Indian Institute of Information Technology, Sri City, Chittoor
(An Institute of National Importance under an Act of Parliament)

BEC Tutorial 7

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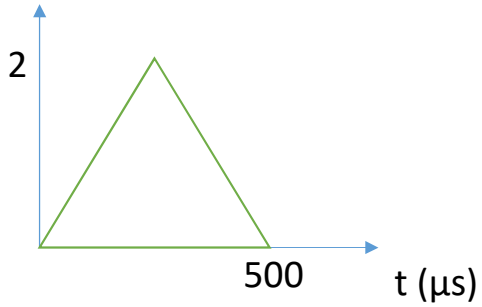
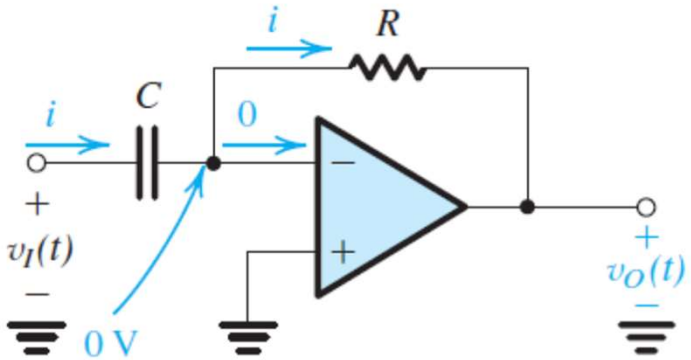
Differentiator

- Input of the Differentiator is given as, find output if R_F = 2 kΩ, and C_1 = 0.1 µF.





Wien bridge oscillator

- A wien bridge oscillator is having R_f = 6.4 KΩ, R_i = 3.2 KΩ, series combination (R_1 = 5 KΩ, C_1 = 7.5nF), and parallel combination (R_2 = 13KΩ and C_2 = 4.65nF). Determine the transfer function of the feed back network (V_a/V_o), also determine the frequency of oscillations.

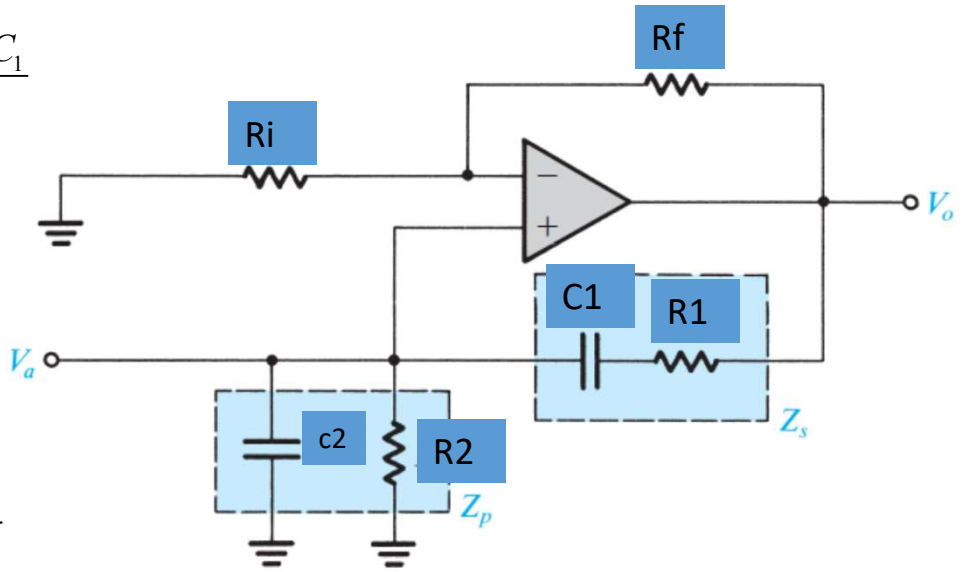
$$Z_p = \frac{1}{Y_p} = \frac{1}{\frac{1}{R_2} + j\omega c_2} = \frac{R_2}{1 + j\omega R_2 C_2}$$

$$Z_s = \frac{1}{j\omega c_1} + R_1 = \frac{1 + j\omega R_1 C_1}{j\omega c_1}$$

$$Z_s + Z_p = \frac{1 + j\omega R_1 C_1}{j\omega C_1} + \frac{R_2}{1 + j\omega R_2 C_2} = \frac{1 - \omega^2 R_1 C_1 R_2 C_2 + j\omega\left(R_1 C_1 + R_2 C_2 + R_2 C_1\right)}{j\omega C_1\left(1 + j\omega R_2 C_2\right)}$$

$$\beta = \frac{Z_p}{Z_p + Z_s} = \frac{j\omega R_2 C_1}{1 - \omega^2 R_1 C_1 R_2 C_2 + j\omega\left(R_1 C_1 + R_2 C_2 + R_2 C_1\right)}$$

$$1 - \omega^2 R_1 C_1 R_2 C_2 = 0 \qquad f = \frac{1}{2\pi\sqrt{R_1 C_1 R_2 C_2}}$$



Schmitt Trigger

An operational amplifier is to be used with positive feedback to produce a Schmitt trigger circuit. If resistor, R_1 = 90kΩ and resistor, R_2 = 10kΩ, what will be the values of the upper and lower switching points of the reference voltage and the width of the hysteresis if the op-amp is connected to a dual ±10v power supply. (i) Vref = 0 V and (ii) Vref = 4 V.

$$V_{UT} = \frac{R_1}{R_1 + R_2} V_{ref} + \frac{R_2}{R_1 + R_2} V_{sat}$$

$$V_{LT} = \frac{R_1}{R_1 + R_2} V_{ref} - \frac{R_2}{R_1 + R_2} V_{sat}$$

$$V_H = \frac{2R_2}{R_1 + R_2} V_{sat}$$