Analog and Digital Systems (UEE505)

Lecture # 14
Multivibrators

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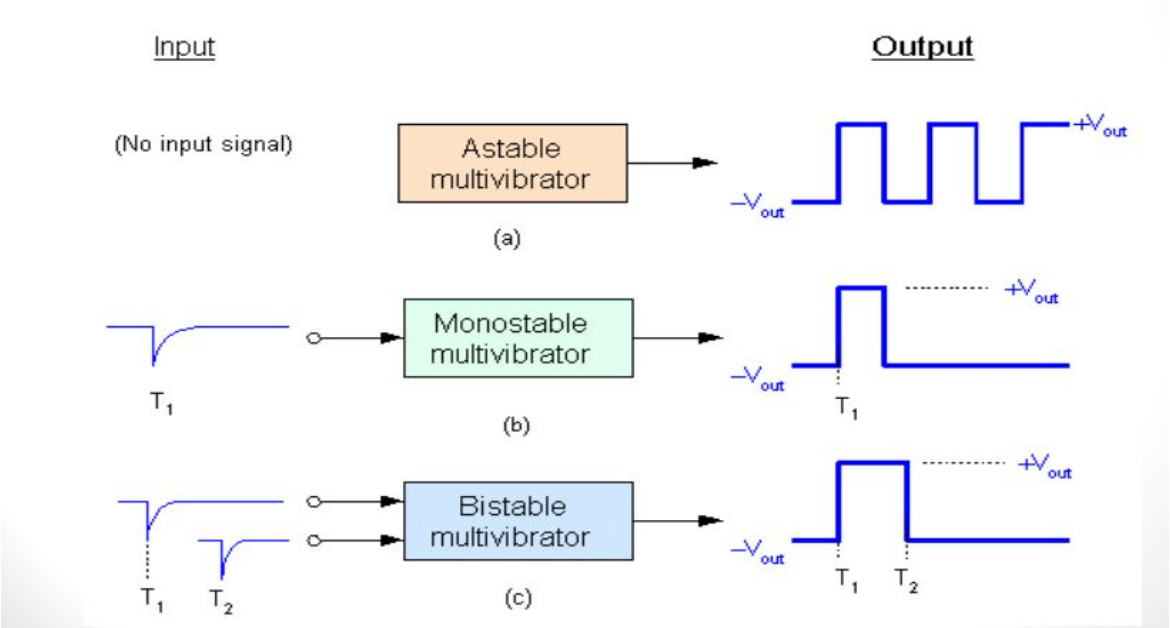
Multivibrators

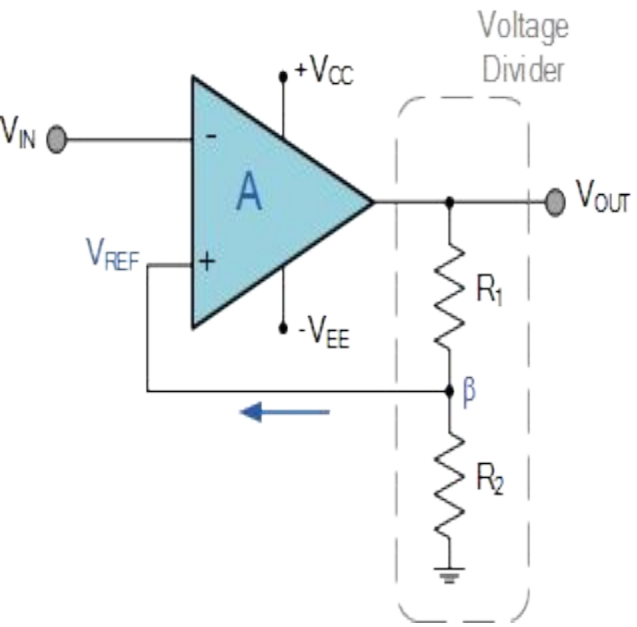
- Non sinusoidal signal generators.
- Clock pulses are generally continuous square or rectangular shaped waveform that is produced by a single pulse generator circuit such as a **Multivibrator**.
- A *Multivibrator* circuit oscillates between a “HIGH” state and a “LOW” state producing a continuous output.
- Types:

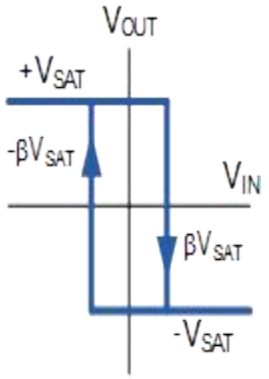


Multivibrators

- In the Multivibrator circuits, the op-amp works as an analogue comparator.
- An op-amp comparator compares the voltages on its two inputs and gives a positive or negative output depending on whether the input is greater or less than some reference value, V_{REF}.

Bistable Multivibrator





$$V_{REF} = V_{OUT}\frac{R_2}{R_1 + R_2} = \beta V_{SAT}$$

$$\beta = \frac{R_2}{R_1 + R_2}$$

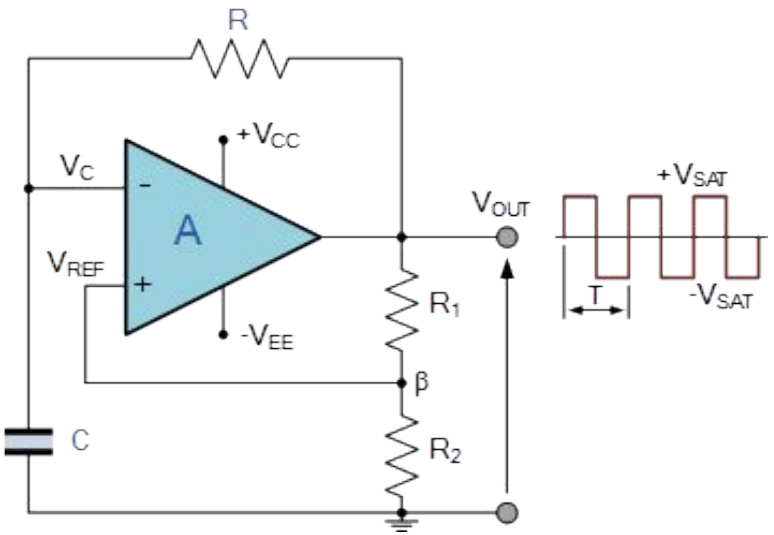
β is called as feedback fraction.

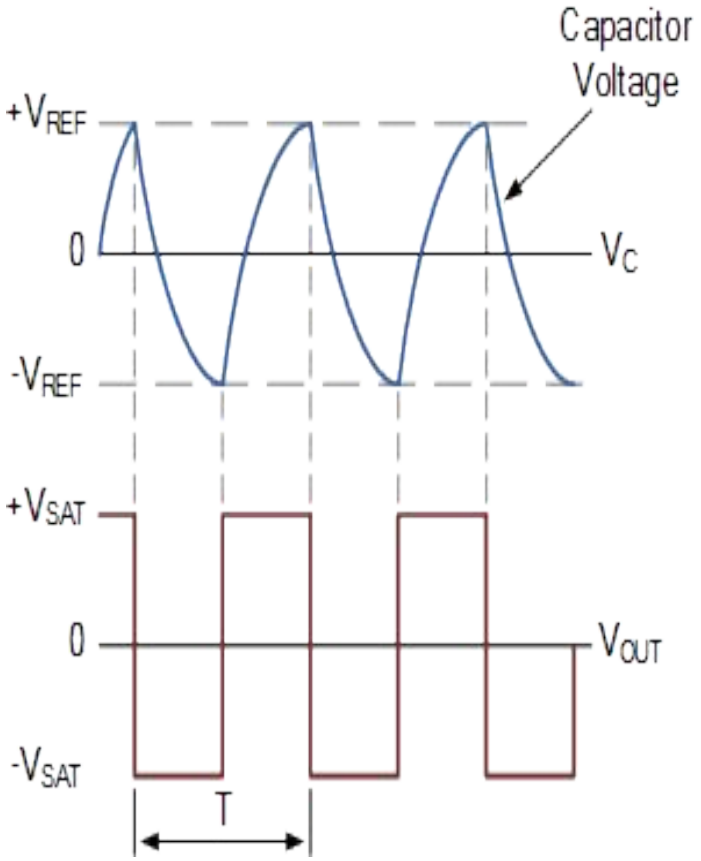
Therefore, $+V_{REF} = +\beta V_{SAT}$

$$-V_{REF} = -\beta V_{SAT}$$

Where $+V_{SAT}$ is the positive op-amp DC saturation voltage and $-V_{SAT}$ is the negative op-amp DC saturation voltage

Astable Multivibrator





If the positive and negative values of the amplifiers saturation voltage have the same magnitude, then t1 = t2 and the expression to give the period of oscillation becomes:

$$\beta = \frac{R_2}{R_1 + R_2}$$

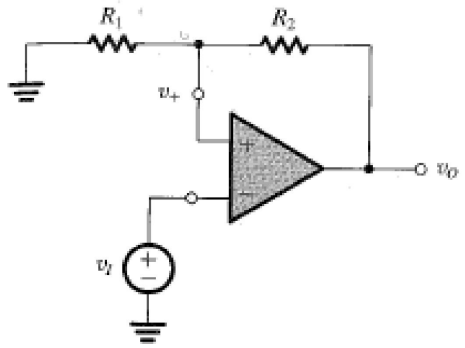
$$T = 2RC \times \ln\left(\frac{1+\beta}{1-\beta}\right) \qquad \therefore f = \frac{1}{T}$$

Derivation for Frequency of Oscillations

Example

The op amp in the bistable circuit shown has output saturation voltages of 13 V . Design the circuit to obtain threshold voltages of ± 5 V .

For R1 = 10 kOhm find the values of R2.



References

- For more details, refer to:
  - *Boylestad R. L., Electronic Devices and Circuit Theory, Pearson Education*
  - *Neamen, Donald A., Electronic Circuit Analysis and Design, McGraw Hill*
  - *Sedra A. S. and Smith K. C., Microelectronic Circuits, Oxford University Press*