
Basic Electric Circuit Thoery (BECT)

Preview

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Course Introduction

- What is the definition of “ENGINEERING”?

I can answer this as follows:

“Utilize the concept of science with purpose”

- What is this lecture (“BECT”) about?

From electrons to lumped circuit elements

↳ 전류 제공자

↳ 회로 구성 부품

- Maxwell's Equation in Electromagnetic Theory vs. Electric Circuit Theorems

Model은 정형이다 (외부를 포함해 때론)



Circuit Model

Experiments
(data table)

Physics law / Abstraction
(Maxwell's equation / Ohm's law)

(비저항을 고려한다는 뜻인가)

Lumped circuit model (abstraction)

간-략

→ 선형회로를 원한다

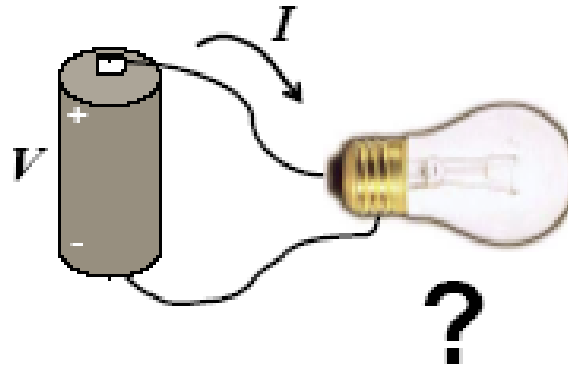
↓
원하는 저항이 하나의 값일

생제: 몇 ... 등등

모르고 계산하면 소결을 내는거지

Physics to Electric circuit theory

- Example



+) 겉만은 V 처럼 보이지만
사실 축전기의 양

What is the current through the bulb?

Hard way to find the current I

- Apply Maxwell's equations

Differential form Integral form

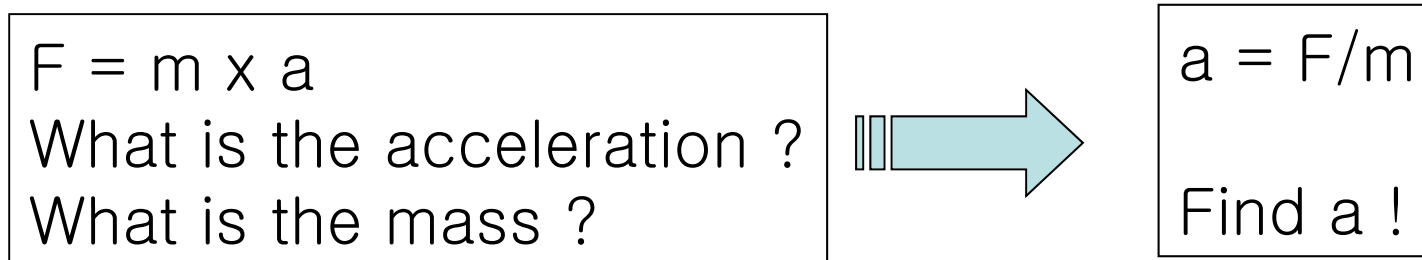
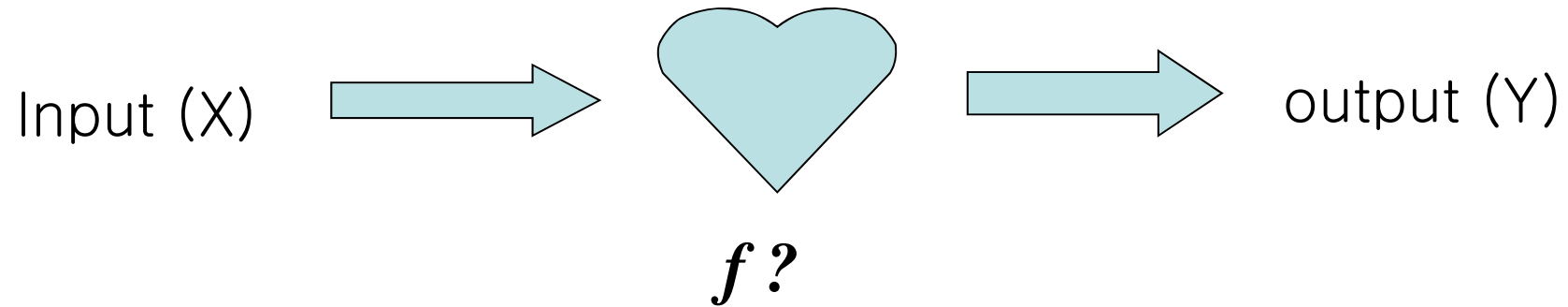
Faraday's	$\nabla \times E = -\frac{\partial B}{\partial t}$	$\oint E \cdot dl = -\frac{\partial \phi_B}{\partial t}$
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Continuity	$\nabla \cdot J = -\frac{\partial \rho}{\partial t}$	$\oint J \cdot dS = -\frac{\partial q}{\partial t}$
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Others	$\nabla \cdot E = \frac{\rho}{\epsilon_0}$	$\oint E \cdot dS = \frac{q}{\epsilon_0}$
	\vdots	\vdots

Easier Way to find the current I

- Using the following steps:



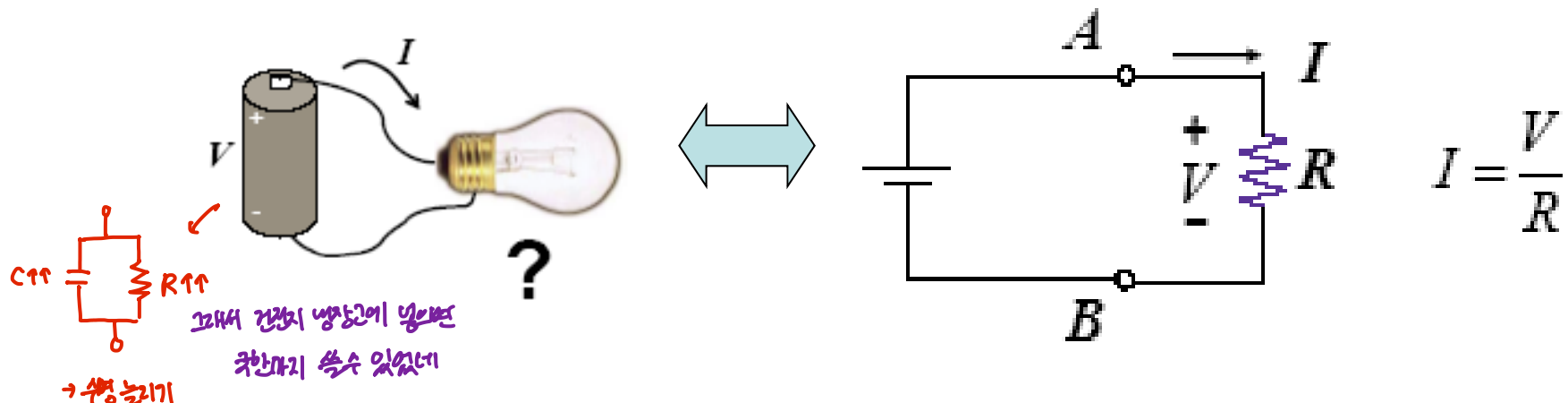
↳ 예제 문제 상황 부하하듯이

Easier Way to find the current I

- In this case, the followings are ignored:
 - 1) the object's shape
 - 2) its temperature
 - 3) point of force application
 - 4) other factors...called “Abstraction”
- In the previous example, the bulb can be replaced with a resistor!

Electric circuit model and lumped element

- Electric circuit model



- **Lumped element** is defined as a element whose behavior is completely captured by I-V relationship