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Memristor-based voltage controlled relaxation oscillator and applications

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Memristors have received intensive attention from researchers in many different fields due to their unique characteristic. They provide a huge storage where more powerful type of electronic circuits can be obtained using memristors. They play an important role in many applications such as non-volatile memory, neural networks, pattern configuration, reconfigurable logic, cryptography, chaotic circuits and circuit modeling. Oscillators are widely used in electronic applications such as timing circuits, modulation, test and measurement devices. They are classified into sinusoidal or relaxation oscillators. Sinusoidal oscillators are based on positive feedback, where a frequency selective network is used to determine oscillation frequency of the sinusoidal output. Relaxation oscillators generate square or triangular waveforms based on astable multivibrators. Both oscillators rely on reactive elements such as capacitors and inductors to achieve oscillation. The well-known Wien oscillator was presented where the resistors are replaced by memristors. The properties of the memristor enable the circuit to maintain sustained oscillations. The memristor is used to mimic the charging and discharging of the reactive elements, where the memristance can be increased or decreased. Therefore, the memristor is considered as a resistance-storing element. The memristor replaced a reactive element such as a capacitor or an inductor in the relaxation oscillators. The circuit introduced in consists of one memristor and resistor (M-R) and another circuit introduced where the memristor is exchanged with the resistor (R-M). Also, two general oscillator circuit topologies were introduced, employing two memristors (M-M) with the same and different polarities. The concept of voltage controlled memristor based relaxation oscillator with the use of one memristor was discussed. From the above brief discussion, it is noticeable that there is a great scope of new types of circuit implementations of voltage control relaxation oscillators using memristive elements.

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