Research Migration Project

https://esim.fossee.in/research-migration-project

The Research Migration Project is an initiative of FOSSEE, IIT Bombay that promotes the use of eSim for reproducing published research circuits originally implemented using proprietary simulation tools. The objective is to migrate these validated designs to eSim to build an open source resource database.

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Title of the circuit: *Amplitude-Stabilized Wien Bridge Oscillator Using AGC*

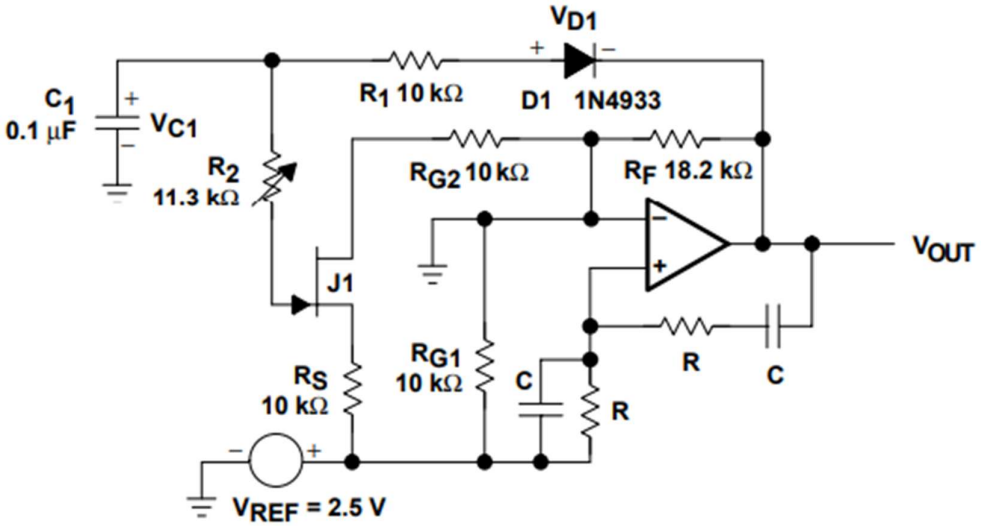
Theory/Description: The Wien Bridge Oscillator is a sinusoidal oscillator that uses an RC bridge network to satisfy the Barkhausen criterion for sustained oscillations. The bridge provides zero phase shift at the oscillation frequency $f=1/2\pi RC$, while an operational amplifier supplies the required gain.

Automatic Gain Control (AGC) is used to stabilize the output amplitude by dynamically adjusting the amplifier gain. At startup, the gain is slightly greater than unity to initiate oscillations. As the output amplitude increases, the AGC reduces the gain to unity, ensuring stable, low-distortion sinusoidal output.

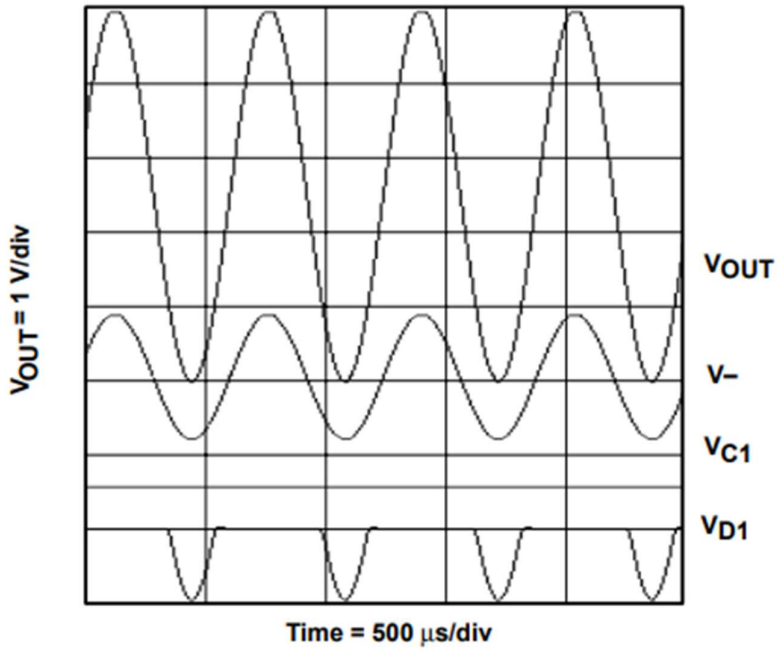
The circuit consists of an operational amplifier, RC components forming the Wien bridge, and an AGC element for amplitude stabilization, resulting in a self-sustained oscillator with stable frequency and amplitude.

Expected Outcome/outputs: Upon simulation, the circuit is expected to generate a stable sinusoidal output without requiring any external input signal. During startup, oscillations gradually build up from noise and settle to a constant amplitude due to the action of the Automatic Gain Control. The output frequency is determined by the RC components of the Wien bridge network and remains stable over time. Circuit performance can be validated by observing the startup transient, steady-state sinusoidal waveform, frequency accuracy, and stable output amplitude in the simulation results.

Circuit Diagram(s):



Expected Results:



Research Paper/Journal/etc.:

Title: Design of an Amplitude-Stable Sine-Wave Oscillator
Author: B.J. Shekan
Page No.: 312–315
Link: https://ieeexplore.ieee.org/document/1049913

Source/Reference(s):

1. **Texas Instruments, *"Sine Wave Oscillator"***
   Texas Instruments Application Report.
2. **Ramakant A. Gayakwad, *"Op-Amps and Linear Integrated Circuits,"***
   Pearson Education - Chapter on sinusoidal oscillators.
