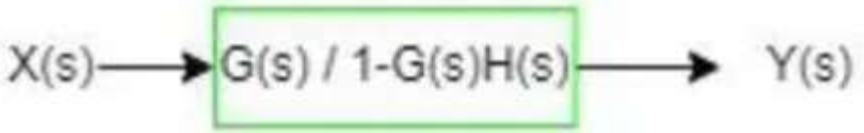
- Two block in series can be replaced by a single block whose transfer function is the Sum of the transfer function of the two blocks in series.



Feedback Connection

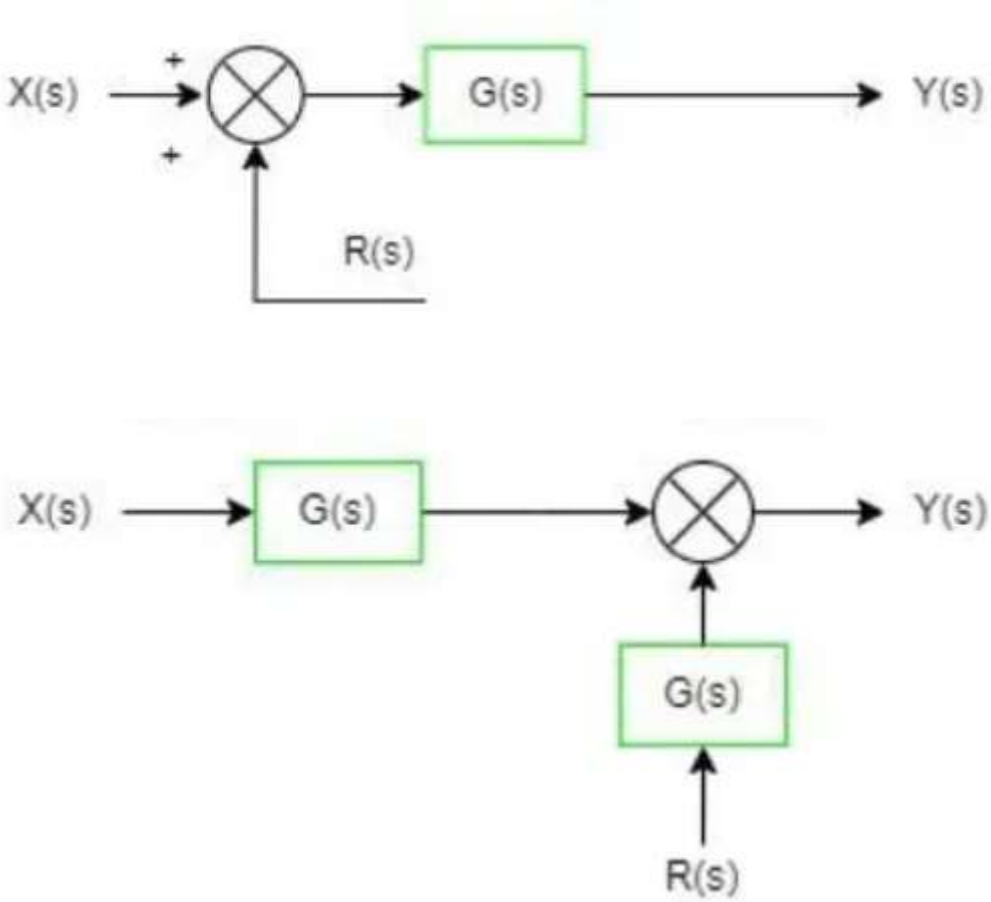
- When output of the system is fed back to the input to stabilize and reduce error of the system is called as feedback.
- Feedback can be of positive or negative type.
- When the feedback loop is added with the input signal it is called as **positive feedback** and when the feedback is subtracted from the input signal it is called as **negative feedback**.





Shifting The Summing Point After The Block

- This involves the shift of the summation point after the block. But after the shift the output result should not change.



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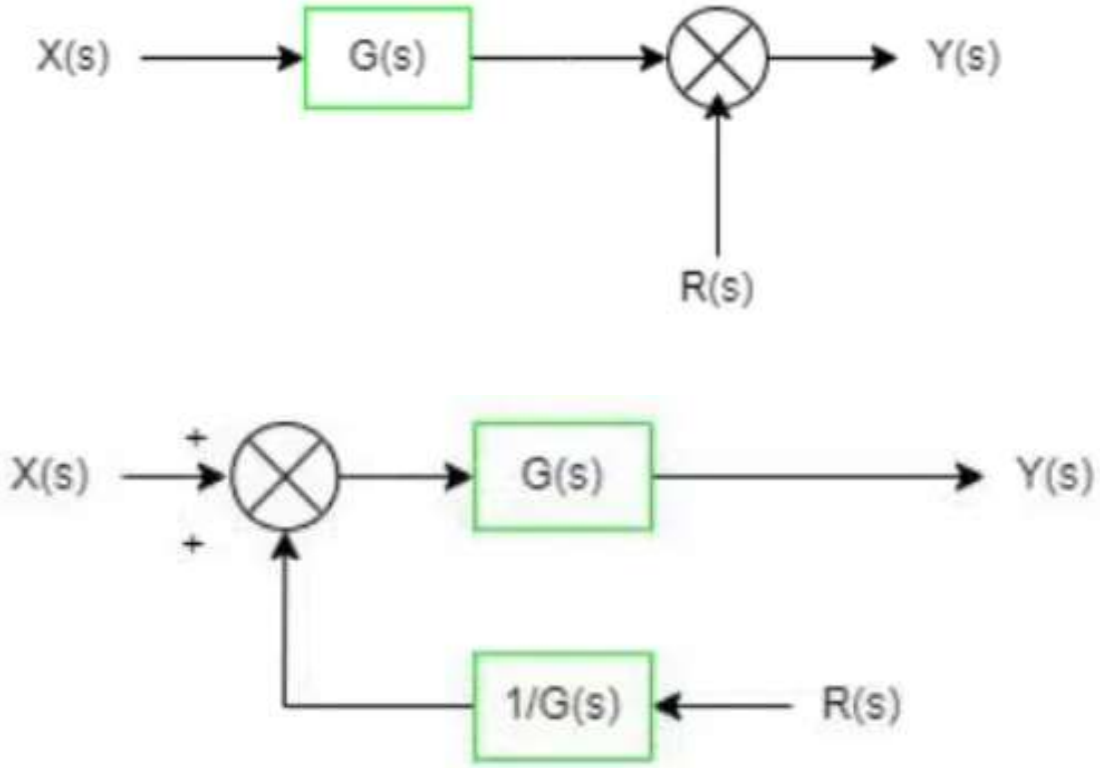
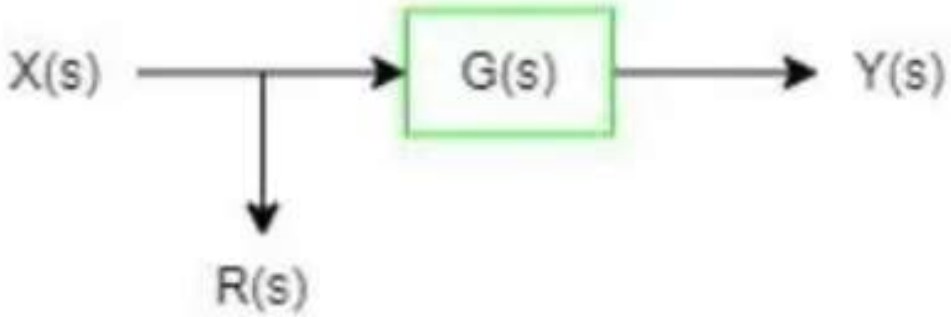
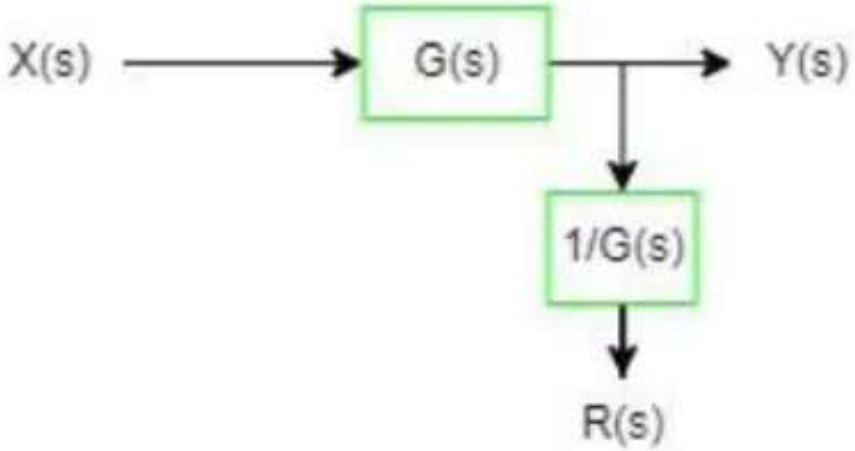


Shifting The Take-off Point After The Block





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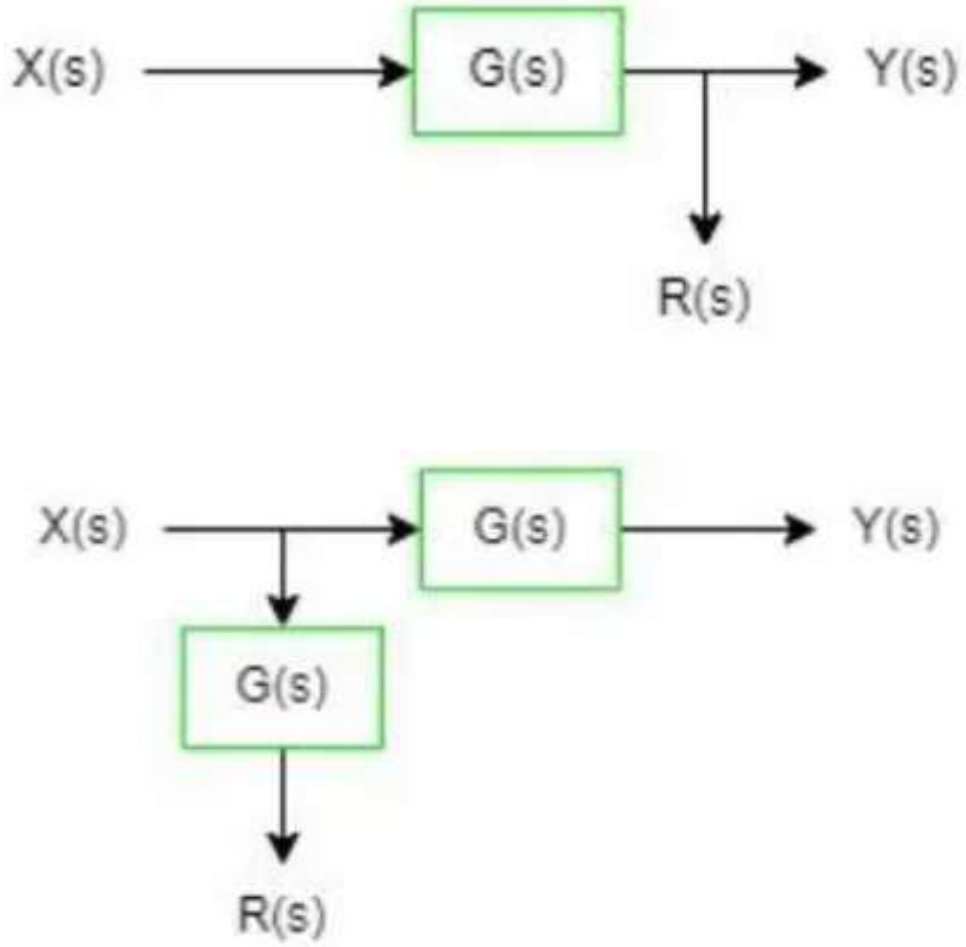

Application - Block Diagram

- Block diagrams are used for for simplified representation of control systems.
- Signal processing systems are also represented through block diagram and block diagram algebra is used to analyze these systems.
- It is used for block diagram reduction which is used to find the transmittance of the overall system.

Thank You