



Faculty of Engineering
Department of Electrical & Computer Engineering

Control Systems (ECE 331)

Block Reduction Techniques - I

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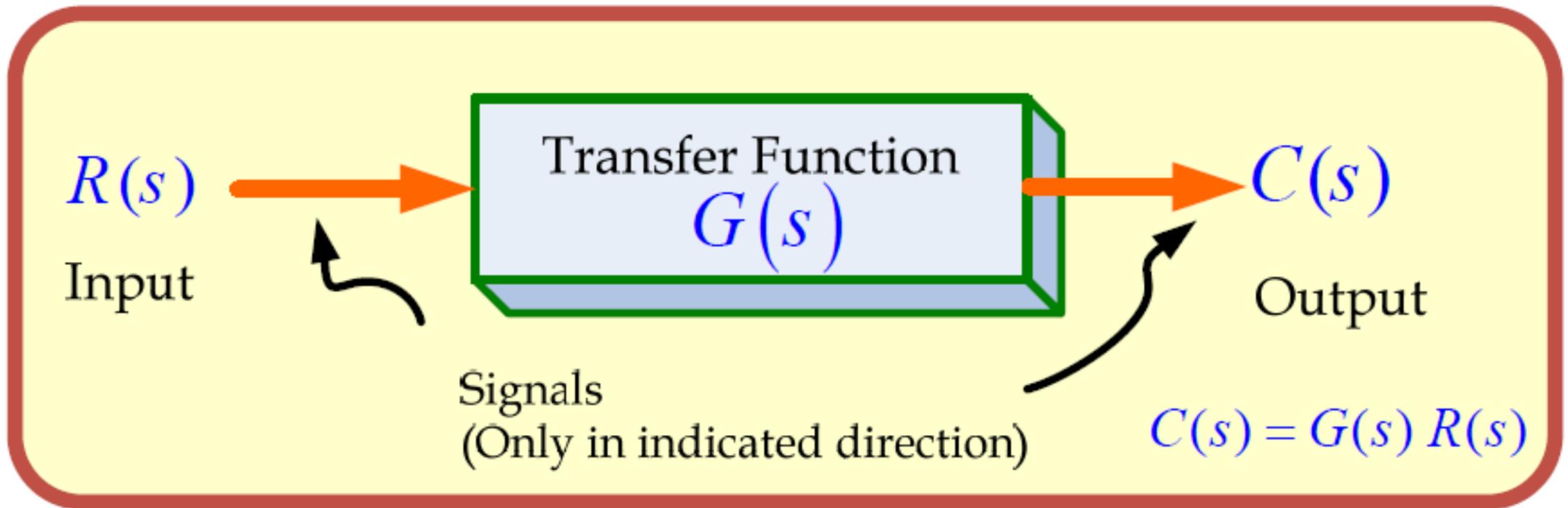
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Block Reduction Techniques:

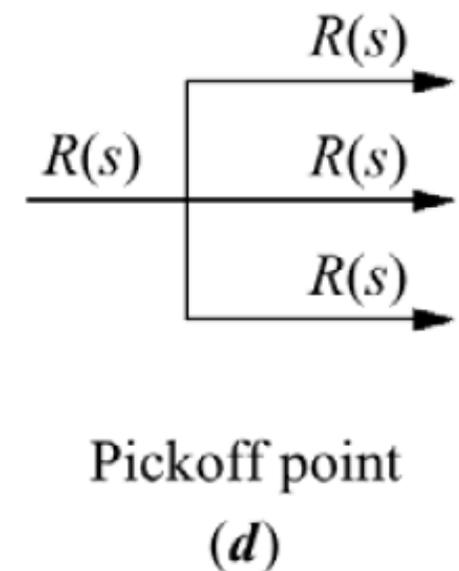
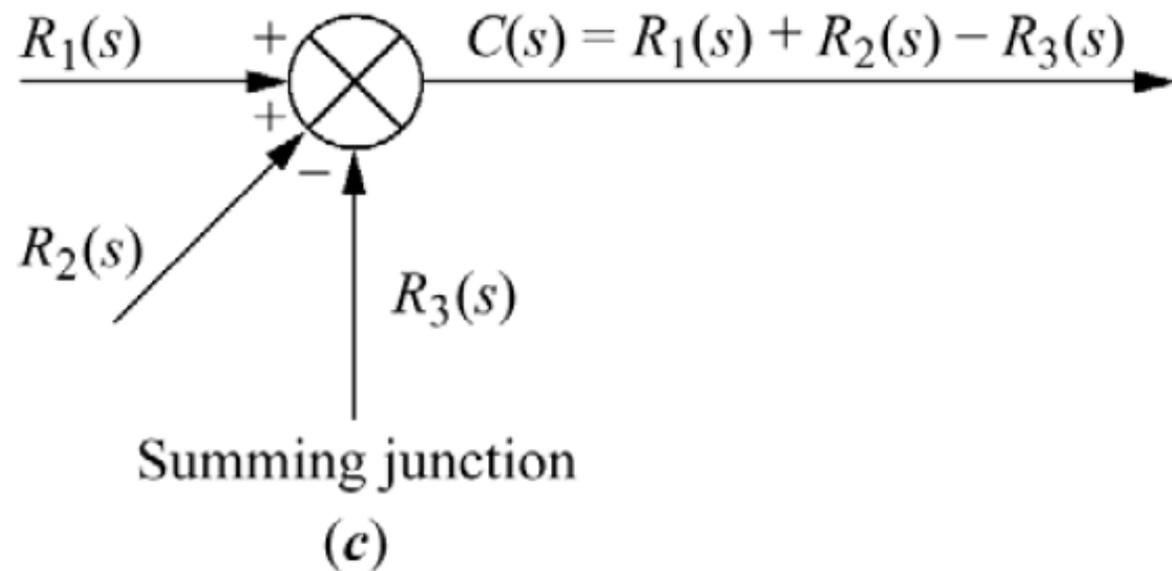
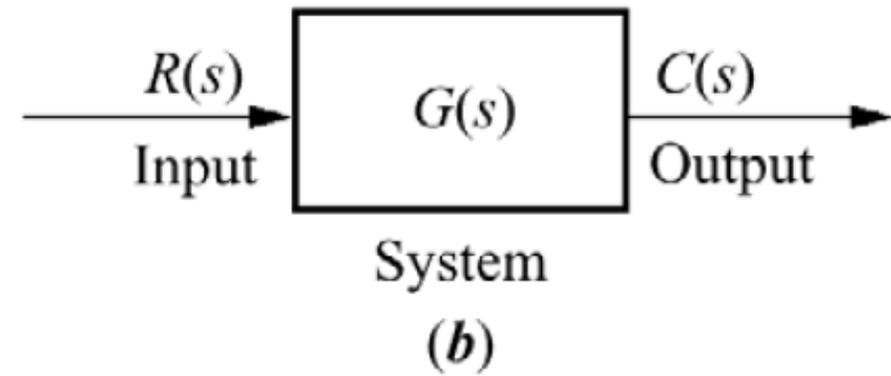
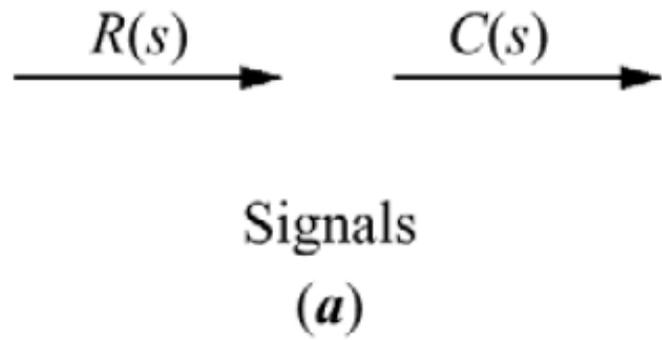
What is Block Diagram ??

“ It is pictorial representation of functions performed by each component of a system and that of flow of signals ”.

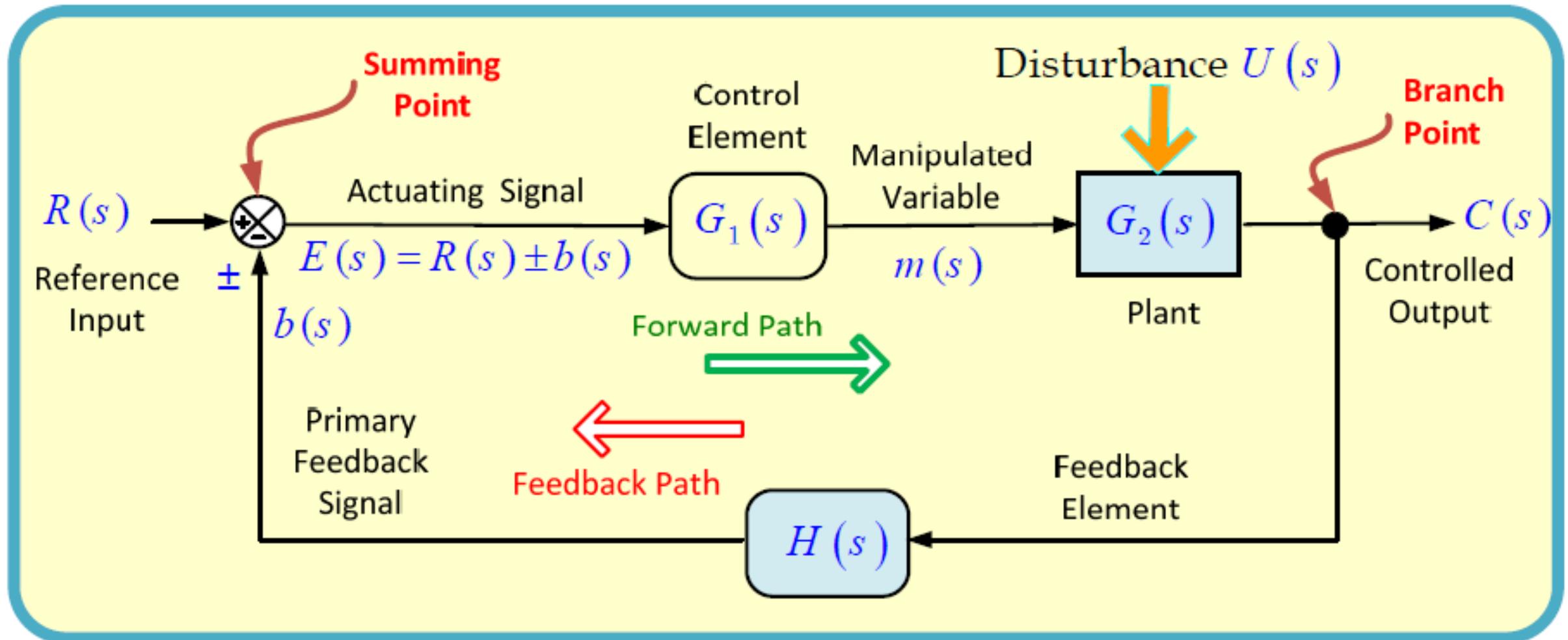


Single Block Diagram Representation

Components for Linear Time Invariant (LTI) Systems :



Block Diagram Components:



Block Diagram Components:

Conti...

1. **Plant:** A physical object to be controlled. The Plant $G_2(s)$, is controlled system, of which a particular quantity or condition is to be controlled.
2. **Feedback Control System:** A system which compares output to some reference input and keeps output as close as possible to this reference.
3. **Open Loop Control System:** An output of the system is not feedback to the system.
4. **Control Element:** $G_1(s)$, also called the controller, are the components required to generate the appropriate control signal $M(s)$ applied to the plant.
5. **Feedback Element:** $H(s)$ is the component required to establish the functional relationship between the primary feedback signal $B(s)$ and the controlled output $C(s)$.

Block Diagram Components:

Conti...

6. **Reference Input:** $R(s)$ is an external signal applied to a feedback control system in order to command a specified action of the plant. It often represents ideal plant output behavior.
7. **The Controlled Output:** $C(s)$ is that quantity or condition of the plant which is controlled.
8. **Actuating Signal:** $E(s)$, also called the error or control action, is the algebraic sum consisting of the reference input $R(s)$ plus or minus the primary feedback $B(s)$.
9. **Manipulated Variable:** $M(s)$ (control signal) is that quantity or condition which the control element $G_1(s)$ apply to the plant $G_2(s)$.

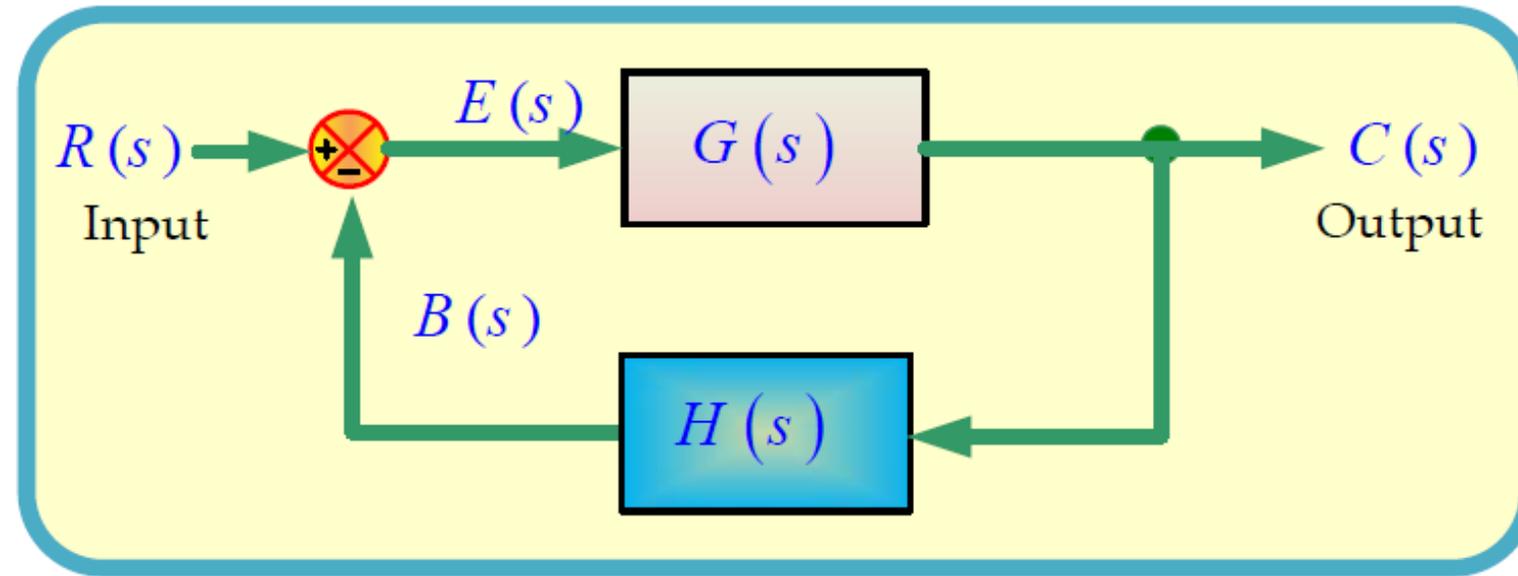
Block Diagram Components:

Conti...

10. **Disturbance:** $U(s)$ is the undesired input signal which affects the value of controlled output $C(s)$. It may enter the plant by summation with $M(s)$, or via an intermediate point, as shown in the component figure.
11. **Forward Path:** It is transmission path from actuating signal $E(s)$ to output $C(s)$.
12. **Feedback Path:** It is the transmission path from the output $C(s)$ to the feedback signal $B(s)$.
13. **Summing Point:** A circle with a cross is the symbol that indicates a summing point. The (+) or (-) sign at each arrowhead indicates whether that signal is to be added or subtracted.
14. **Branch Point:** It is a point from which signal from a block goes concurrently to other blocks or summing points.

Block Diagram Components:

Conti...



$G(s)$ = Direct Transfer Function
= Forward Transfer Function

$H(s)$ = Feedback Transfer Function

$G(s)H(s)$ = Open Loop Transfer Function

$C(s)/R(s)$ = Closed Loop Transfer Function = Control Ratio

$C(s)/E(s)$ = Feed Forward Transfer Function

Thank You !