

## **Title (proposal) : FREQUENCY MODULATION USING IC555**

**PRESENTED BY**

**ANISH R. KHAPARE**

**BE/ EXTC (3<sup>rd</sup> year)**

**1) THEORY :** Frequency Modulation (FM) is a technique in which the frequency of a carrier signal is varied in accordance with the instantaneous amplitude of a modulating signal while keeping the amplitude of the carrier constant. This method provides improved noise immunity and better signal quality compared to Amplitude Modulation (AM).

When a modulating signal is applied to the control voltage pin (pin 5) of the IC555, it alters the threshold and trigger levels internally. This in turn changes the charging and discharging times of the capacitor, thereby varying the output frequency in proportion to the input signal amplitude.

In simulation using eSim, the IC555-based FM circuit can be analyzed by observing the variation of the output frequency when a low-frequency modulating input is applied at the control voltage pin. The waveform analysis shows the frequency deviation, validating the FM generation capability of the IC555 timer.

### **2) WORKING PRINCIPLE :**

1. The IC555 is connected in astable mode so that it continuously generates a square wave output. The frequency of this oscillation depends on the charging and discharging time of capacitor C2, through the resistors R2 and R3, as per proposed circuit diagram.
2. In the 555 Oscillator circuit below, pin 2 and pin 6 are connected together allowing the circuit to re-trigger itself on each and every cycle allowing it to operate as a free running oscillator.
3. During each cycle capacitor, C2 charges up through both resistors R2 and R3 but discharges itself only through resistor R2 as the other side of R2 is connected to the discharge terminal, pin 7.
4. Additionally, in this circuit, a low-frequency sinusoidal signal is applied to the control voltage pin (pin 5) of the IC555. By applying the modulating signal here, these threshold levels vary in accordance with the instantaneous amplitude of the input waveform.
5. As a result, the charging and discharging times of capacitor C2 change dynamically with the modulating input. This causes the output frequency of the IC555 to shift above and below the carrier frequency, producing a frequency modulated waveform.

### 3) PROPOSED CIRCUIT IN eSIM SOFTWARE

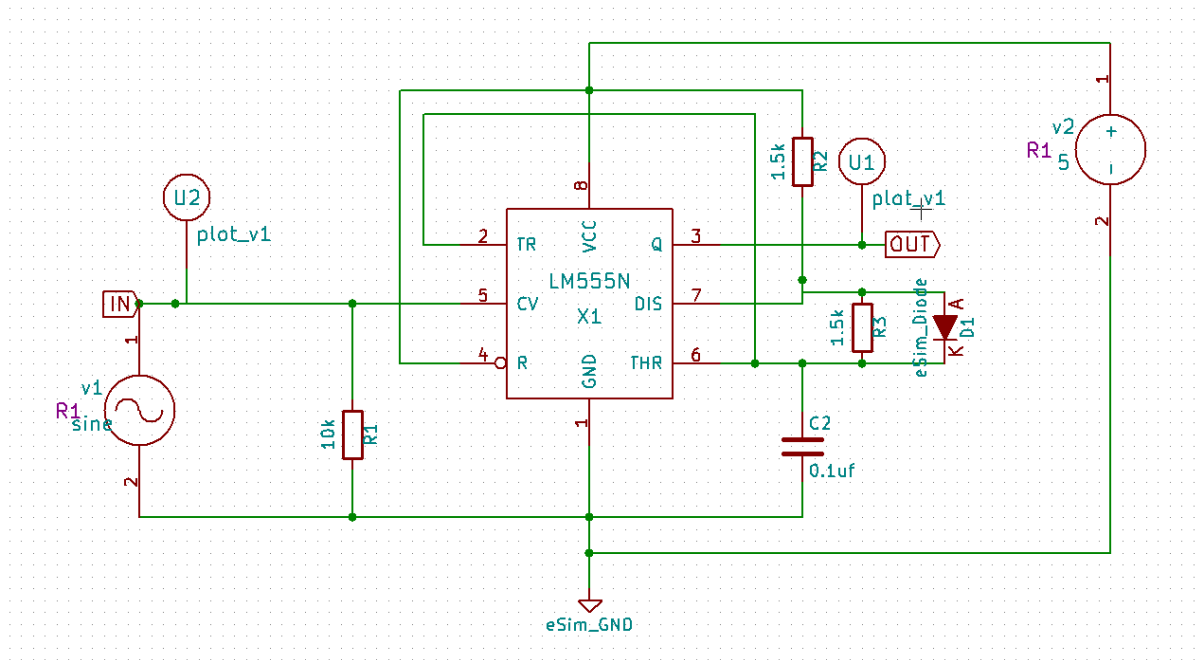


Fig 1 : Frequency Modulation circuit in eSim software

### 4) SIMULATION RESULTS

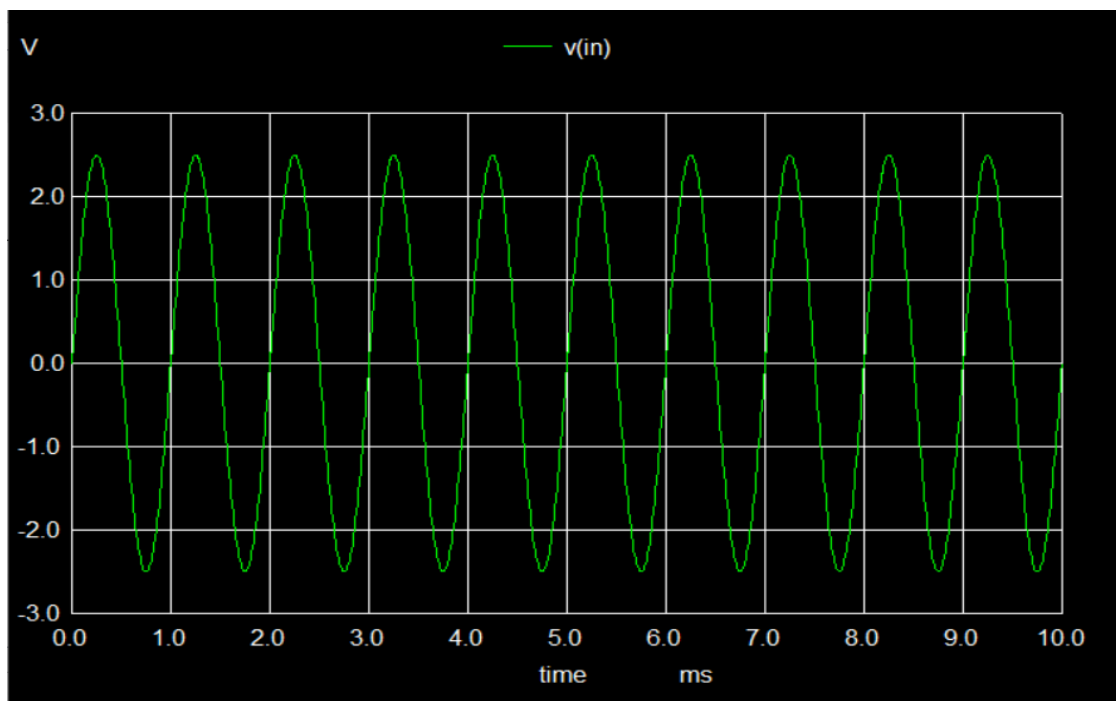


Fig 2: Modulating Waveform

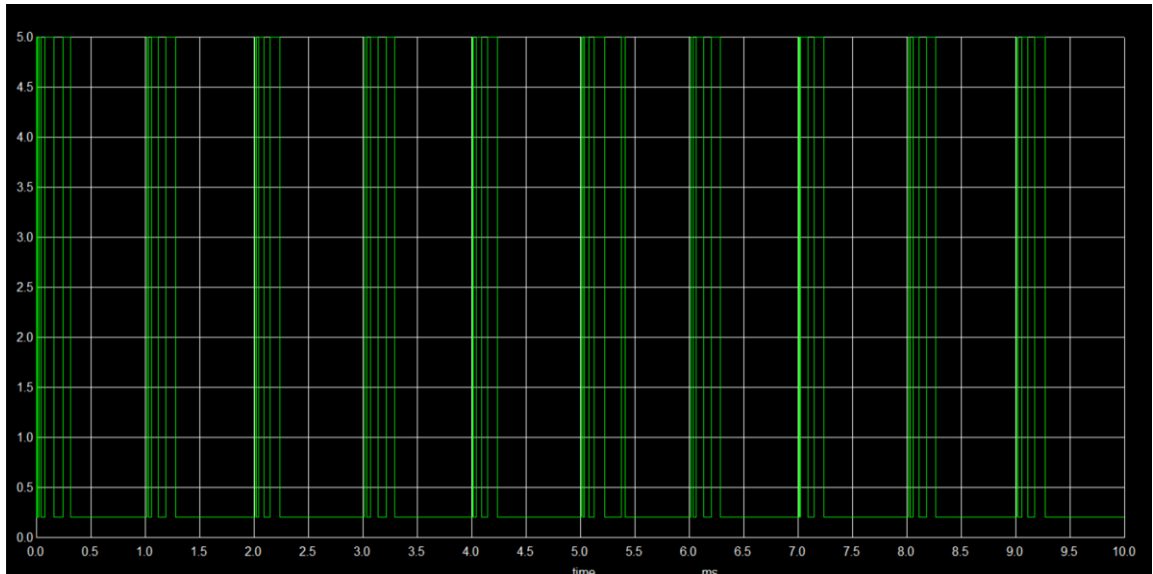


Fig 3 : Frequency Modulated Waveform

## 5) CONCLUSION :

The IC555 timer can be effectively used to generate a frequency modulated signal when operated in astable mode with a modulating input applied to its control voltage pin. The simulation results in eSim confirm that the output frequency varies in proportion to the applied sinusoidal input, demonstrating the capability of the IC555 as a simple FM generator.

## 6) REFERENCE :

<https://electrosome.com/fm-generation-using-555-timer/>