

AMPLIFIERS

All an amplifier is, is a circuit that multiplies a signal. If you had an amplifier that multiplied a signal by 10, then any signal you input would be multiplied by 10. This can be done for voltage, current, power, etc.

VOLTAGE AMPLIFIERS

Let's say you had a voltage amplifier that multiplied the voltage of circuit A by 100. If the voltage of circuit A was 1 V, what would the voltage in circuit B be? $V_B = 1\text{ V} \times 100 = 100\text{ V}$

What if the voltage in circuit A was 5.5 mV? $V_B = 5.5\text{ mV} \times 100 = 550.0\text{ mV} = 0.55\text{ V}$

What if the amplifier was 15 and the input voltage was 5 V? $V_B = 5\text{ V} \times 15 = 75\text{ V}$

CURRENT AMPLIFIERS

Let's say you had a current amplifier that multiplied the current of circuit A by 20. If the current of circuit A was 5 amps, what would the current in circuit B be? $I_B = 5\text{ A} \times 20 = 100\text{ A}$

What if the current in circuit A was 1.5 amps? $I_B = 1.5\text{ A} \times 20 = 30\text{ A}$

What if the amplifier was 15 and the current was 10 mA? $I_B = 10\text{ mA} \times 15 = 150\text{ mA} = 0.15\text{ A}$

TRANSFER FUNCTIONS

What is a *transfer function*? Let's break it down into each word. What is a function? Write your understanding below:

A transfer function, in the context of circuits, is defined mathematically as:

$$H(s) = V_{out}(s) / V_{in}(s).$$

In layman's terms, this is the ratio of the output signal to the input signal. Transfer functions allow us to characterize the frequency response of a circuit and demonstrates how the system responds to inputs of varying frequencies.

A function, in the context of mathematics, can be defined as a computational problem where there is a set of inputs that map to a set of possible inputs. For each input, we can specify which output is correct.

A function is a relation between an input and output, wherein, given an input, the function will provide a particular output. It can be thought of as a box, where you put in a number, and it operates on the number and results in a new number, given as the output.

The word *transfer* is in reference to a signal moving from one part of a circuit into another. If the components of a circuit are written as a box, the signal *transfers*, or moves from one side to the other of the circuit.

Thus, a *transfer function* is an operation done on a signal as a result of a circuit. If you know a transfer function, you can take any input into the circuit and know the output, because of the transfer function.

The notation for a transfer function is written as $H(s)$. Therefore, $H(s) = \frac{X_{out}}{X_{in}}$, where X can be voltage, current, power, or any other electrical measure.