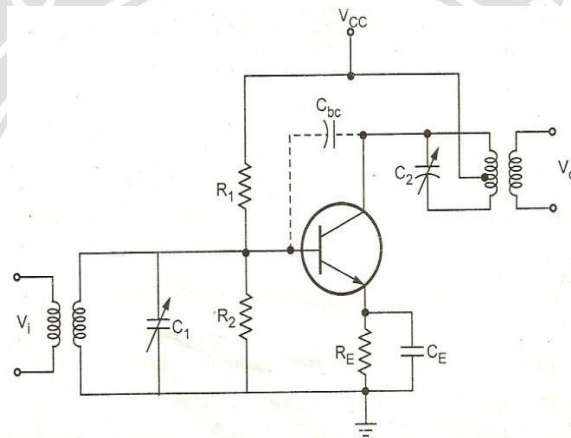


Neutralization methods

Instability of Tuned Amplifiers

In tuned RF amplifiers, transistors are used at frequencies nearer to their unity gain bandwidths to amplify a narrow band of frequencies centered about a radio frequency.

At this frequency, inter-junction capacitance between base and collector, C_{bc} of the transistor is high, i.e. its reactance becomes low enough to be considered.



Considering an amplifier in C-E configuration, capacitance C_{bc} comes across input and output circuits of an amplifier. As the reactance of C_{bc} at RF is low enough it provides the feedback path from collector to base. If some feedback signal manages to reach the input from the output in a positive manner with proper phase shift, then, there is a possibility of the circuit to be converted to an unstable one, generating its own oscillations hence stopping working as an amplifier.

Such a circuit will oscillate if enough energy is fed back from the collector to the base in the correct phase to overcome circuit losses. Since the conditions for best gain and selectivity are those which also promote oscillations, in order to prevent oscillations in tuned RF amplifiers it is necessary to reduce the stage gain to a level that ensures circuit stability.

Methods of lowering the quality factor Q of tuned circuits:

- Stagger tuning,
- Loose coupling between the stages,
- Inserting a “loser” element into the circuit,

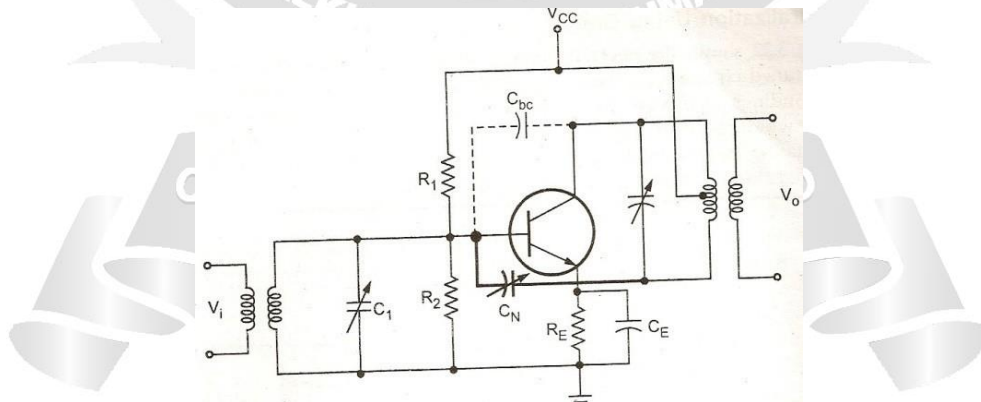
These methods of reduced gain, detuning and Q reduction has disadvantageous effects on selectivity.

Stabilization techniques that does not need to lose the circuit performance in order to achieve stability are:-

- Hazeltine neutralization,
- Neutrodyne neutralization
- Neutralization using coil

Hazeltine neutralization

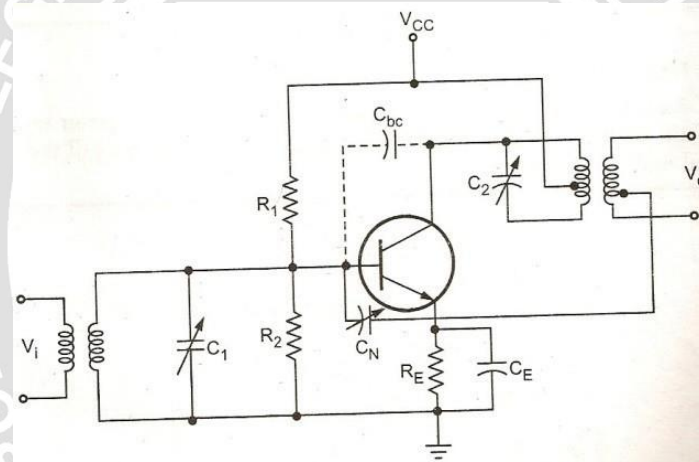
Hazeltine neutralization is achieved by feeding back a portion of the output signal to the input in such a way that it has the same amplitude as the unwanted feedback but the opposite phase. This is done by connecting a small value of variable capacitance C_N from the bottom of the coil, point B, to the base. The neutralization capacitor can be adjusted correctly to completely nullify the signal fed through the C_{bc}



[Ref:Robert L. Boylestad and Louis Nasheresky, “Electronic Devices and Circuit Theory”, 10th Edition, Pearson Education / PHI, 2008]

Neurodyne neutralization

In Neurodyne neutralization technique, the neutralization capacitor is connected from the lower end of base coil of the next stage to the base of the transistor. The circuit functions as the Hazeltine neutralization circuit with an advantage that the neutralization capacitor does not have the supply voltage across it.



[Ref: Robert L. Boylestad and Louis Nasheresky, "Electronic Devices and Circuit Theory", 10th Edition, Pearson Education / PHI, 2008]

Neutralization using coil

Neutralization of RF amplifier using coil L part of the tuned circuit at the next stage is oriented for maximum coupling to the other winding. It wound on a separate form and is mounted at right angles to the coupled windings. If the windings are properly polarized, the voltage across L due to the circulating current in the base circuit will have proper phase to cancel the signal coupled through the base to collector, C_{bc} capacitance

