MEEG 311 – Lecture 8
Vibration and Control

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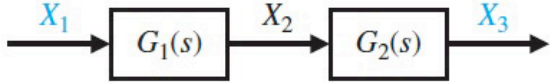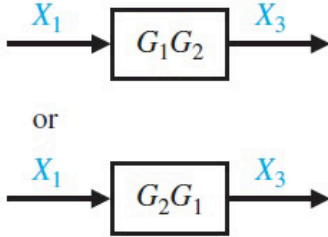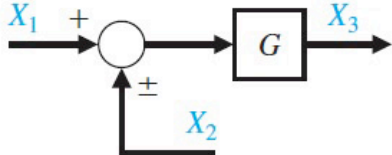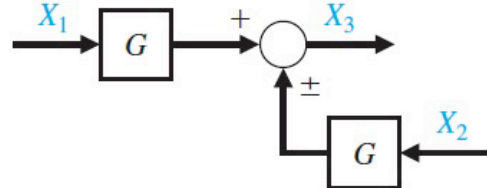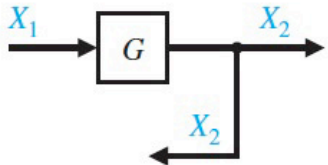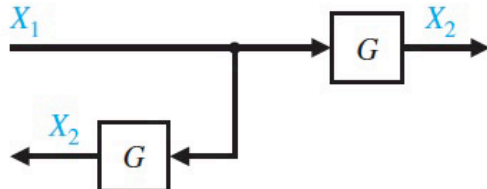
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Goals:

- Example (cont'd): Modeling armature control DC motors
    - Transfer function with voltage input AND disturbance input
    - Block diagram

- Block diagram simplifications
    - Extracting transfer functions from block diagrams
    - Transfer function of block diagram with feedback loop
    - See attached table with block diagram manipulations

- Modeling gearboxes: basic principles
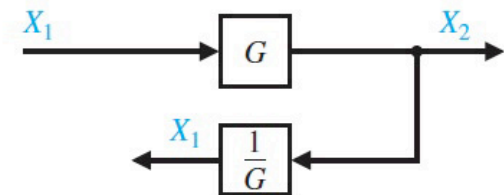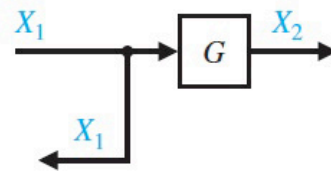
Block diagram simplifications: Basic rules

Table 2.6 Block Diagram Transformations

Transformation	Original Diagram	Equivalent Diagram
1. Combining blocks in cascade	$X_1 \to \boxed{G_1(s)} \xrightarrow{X_2} \boxed{G_2(s)} \to X_3$	$X_1 \to \boxed{G_1 G_2} \to X_3$ or $X_1 \to \boxed{G_2 G_1} \to X_3$
2. Moving a summing point behind a block	$X_1 \xrightarrow{+} \bigcirc \to \boxed{G} \to X_3$, $\pm$, X_2	$X_1 \to \boxed{G} \xrightarrow{+} \bigcirc \to X_3$, $\pm$, $\boxed{G} \leftarrow X_2$
3. Moving a pickoff point ahead of a block	$X_1 \to \boxed{G} \to X_2$, X_2	$X_1 \to \to X_2$ over $\boxed{G} \to X_2$, $X_2 \leftarrow \boxed{G} \leftarrow$

Block diagram simplifications: Basic rules

4. Moving a pickoff point behind a block

5. Moving a summing point ahead of a block
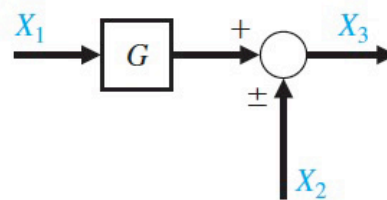
6. Eliminating a feedback loop

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Block diagram simplifications: Example

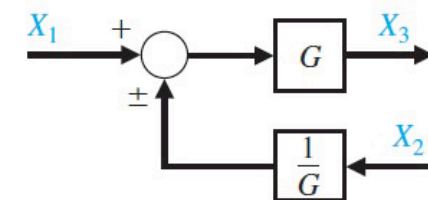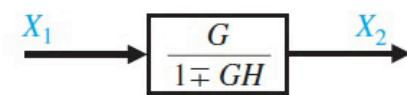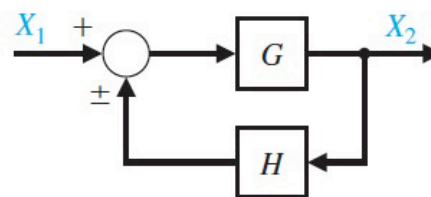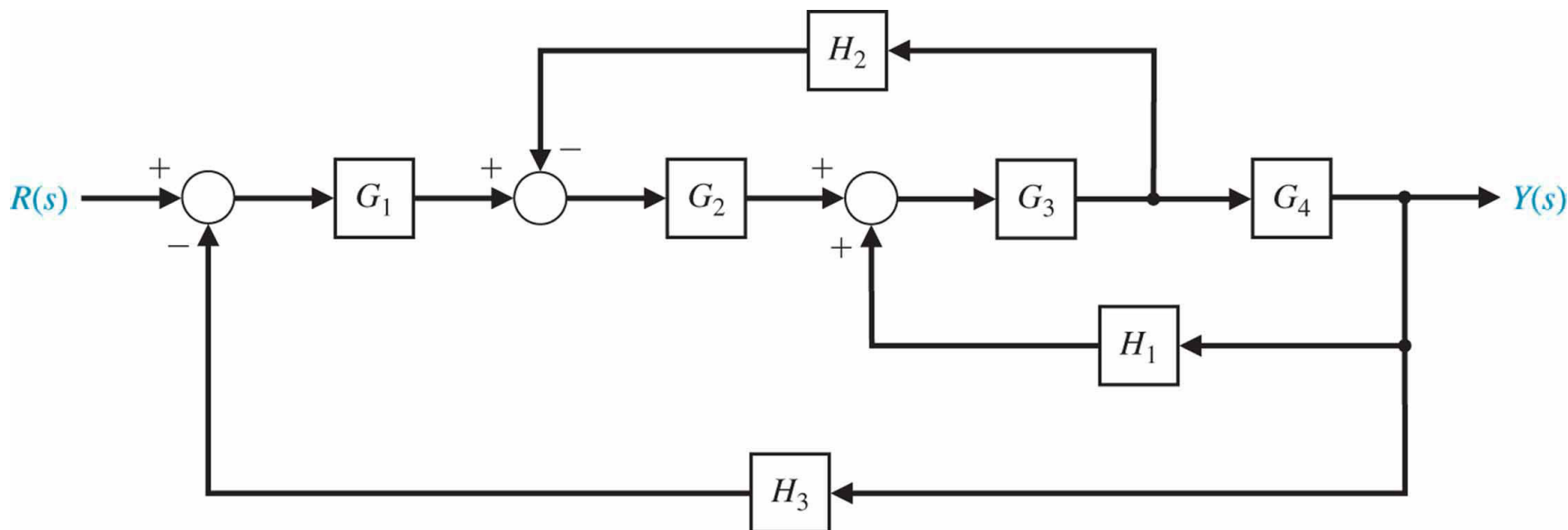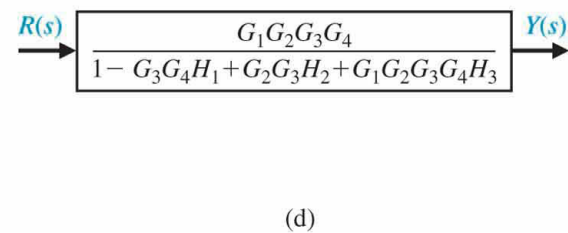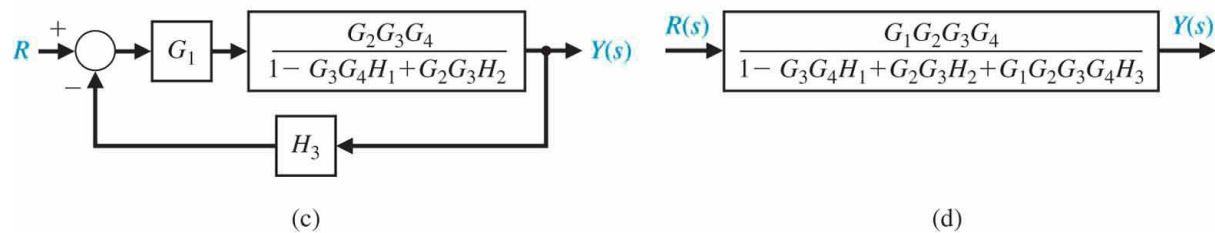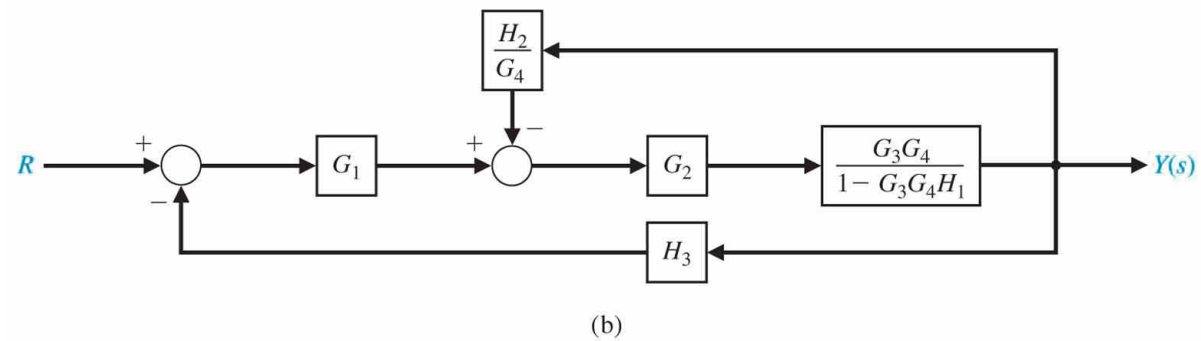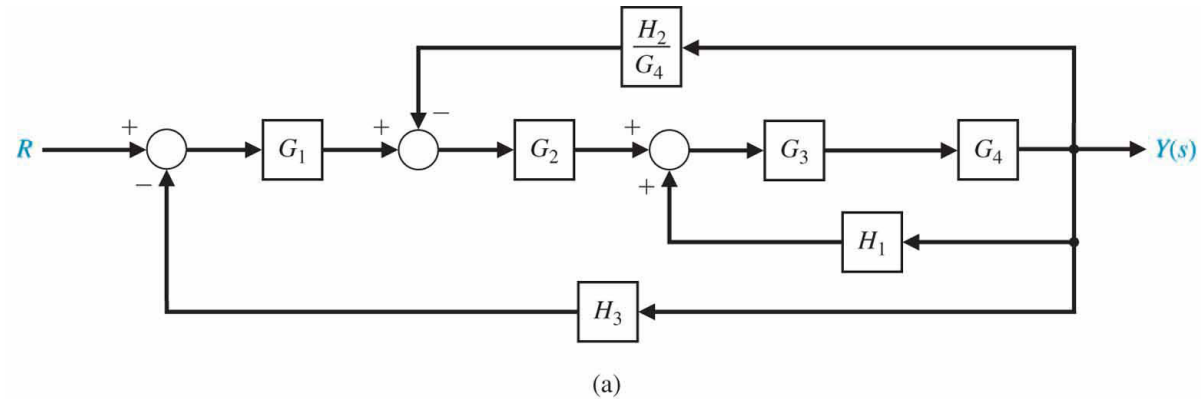
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Block diagram simplifications: Example solution

(a)

(b)

(c)

(d)