Digital Circuit Fall 2019

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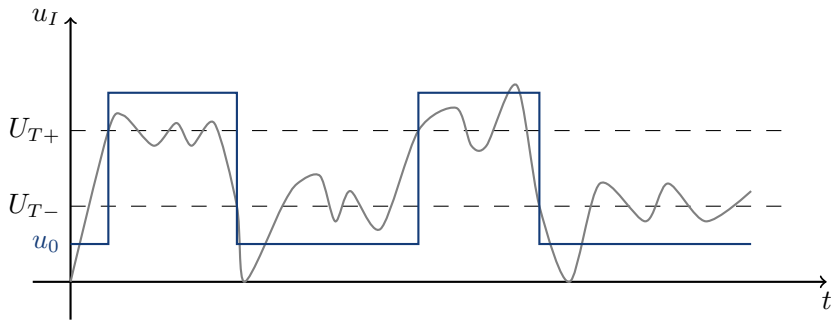
Session 6 - Pulse generating and shaping

Session 6 Homework

• **Problem 1 - 9.1** Give the waveform of u_0 **.**



• **Problem 2 - 9.5** Given a 74121 connected as shown**.**

1.Calculate the range of delay time

$$CR \leq t_d \leq C(R + R_W)$$

$$3.57ms \leq t_d \leq 18.97ms$$

2.What's the functionality of the resister next to R_w?

It prevents short circuit when R_w is set to 0.

• **Problem 3 - 9.8**

1. Analyze the status of circuit when S is open.

When S remains open,

$$\overline{TR} \equiv V_{cc} > \frac{1}{3}V_{cc}$$

TH will be flipped to Low if it was High, and remains Low as a stable status.

Hence, u_0 holds on 0. The circuit is stable.

2. Let $C = 10\,\mu F$, give the value of R so as the circuit outputs a pulse of $t_w = 10s$ when S is pressed.

Since the given design is a standard monostable trigger, we can use $t_w = RC\,ln3 = 10s$.

Hence, $R = 910\,k\Omega$.

3. What's the value of R if $C = 0.1\,\mu F$, $t_w = 5\,ms$? What value of t_w do we expect if we replace C by $1\,\mu F$ with

the same R?

$$t_w = RC\,ln3 = 5\,ms$$

$$R = \frac{5\,ms}{0.1\,\mu F\,\cdot\,ln3} = 45.5\,k\Omega$$

$$Replace \Rightarrow C = 1\,\mu F$$

$$t_w = 50\,ms$$

• **Problem 4 - 9.13 .**

1. What kind of function dose each of the 555 chip serve?

   Each of them is a multivibrator.

2. Analyze the status of circuit when S is set to 1.

   Charging time:

$$(Chip1)\ \ T_1 = (R_1 + R_2)C\,ln\,2 = 2.84\,ms$$

$$(Chip2)\ \ T_1 = (R_1 + R_2)C\,ln\,2 = 0.284\,ms$$

   Discharge time:

$$(Chip1)\ \ T_2 = R_2\,C\,ln\,2 = 1.53\,ms$$

$$(Chip2)\ \ T_2 = R_2\,C\,ln\,2 = 0.153\,ms$$

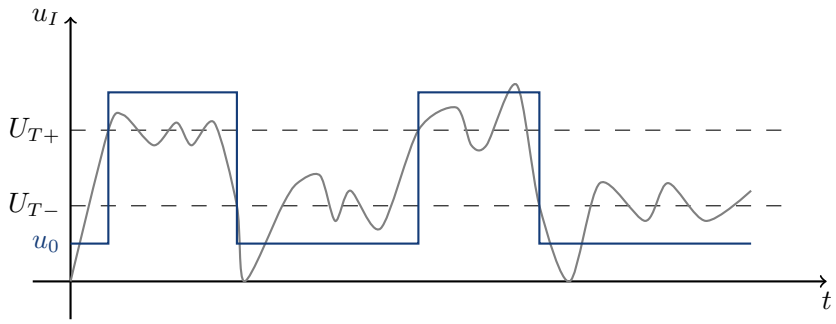
   Duty cycle:

$$(Chip1)\ \ F = 228.3\,Hz$$

$$(Chip2)\ \ F = 2.283\,kHz$$

$$Ratio\ 65\%$$

3. Draw the wave form of both u_0 and u_1 when S is set to 2.



Session 7 - D/A and A/D converter

Session 7 Homework

- **Problem 1 - 10.2 .**
- **Problem 2 - 10.6 .**
- **Problem 3 - 11.3 .**
- **Problem 4 - 11.12 .**