

## Lecture Module - Alternate Model Forms

ME3050 - Dynamic Modeling and Controls

Mechanical Engineering

Tennessee Technological University

### Topic 2 - Transfer Functions and Block Diagrams

## Alternate Model Forms

- Free and Forced Response
- Transfer Function Concept
- Block Diagram - Basic Shapes
- Block Diagrams - Mathematical Operations
- Block Diagram - Feedback Loops

# Free and Forced Response

# Free and Forced Response

# Transfer Function Concept

The transfer function is a way of describing a system that can be used to analyze the system response to an external input with the assumption of zero initial conditions.

$$T(s) = \frac{X(s)}{F(s)}$$

Does this look familiar? How can we find the transfer function?

Free and Forced Response

**Transfer Function Concept**

Block Diagram - Basic Shapes

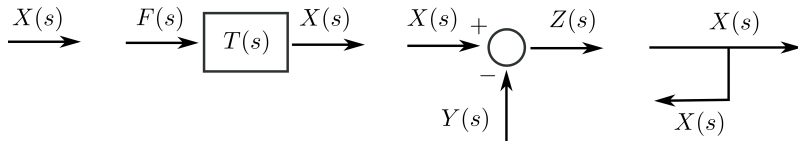
Block Diagrams - Mathematical Operations

Block Diagram - Feedback Loops

# Transfer Function Concept

# Block Diagram - Basic Shapes

A block diagram is a visual representation of the transfer function concept. Here are the four basic symbols.



Free and Forced Response

Transfer Function Concept

**Block Diagram - Basic Shapes**

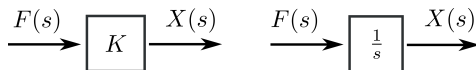
Block Diagrams - Mathematical Operations

Block Diagram - Feedback Loops



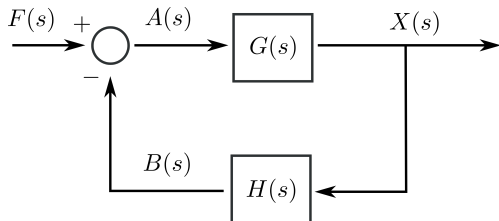
# Block Diagrams - Mathematical Operations

Mathematical operations can be represented as block diagrams.



## Block Diagram - Feedback Loops

Block diagrams are used to represent feedback loops.



This block diagram can be simplified into a single equivalent block. Can you determine what that is?