Lecture7:
Diode models and circuits (1)

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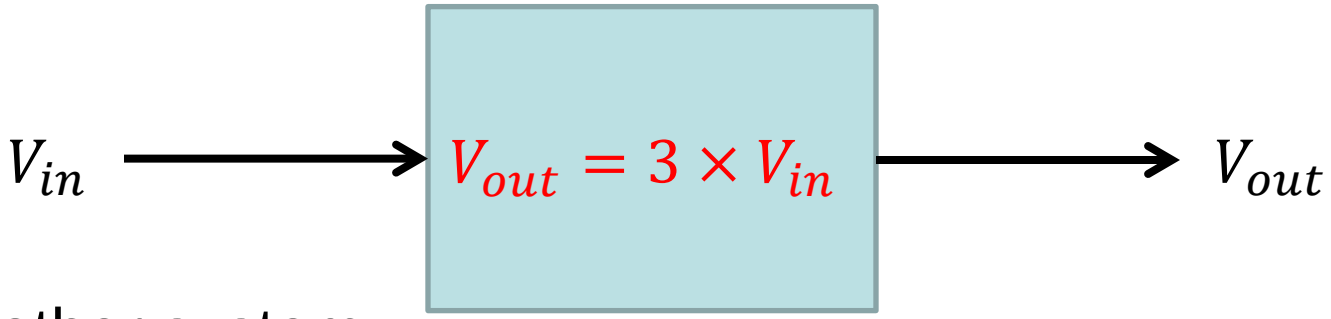
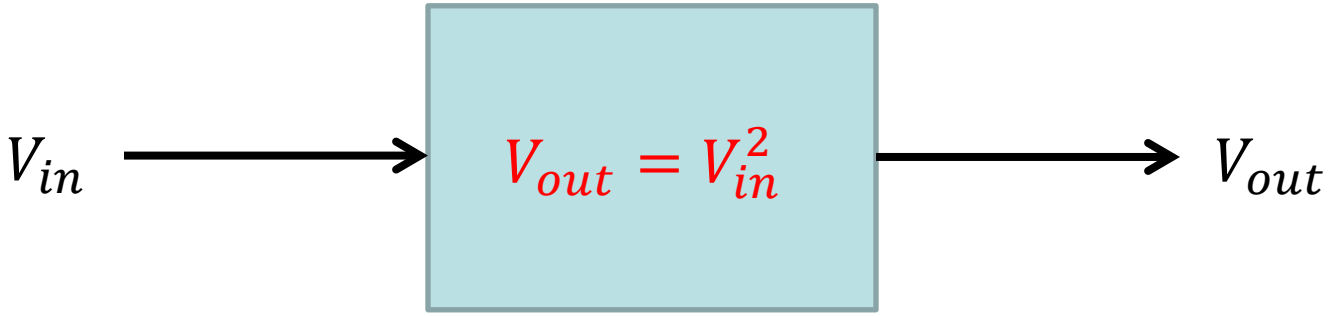
A simple math

- An input voltage, $V_{in}(t) = \sin \omega t$
- A system

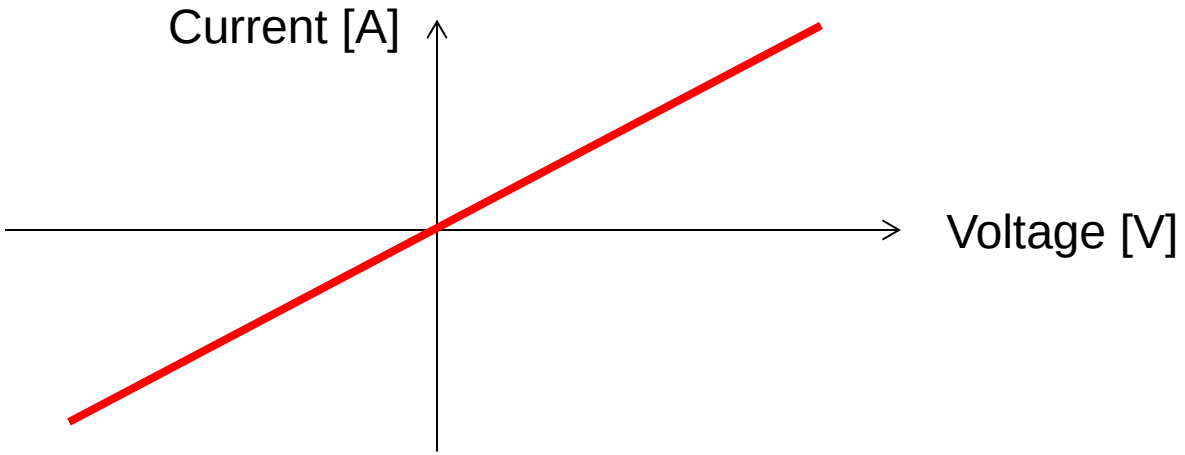


- Another system

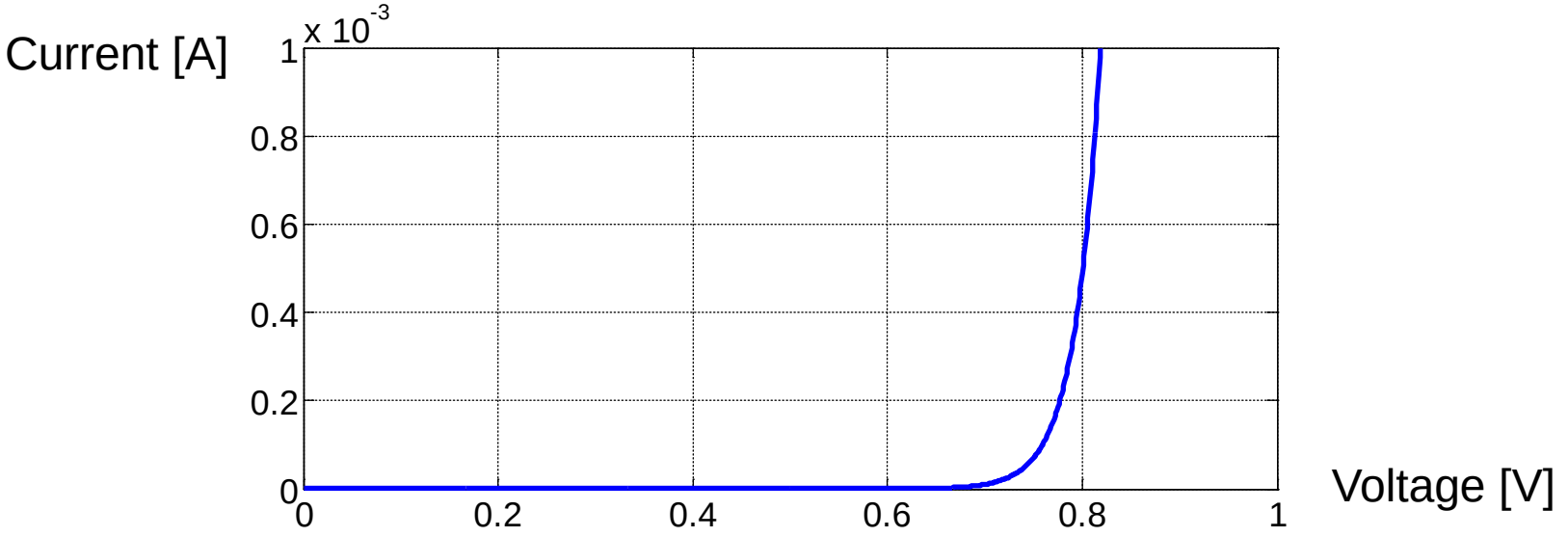


Which is nonlinear?

- A resistor

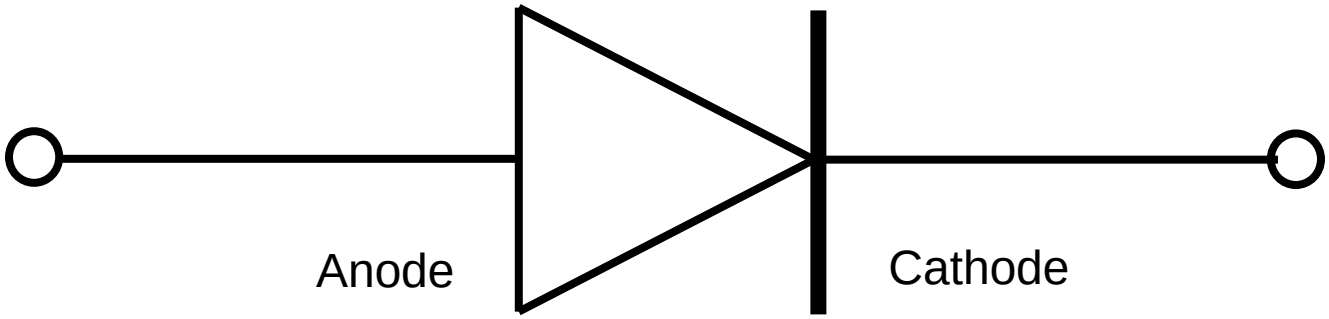


- A diode

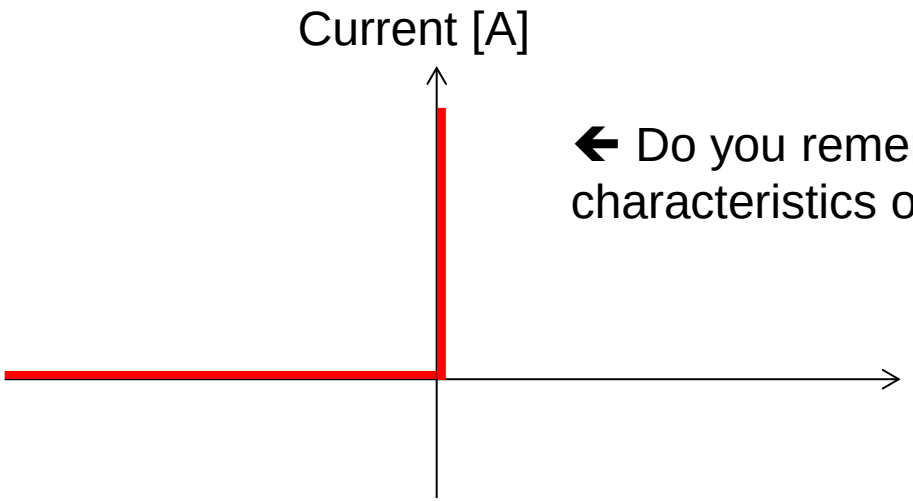


Diode

- Its symbol



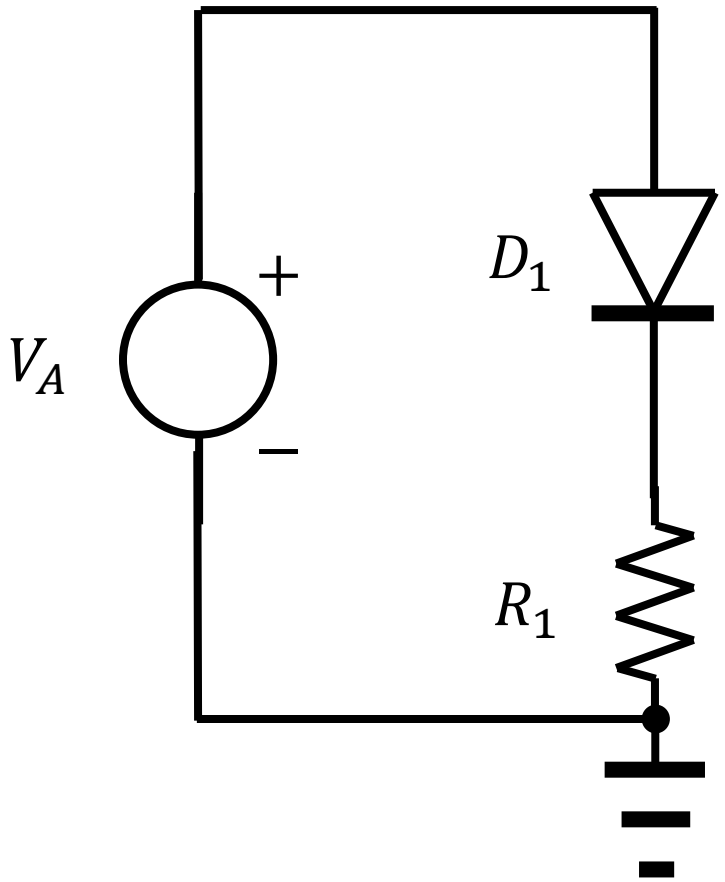
- Ideally, a perfect rectifier



← Do you remember the IV characteristics of a pn diode?

Example 3.4

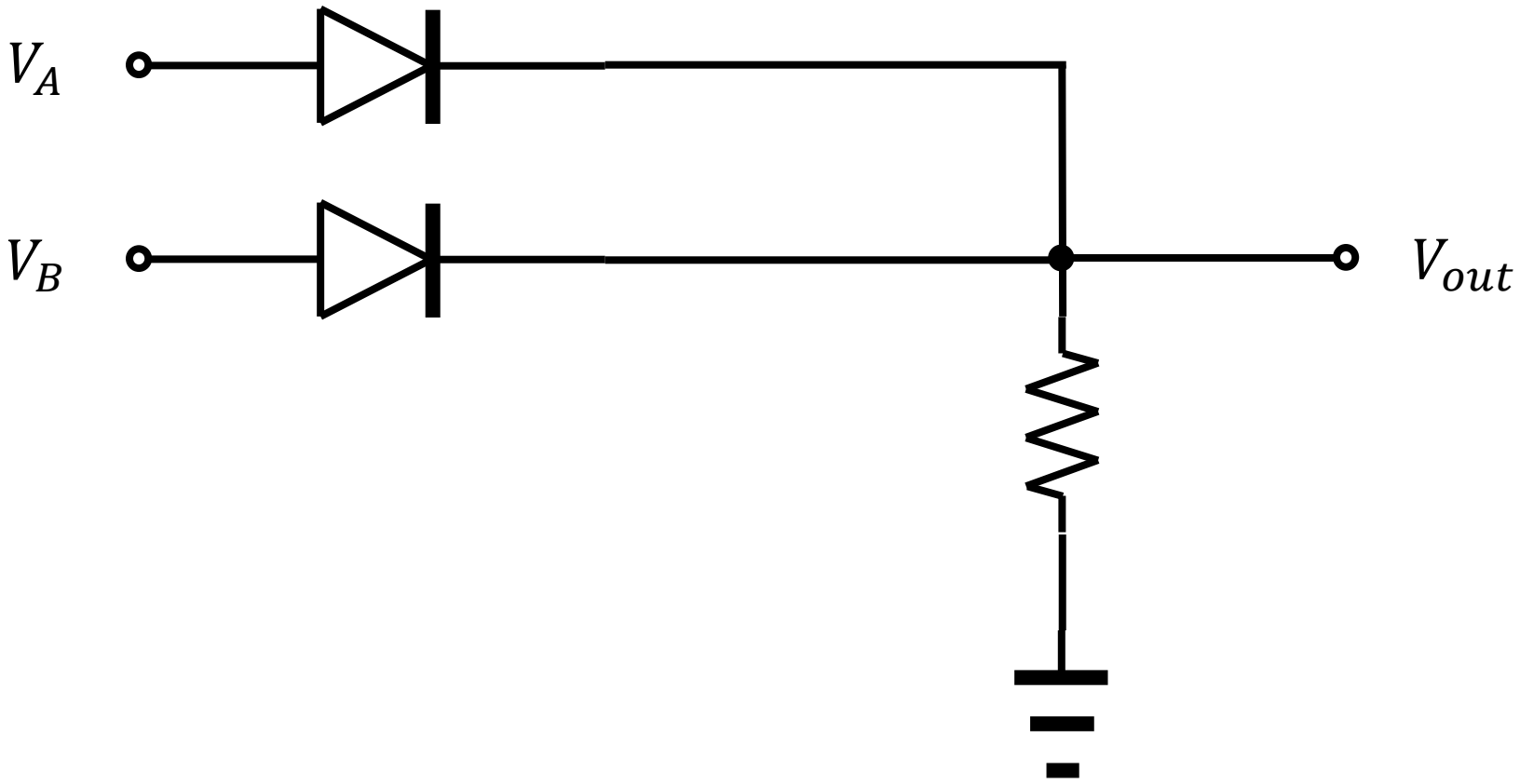
- A diode-resistor combination



- Consider two cases, $V_A > 0$ and $V_A < 0$.
- Draw the IV curve.

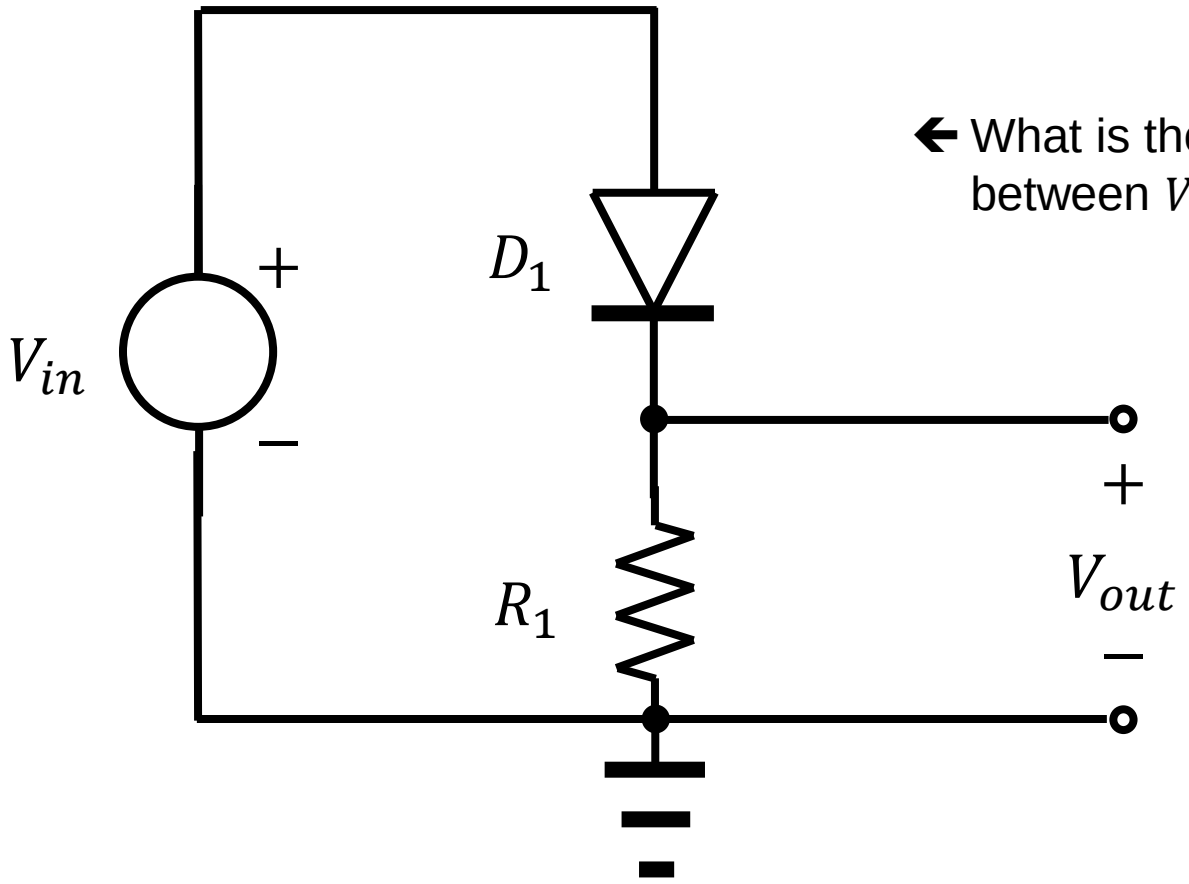
Example 3.6

- An OR gate



Rectifier

- Same circuit shown in Example 3.4.

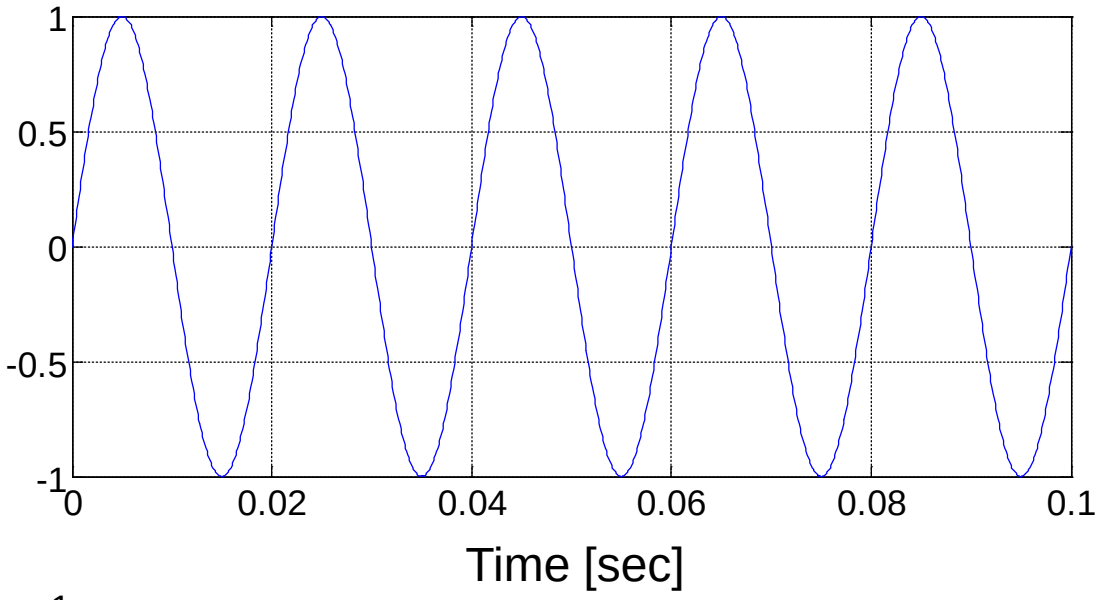


What is the relation between V_{in} and V_{out}?

Input vs. output

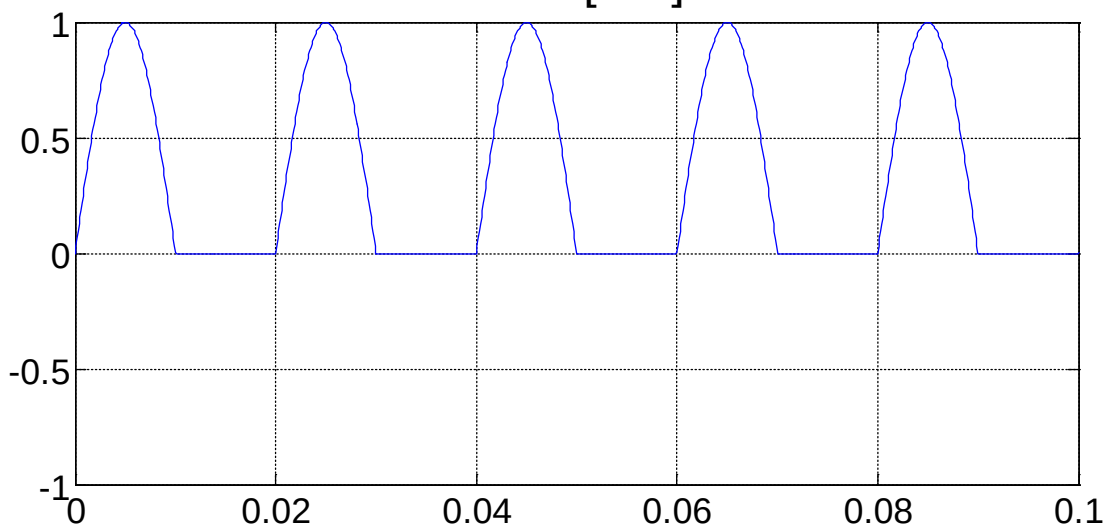
- Input
  - 50 Hz
  - Pure sine
  - No dc

V_{in}



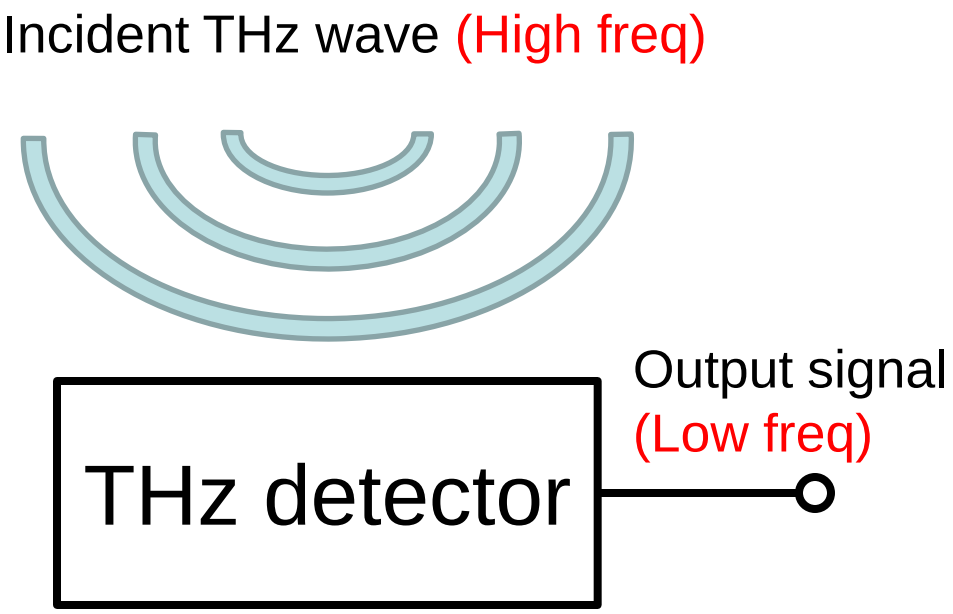
- Output
  - 0, 50, 100, … Hz
  - dc voltage: $\frac{1}{\pi}$ V

V_{out}



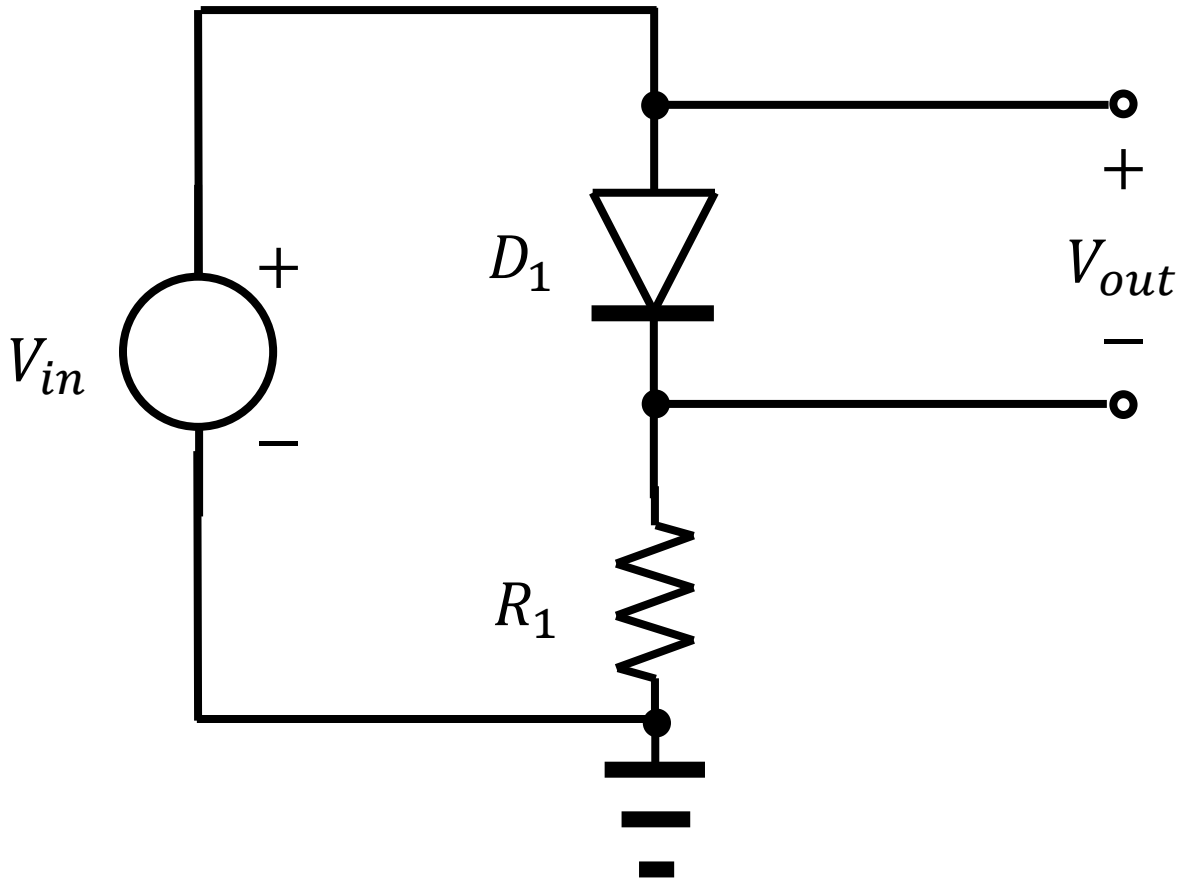
Concept!

- How to detect the electromagnetic radiation
  - Nonlinearity is required.



Rectifier, revisited

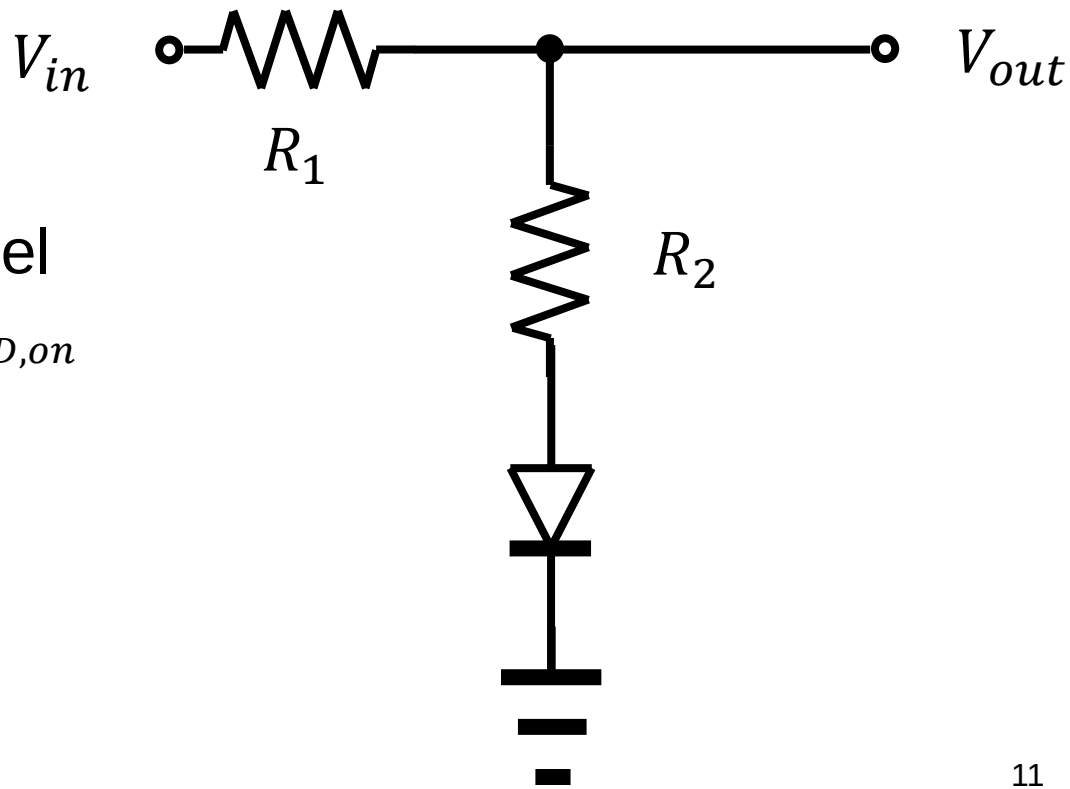
- Same circuit shown in Example 3.4.



pn junction as a diode

- Exponential model

$$I_D = I_s\left(\exp\frac{V_D}{V_T} - 1\right)$$



- Constant-voltage model
  - An "offset" voltage of $V_{D,on}$

Read your textbook.

- Today, we have covered up to Sec.3.2.
  - Up to p. 59.
  - Sec. 3.3, “Additional examples,” will be skipped.

- On Wednesday, we will finish the short chapter, Ch. 4.
  - Read your textbook in advance.
  - Especially, Sec. 3.4.