TUNED CLASS C AMPLIFIER

Altair
Innovation Intelligence®

Class C Amplifier

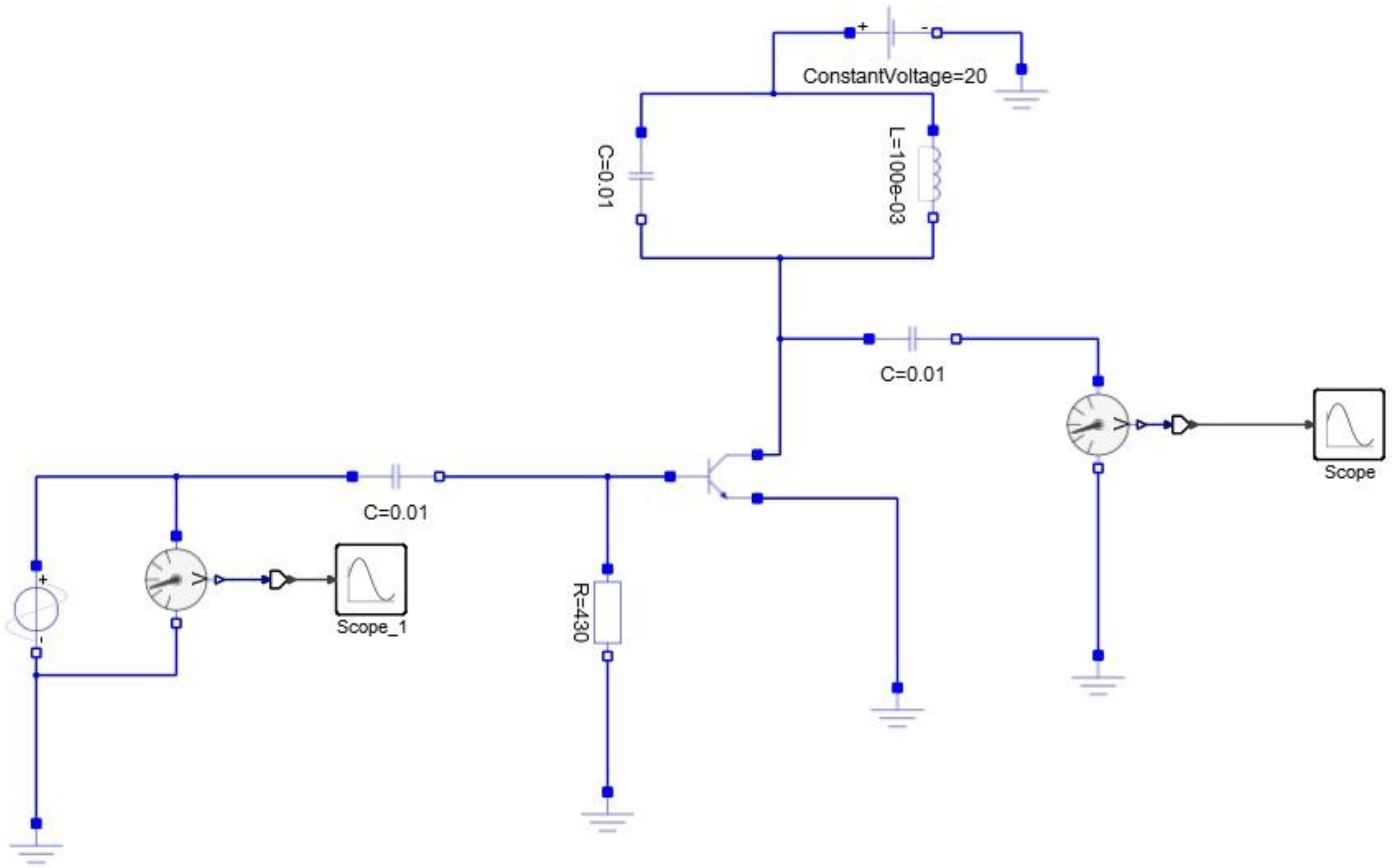
- Class C amplifiers are biased so that conduction occurs for much less than Class C amplifiers are more efficient than either class A or push-pull class B and class AB, which means that more output power can be obtained from class C operation. The output amplitude is a nonlinear function of the input, so class C amplifiers are not used for linear amplification. They are generally used in radio frequency (RF) applications, including circuits, such as oscillators, that have a constant output amplitude, and modulators, where a high-frequency signal is controlled by a low-frequency signal.

- A class C amplifier is normally operated with a resonant circuit load, so the resistive load is used only for the purpose of illustrating the concept. It is biased below cutoff with the negative VBB supply.

Tuned Class C Amplifier

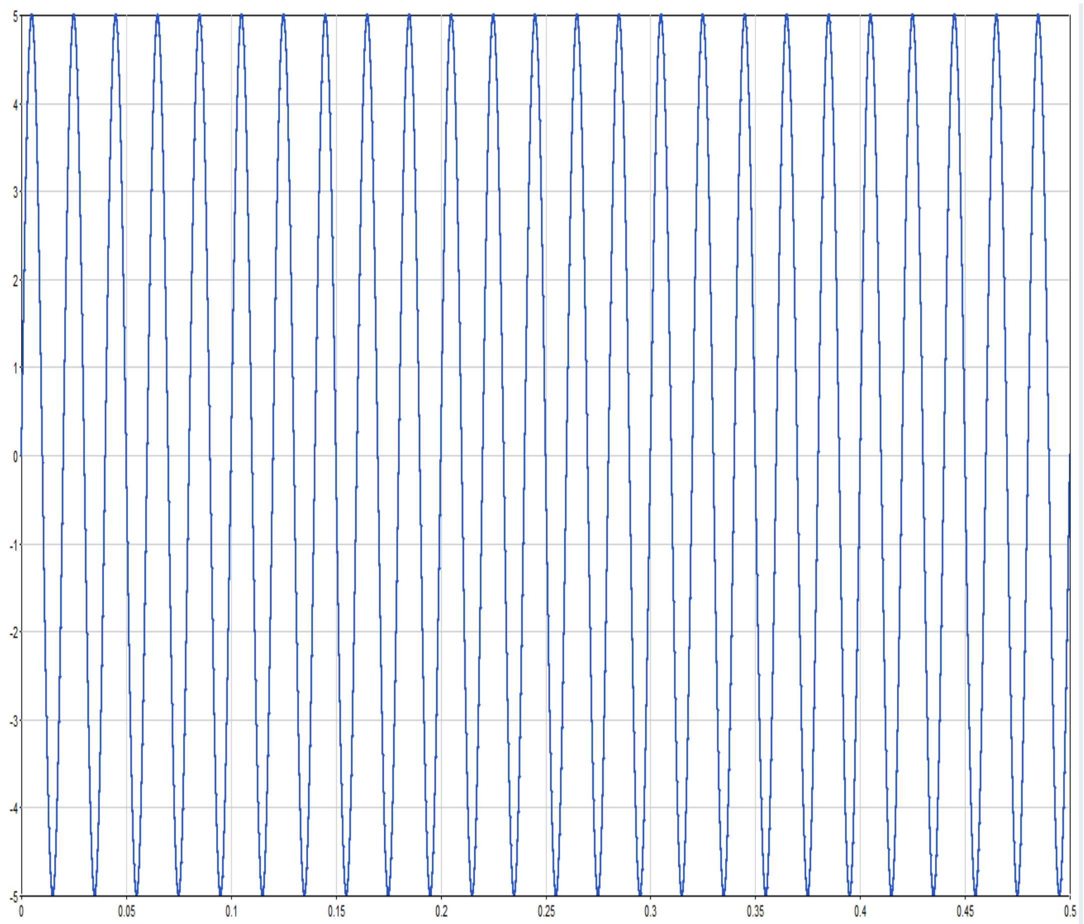
- The basic concept of class C operation is illustrated below. A common-emitter class C amplifier with a resistive load is shown in the following circuit topology. A class C amplifier is normally operated with a resonant circuit load, so the resistive load is used only for the purpose of illustrating the concept. It is biased below cutoff with the negative Source supply. The ac source voltage has a peak value that is slightly greater than so that the base voltage exceeds the barrier potential of the base-emitter junction for a short time near the positive peak of each cycle. During this short interval, the transistor is turned on. When the entire ac load line is used, the ideal maximum collector current is collector saturation current, and the ideal minimum collector voltage is Vce(sat).

Circuit Topology

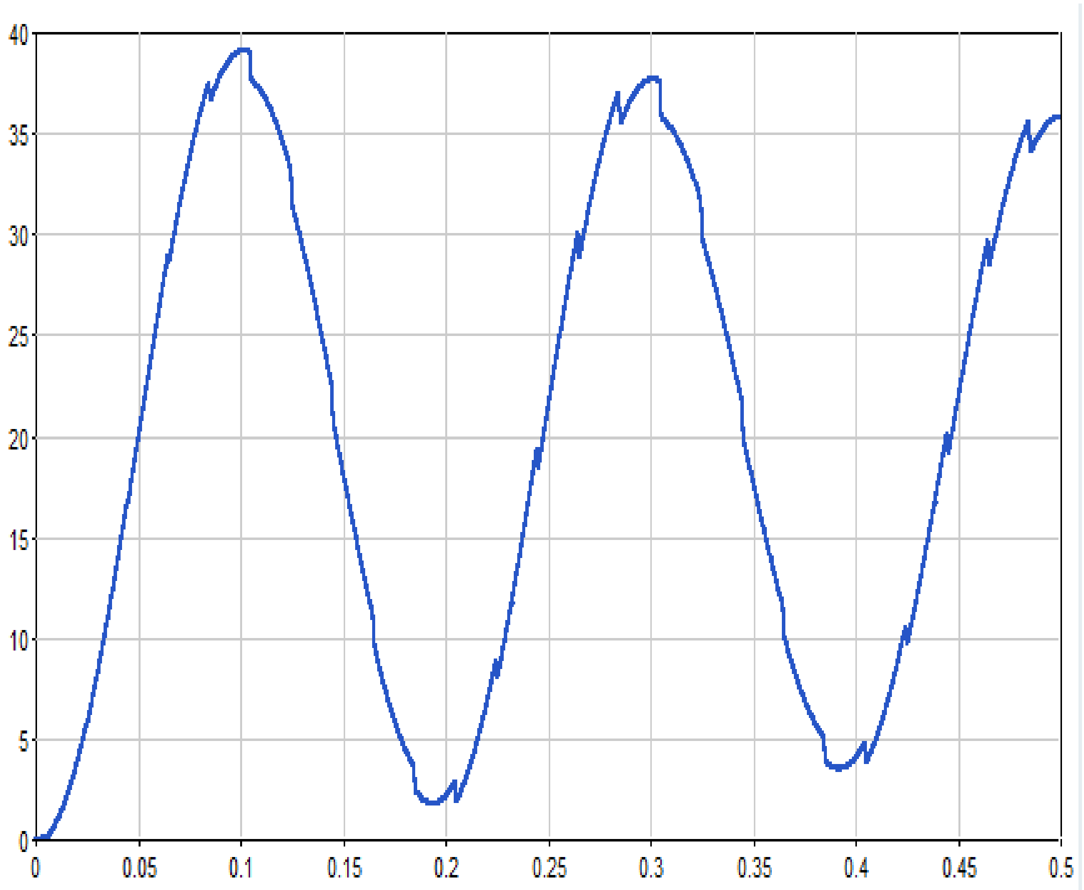


Waveforms

Input Voltage



Output Voltage



- The power dissipation of the transistor in a class C amplifier is low because it is on for only a small percentage of the input cycle. The circuit shows the collector current pulses. The time between the pulses is the period (T) of the ac input voltage. The collector current and the collector voltage during the on time of the transistor are shown. To avoid complex mathematics, we will assume ideal pulse approximations. Using this simplification, if the output swings over the entire load, the maximum current amplitude is Ic(sat) and the minimum voltage amplitude is Vce(sat) during the time the transistor is on.

- The current pulse charges the capacitor to approximately VCC. After the pulse, the capacitor quickly discharges, thus charging the inductor. Then, after the capacitor completely discharges, the inductor's magnetic field collapses and then quickly recharges C to near VCC in a direction opposite to the previous charge. This completes one half-cycle of the oscillation.

- The capacitor discharges again, increasing the inductor's magnetic field. The inductor then quickly recharges the capacitor back to a positive peak slightly less than the previous one, due to energy loss in the winding resistance. This completes one full cycle. The peak-to-peak output voltage is therefore approximately equal to 2VCC.

Conclusion

- The Class C amplifier is used in the applications like RF oscillators, RF amplifier, FM transmitters, Booster amplifiers, High frequency repeaters and Tuned amplifiers.
- The main advantage of the Class C amplifier is, it has a Lowest physical size for a given power output.
- Thus the Class C Amplifier model is implemented using the Activate tool.