Lecture 15, Friday, February 11, 2022

- For a general resistive circuit with just one capacitor:

$$v_c(t) \;=\; V_T \;+\; \left(v_c(0^-) - V_T\right) e^{-\frac{t}{R_T C}}$$

  - A simple way to solve for $v_c(t)$ for $t > 0$ is to consider
    * $v_c(t) \;=\; B \;+\; Ae^{-\frac{t}{\tau}}$
    * $v_c(\infty) = V_T \;=\; B$
    * $v_c(0^+) \;=\; v_c(0^-) \;=\; B + A$
    * $\tau \;=\; R_T C$
    * V_T and R_T are the Thevenin equivalent from the capacitor's perspective.

- General first order ODE with constant coefficients and constant input:
  - A simple way to separate the ZI and ZS responses is to not substitute the value of K nor $y(0^+)$ while solving the equations.
  - That way, the expression for $y(t)$ will clearly show K and $y(0^+)$

$$y(t) \;=\; \frac{K}{a}\left(1 - e^{-at}\right) \;+\; y\left(0^+\right) e^{-at}$$

  - To get $y_{ZI}(t)$ simply set $K = 0$
  - To get $y_{ZS}(t)$ simply set $y(0^+) = 0$

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- For a general resistive circuit with just one inductor:

$$i_L(t) \;=\; I_N \;+\; \left(i_L(0^-) - I_N\right) e^{-\frac{R_T}{L}t}$$

  - A simple way to solve for $i_L(t)$ for $t > 0$ is to consider
    * $i_L(t) \;=\; B \;+\; Ae^{-\frac{t}{\tau}}$
    * $i_L(\infty) = I_N \;=\; B$
    * $i_L(0^+) \;=\; i_L(0^-) \;=\; B + A$
    * $\tau \;=\; \frac{L}{R_T}$
    * I_N and R_T are the Norton equivalent from the capacitor's perspective.

