PART 1 AGC with passive peak detector

Circuit Diagram

Variable amplitude signal

12k

0.33 uF

Vin

12k

0.33 uF

AGC VOLTAGE

ANALOG MULTIPLIER

+15V

Vw

2.2k

22k

LF347

Vo1

Constant amplitude signal

INTEGRATOR

1N4148

PASSIVE PEAK DETECTOR

0.33 uF

100k

100k

1N5234B

470

+15V

AD633JN/AD633AN

AD633 Analog Multiplier

LF347 Quad Op Amp
ELECTRONICS 2 LAB

AUTOMATIC GAIN CONTROL (AGC)

Pre-lab

1. Determine the regulated amplitude of $V_{o1}$ – look up Zener data at http://www.fairchildsemi.com/

2. Determine $V_{Y1}$ min and max assuming typical saturation voltages for LF347 with $V_{sup} = \pm 15V$

3. Determine the range of input voltages (main input $V_{in}$) for which the AGC is operational. Why does not the AGC work outside this above-calculated range?

4. What is the peak AC voltage of $V_w$?

5. Determine the peak to peak ripple at the peak detector output and at $V_{Y1}$ for frequencies of 1 kHz and 10 kHz. Draw the expected ripple waveforms.

Lab Procedure

NOTE: The HP signal generator displays half the actual O/P amplitude if load >> 50Ω
If load = 50Ω, it displays the correct amplitude.

1. Assemble circuit as per breadboard layout provided at the end.

2. Using a 1 kHz input sinewave, adjust the amplitude of $V_{in}$ in order to obtain the DC voltages for $V_{Y1}$ listed below. For each case measure the corresponding values of $V_{o2} (DC)$, $V_{o1} (rms)$, $V_w(rms)$ and $V_{in} (rms)$ with the DMM. Monitor $V_{in}$ and $V_{o1}$ on the oscilloscope throughout. Calculate $A_{mult}$ from measurements.

3. Repeat the above for $V_{Y1}(DC)$ slightly above minimum and slightly below maximum when $V_{o1}$ is still constant.

<table>
<thead>
<tr>
<th>$V_{Y1} (DC)$</th>
<th>min</th>
<th>1</th>
<th>2</th>
<th>4</th>
<th>6</th>
<th>8</th>
<th>10</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o2} (DC)$</td>
<td></td>
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<td>$V_{o1} (rms)$</td>
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<tr>
<td>$V_{in} (rms)$</td>
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<tr>
<td>$V_w(rms)$</td>
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</table>

$A_{mult} = \frac{V_w}{V_{in}}$

4. Measure the exact value of the Zener reference voltage – record value.

5. Measure the ripple voltage (with the scope) at the peak detector output and at $V_{Y1}$ at frequencies of 100 Hz, 1 kHz and 10 kHz – ripple may be too small to be measured in some cases. Ensure that $V_{in}$ is within operating range.
6. With $V_{in}$ set such as to obtain $V_{Y1}$ around 4V DC, measure $V_{o1\text{ (rms)}}$ at 1 kHz, 10 kHz, 100 kHz and measure the minimum and maximum frequencies at which $V_{o1}$ is no longer regulated.

7. Measure THD of $V_{in}$, $V_w$ and $V_{o1}$ at 1 kHz when AGC loop functions at $V_{Y1} = 1V$ and $V_{Y1} = 10V$.

<table>
<thead>
<tr>
<th>$V_{Y1}$</th>
<th>%THD of $V_{in}$</th>
<th>%THD of $V_w$</th>
<th>%THD of $V_{o1}$</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{Y1} = 1V$</td>
<td></td>
<td></td>
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<tr>
<td>$V_{Y1} = 10V$</td>
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</tbody>
</table>

**Post lab**

1. Compare measured values to pre-lab values everywhere applicable.

2. Did $V_{o1}$ vary at all? What was the % variation of $V_{o1}$ over the entire range of $V_{in}$ at 1 kHz? Is this % variation acceptable? Explain.

3. Which device introduced the most distortion? Explain. Was distortion different for different input levels?

4. Using the results of step 3 of the procedure, explain how the AGC circuit works.

**PART 2 AGC with active peak detector**

**Circuit Diagram**

**Pre-lab**
1. Determine the regulated amplitude of $V_{o1}$ – look up Zener data at [http://www.fairchildsemi.com/](http://www.fairchildsemi.com/)

2. Determine $V_{Y1}$ min and max assuming typical saturation voltages for LF347 with $V_{sup} = \pm 15V$

3. Determine the range of input voltages (main input $V_{in}$) for which the AGC is operational. Why does not the AGC work outside this above-calculated range?

4. What is the peak AC voltage of $V_w$?

5. Determine the peak to peak ripple at the peak detector output and at $V_{Y1}$ for frequencies of 1 kHz and 10 kHz. Draw the expected ripple waveforms.

**Lab Procedure**

1. Assemble circuit as per breadboard layout provided at the end – don’t forget to remove the 47 pF capacitor in the inverting amplifier.

2. Using a 1 kHz input sinewave, **adjust the amplitude of $V_{in}$** in order to obtain the DC voltages for $V_{Y1}$ listed below. For each case measure the corresponding values of $V_{o2}$ (DC), $V_{o1}$ (rms), $V_w$(rms) and $V_{in}$ (rms) with the DMM. Monitor $V_{in}$ and $V_{o1}$ on the oscilloscope throughout. Calculate $A_{mult}$ from measurements.

3. Repeat the above for $V_{Y1(DC)}$ slightly above minimum and slightly below maximum when $V_{o1m}$ is still constant.

<table>
<thead>
<tr>
<th>$V_{Y1}$ (DC)</th>
<th>min</th>
<th>1</th>
<th>5</th>
<th>10</th>
<th>max</th>
</tr>
</thead>
<tbody>
<tr>
<td>$V_{o2}$ (DC)</td>
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<td></td>
<td></td>
</tr>
<tr>
<td>$V_{o1}$ (rms)</td>
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</tr>
<tr>
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<td></td>
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<tr>
<td>$V_w$(rms)</td>
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<tr>
<td>$A_{mult} = \frac{V_w}{V_{in}}$</td>
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4. Measure the exact value of the Zener reference voltage – record value.

5. Measure the ripple voltage (with the scope) at the peak detector output and at $V_{Y1}$ at frequencies of 100 Hz, 1 kHz and 10 kHz – ripple may be too small to be measured in some cases. Ensure that $V_{in}$ is within operating range.

6. With $V_{in}$ set such as to obtain $V_{Y1}$ around 4V DC, measure $V_{o1}$ (rms) at 1 kHz, 10 kHz, 100 kHz and measure the minimum and maximum frequencies at which $V_{o1}$ is no longer regulated.
1. Compare measured values to pre-lab values everywhere applicable.

2. Did $V_{o1}$ vary at all? What was the % variation of $V_{o1}$? Is it good? Explain.

3. Using the results of step 3 of the procedure, explain how the AGC circuit works.

4. Compare the performance of the two AGC circuits. Which one performed better? Explain.

   Which circuit has a more predictable and accurate output? Explain.

   Which one operated over a wider frequency range?