

ECE 201: Lecture 19

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- Linearity and Response Classification

Background

- “Response” and “output” are the same thing: the voltage at a node or the current in a branch, whatever we are trying to find (response is more common for the time-varying case).
- We saw that the output of a resistive circuit has a linear relationship with its inputs (independent sources)
 - Output can be decomposed as a sum of components, one due to each input (superposition)
 - If one of the inputs is scaled by a factor k , the corresponding component is scaled by the same factor k (linearity)
- The same applies to first order circuits, because derivatives are also linear, but the initial conditions need to be dealt with separately

Response classification

- The complete response of a first order circuit has two components:
 - Zero-input response: response if all the INDEPENDENT sources are de-activated
 - voltage sources become shorts, current sources become open circuits, the initial conditions remain unchanged
 - This gives the response to the initial conditions, without sources.
 - In most cases, the capacitors/inductors will discharge and the response will be a decreasing exponential. However, dependent sources could change this.
 - Zero-state response: response if all the initial conditions are “de-activated” (set to 0)
 - Capacitors are assumed to start with no voltage, inductors with no current
 - This gives the response to the sources, without initial conditions.
- Complete resp. = Zero-input resp. + Zero-state resp.