ENEE 417 -Fall 2004
Week #5
Designs #2: Op-amp Oscillator Designs Using Op-amp Pole

In this experiment various op-amp oscillators will be designed.

1. Experimentally determine the two parameters for the single pole model, equation (2) below, for the 1458 op-amp.

2. Each party in a lab section is to choose one of the oscillator circuits of Fig. 2 below (excluding the (e) circuit), no two parties in the same lab section to have the same circuit. By analyzing it, check that equation (1) holds for the circuit chosen. Insert the 1458 parameters and choose the other parameters (G's and C's) to obtain an oscillation frequency of 10 KHz.

3. Construct and test the circuit. Use LabVIEW to record the oscillations. Investigate the effect of changing the C's and G's on the oscillation and check versus your equations of part 2. above. Especially note the effect of variable G1 on the oscillation frequency.

4. Compare the results on your circuit with those obtained by others in your laboratory section.

5. Write a two page report summarizing your study; include your equations for oscillation conditions, op-amp parameters, and oscillation curves.

Reference:
M. T. Abuelma'ati, "Identification of Two-Amplifier Partially Active-R Sinusoidal Oscillators," Proceedings of the National Science Council, ROC(A), Vol. 25, No. 2, 2001, pp. 127 - 130.

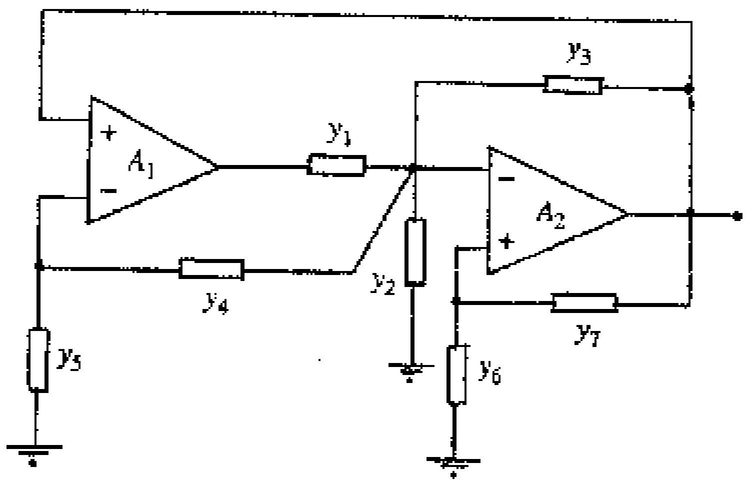

Fig. 1. Generalised representation of a two amplifier partially active-R sinusoidal oscillator. y_1 can be the output resistance of the operational amplifier plus any added external resistance.

$$
\begin{aligned}
&A_2(s)y_7(y_4(y_1+y_2+y_5)+y_5(y_1+y_2))\\
&= y_4y_6(y_1+y_2+y_3+A_1(s)y_1+A_2(s)y_3+A_1(s)A_2(s)y_1)\\
&\quad + y_5y_6(y_1+y_2+y_3+y_4+A_2(s)y_3+A_1(s)A_2(s)y_1)\\
&\quad + y_4y_7(y_1+y_2+y_3+A_1(s)y_1)\\
&\quad + y_5y_6(y_1+y_2+y_3+y_4+A_1(s)A_2(s)y_1) \qquad (1)
\end{aligned}
$$

where $A_i(s)$, $i = 1, 2$ is the open-loop gain of the ith operational amplifier which can be represented by the single-pole model given by

$$A_i = \frac{A_{oi}\omega_{ai}}{s + \omega_{ai}} \qquad (2)$$

where A_{oi} is the open loop gain, ω_{ai} is the first corner frequency,

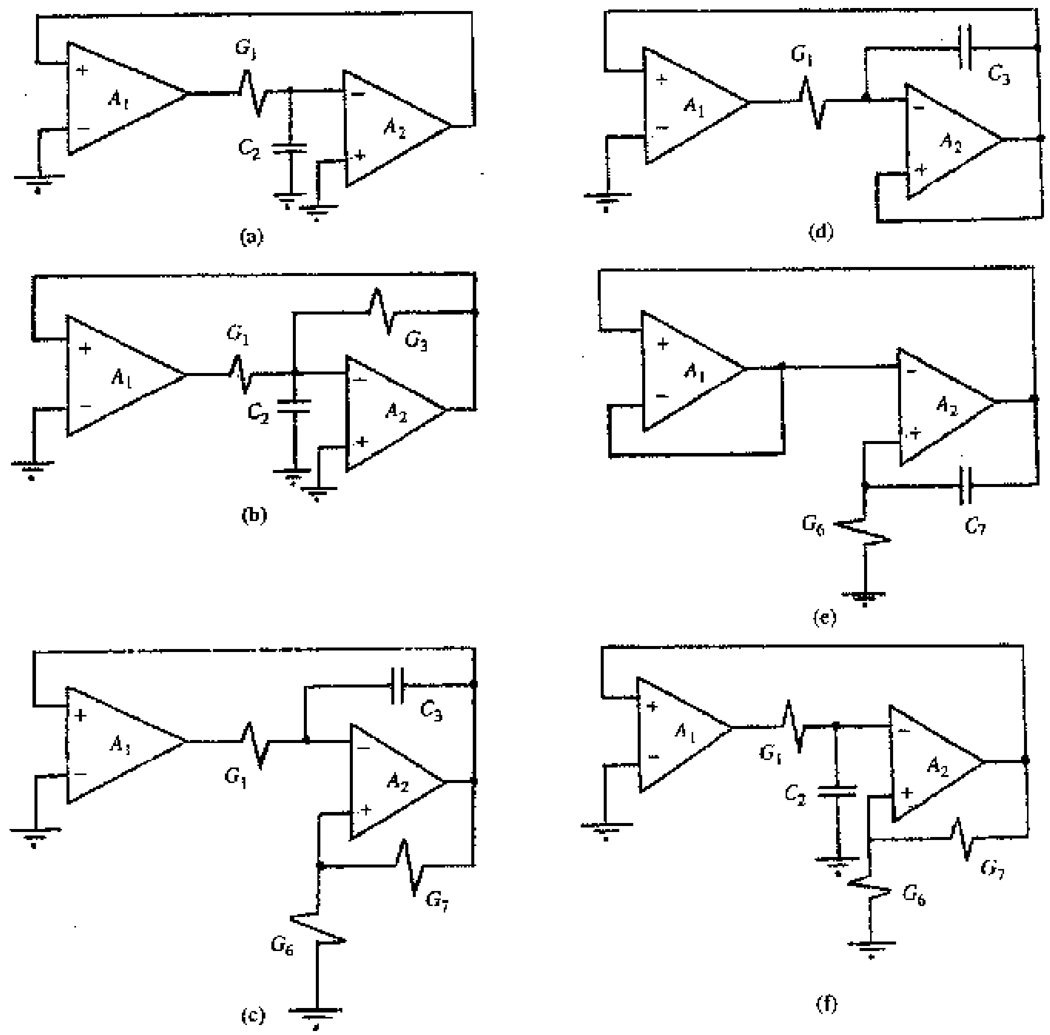

Fig. 2. Six new two-amplifier amplifier partially active-R sinusoidal oscillators derived from the general circuit in Fig. 1.