

EECS 16B CSM Drop-In Session

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Computer Science Mentors

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Who am I?

EECS 16B
CSM Drop-In
Session

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Differential
Equations

RC Circuits

Transistors



- 2nd year majoring in EECS
- took EECS 16B Spring 2020
- How I spent break
 - lots of vidya (Civ VI, Valorant, etc.)
 - built mechanical keyboard

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Differential Equations

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Concept check!

Differential Equations

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Concept check!

$$\frac{d}{dt}x(t) = f(x, t) \quad (1)$$

- Focusing on first-order ODEs
- Relates the derivative in other terms
- 3Blue1Brown video

Exponential Differential Equation

Homogeneous

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$$\frac{d}{dt}x(t) = \lambda x(t) \implies x(t) = x_0 e^{\lambda t} \quad (2)$$

Exponential Differential Equation

Non-Homogeneous

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$$\frac{d}{dt}x(t) = \alpha x(t) + \beta \quad (3)$$

$$\frac{d}{dt}x(t) = \alpha \left(x(t) + \frac{\beta}{\alpha} \right) \quad (4)$$

$$\int \frac{1}{x(t) + \frac{\beta}{\alpha}} dx(t) = \int \alpha dt \quad (5)$$

$$\ln \left| x(t) + \frac{\beta}{\alpha} \right| = \alpha t + C \quad (6)$$

$$\Rightarrow x(t) = -\frac{\beta}{\alpha} + Ce^{\alpha t} \quad (7)$$

RC Circuits

Undamped Response

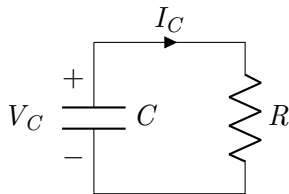
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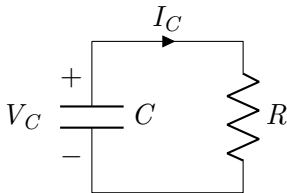
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$$C \frac{d}{dt} V_C = -\frac{V_C}{R} \quad (8)$$

$$\frac{d}{dt} V_C = -\underbrace{\frac{1}{RC}}_{\lambda} V_C \quad (9)$$

$$\Rightarrow V_C(t) = V_0 e^{-\frac{1}{RC}t} = V_0 e^{-\frac{1}{\tau}t} \quad (10)$$

Transistors

NMOS & PMOS

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