Preview: Transfer Functions

Preview of transfer functions.

WE'LL COVER THE FOLLOWING

- Introduction
  - Series
  - Parallel
  - Operations

Introduction

The transfer function is a convenient representation of a linear time-invariant dynamical system. Mathematically, the transfer function is a function of complex variables.

A **transfer function** is the ratio of the output of a system to the input of a system. If we have an input function of $X(s)$, and an output function $Y(s)$, we define the transfer function $H(s)$ to be:

$$H(s) = \frac{Y(s)}{X(s)}$$

An example of a transfer function could be:

$$H(s) = \frac{2s^3 + s^2 + 1}{2s^4 + 2s^2 + 3s}$$

where the output is:

$$2s^3 + s^2 + 1$$

and the input is:

$$2s^4 + 2s^2 + 3s$$

The behavior of **a system** is identified by its transfer function. We can get the output by simply multiplying the transfer function with the input function:

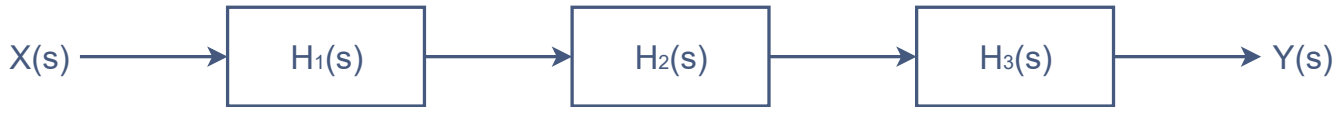
$$Y(s) = H(s)X(s)$$

Transfer functions can either be in series or parallel.

Series

If there is more than one system in the series, we **multiply** their individual transfer functions to get the **transfer function of the entire system**.

Suppose we have a system of three transfer functions in series:



The system transfer function will be:

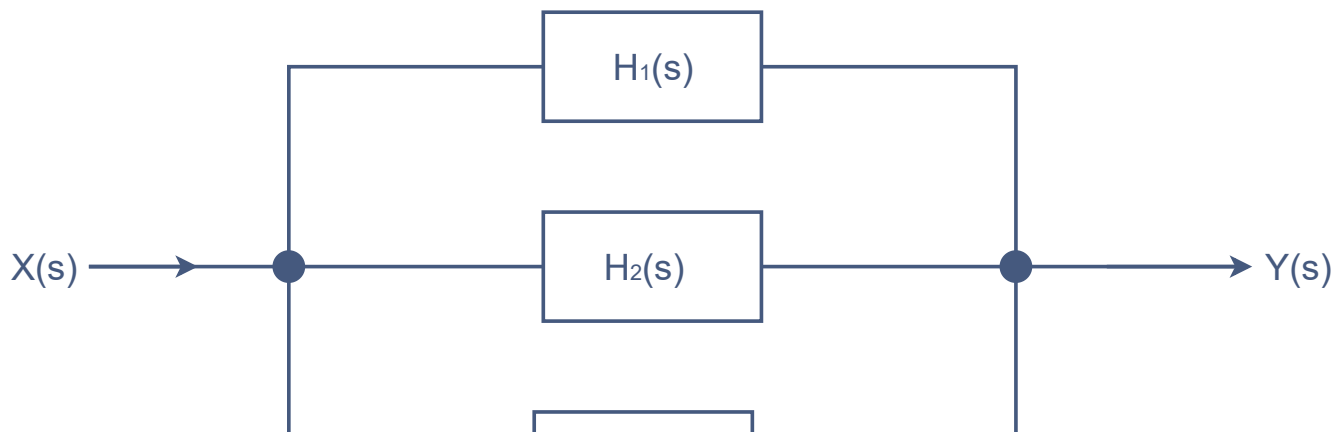
$$H(s) = H_1(s) \times H_2(s) \times H_3(s)$$

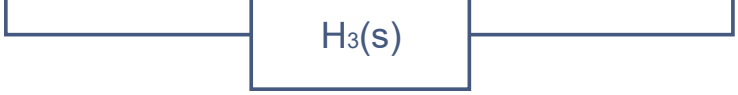
and the output will be:

$$Y(s) = H(s)X(s)$$

Parallel

If there is more than one system in the series, we **add** their individual transfer functions to get the **transfer function of the entire system**.





The system transfer function will be:

$$H(s) = H_1(s) + H_2(s) + H_3(s)$$

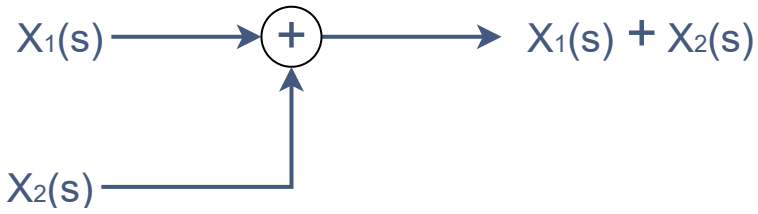
and the output will be:

$$Y(s) = H(s)X(s)$$

Operations

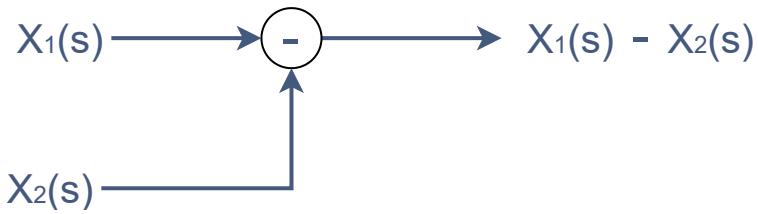
Arithmetic operations can also be performed on the inputs. Some useful examples of this are:

1. Addition



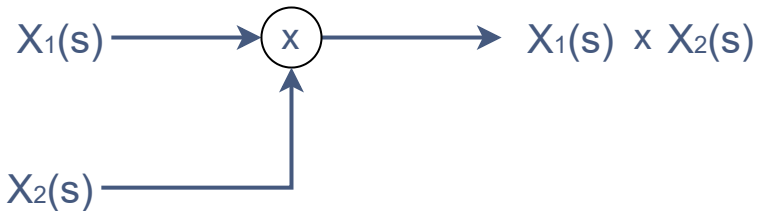
Addition

2. Subtraction



Subtraction

3. Multiplication



Multiplication

In the next lesson, you will solve tasks related to transfer functions.