ECE 203

Circuits I

Series-Parallel Connections

Lecture 3-1

Series and Parallel Connections

Series: Components are connected end-to-end

Parallel: Components are connected across each other

Can also have combinations of series and parallel connections

Examples: Go to example 3-1.1

Connecting multiple voltage sources

- Voltage sources in series add up; manifestation of KVL
- It doesn’t matter if the sources are sequential in the circuit, they can add up in any order
- Don’t connect dissimilar voltage sources in parallel

Connecting multiple current sources

- Current sources in parallel add up; manifestation of KCL
- Doesn’t matter if there are other components in parallel between current sources
- Don’t connect dissimilar current sources in series

Go to example 3-1.2

Series and Parallel Connections of Resistors

- Resistors in series add up

  $R_{tot} = R_1 + R_2 + R_3 + \ldots.$
- Resistors in parallel add like this:

  $1/R_{tot} = 1/R_1 + 1/R_2 + 1/R_3 + \ldots$
- If there are just two resistors in parallel

  $R_{tot} = (R_1 * R_2)/(R_1 + R_2)$

Go to example 3-1.3

Some properties of resistors connected in parallel

1) For two resistors in parallel, if $R_1 >> R_2$, then $R_{tot} \approx R_2$; i.e. the parallel combination is equivalent to the smaller of the two parallel resistors.

2) If there are two identical resistors in parallel, the equivalent resistance is ½ the value of either one.

Notation

A shorthand that is often used to indicate resistors in parallel: $R_1 \| R_2$

Variations on this: $R_1 \| R_2 \| R_3$

$(R_1 + R_2) \| R_3$

Warning!

Determining which components in a circuit are in parallel and which are in series can be tricky.

Sometimes in a circuit diagram, components are drawn parallel to each other, but are really in series, and *vice versa*.

Have to pay close attention to how components are connected, not how they are drawn. Go to example 3-1.4