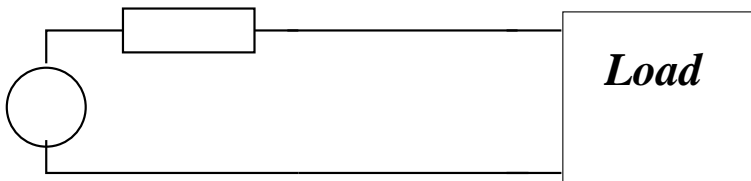


LINEARITY

Most useful systems behave in a linear way with respect to different inputs. It turns out that *any* system can be constrained to behave linearly. *Linearity* applied to systems has a specific meaning.

In terms of design you need to start thinking of ccts as blocks which take some voltage and/or current as *input*. They then *output* some voltage and/or current across some load.



Linear systems obey two properties

1. Response to a weighted sum (superposition) of several inputs is a weighted sum of the responses to each of the inputs.

$$\text{IF } x_1(t) \rightarrow y_1(t)$$

$$\text{AND } x_2(t) \rightarrow y_2(t)$$

$$\text{THEN } x_1(t) + x_2(t) \rightarrow \boxed{}$$

2. Response to an input scaled (= multiplied) by any constant is the corresponding output scaled by that same constant.

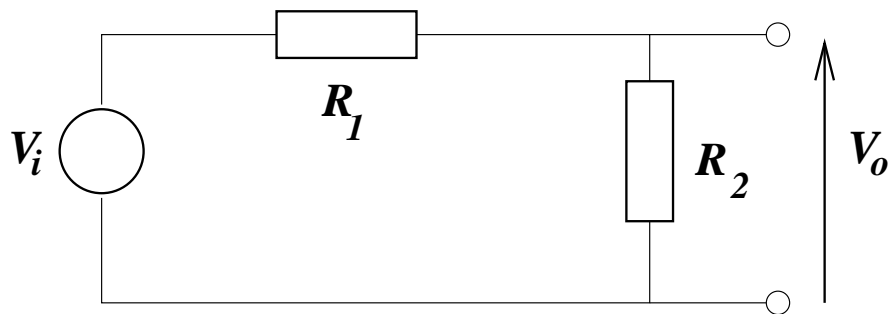
$$\text{IF } x_1(t) \rightarrow y_1(t)$$

$$\text{THEN } ax_1(t) \rightarrow \boxed{}$$

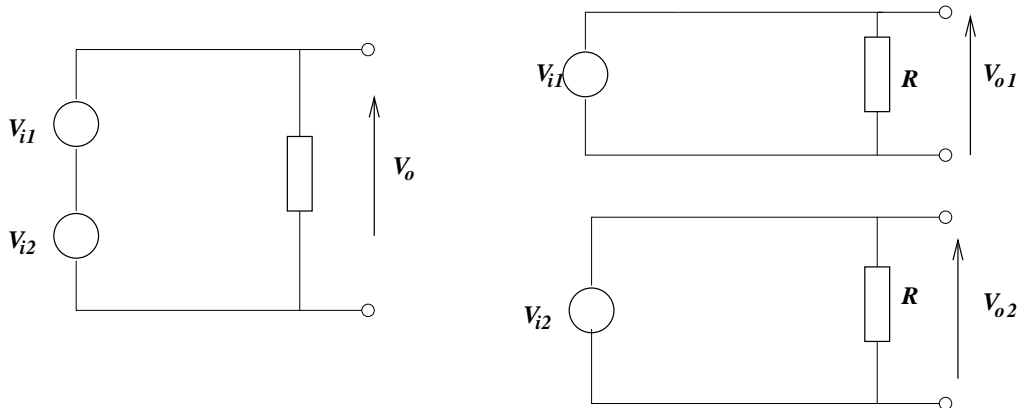
where a is *any* complex constant. (i.e. a can be either real or complex).

1 Meaning for d.c. ccts

- You now know that you can represent any kind of complicated cct by a voltage or current source in series or parallel with some parasitic resistance and a load resistance.
- We can therefore work with a simple example and see what linearity means for d.c. ccts



2 Superposition and ccts



2.1 An example

Determine V_o in the cct below using superposition.

