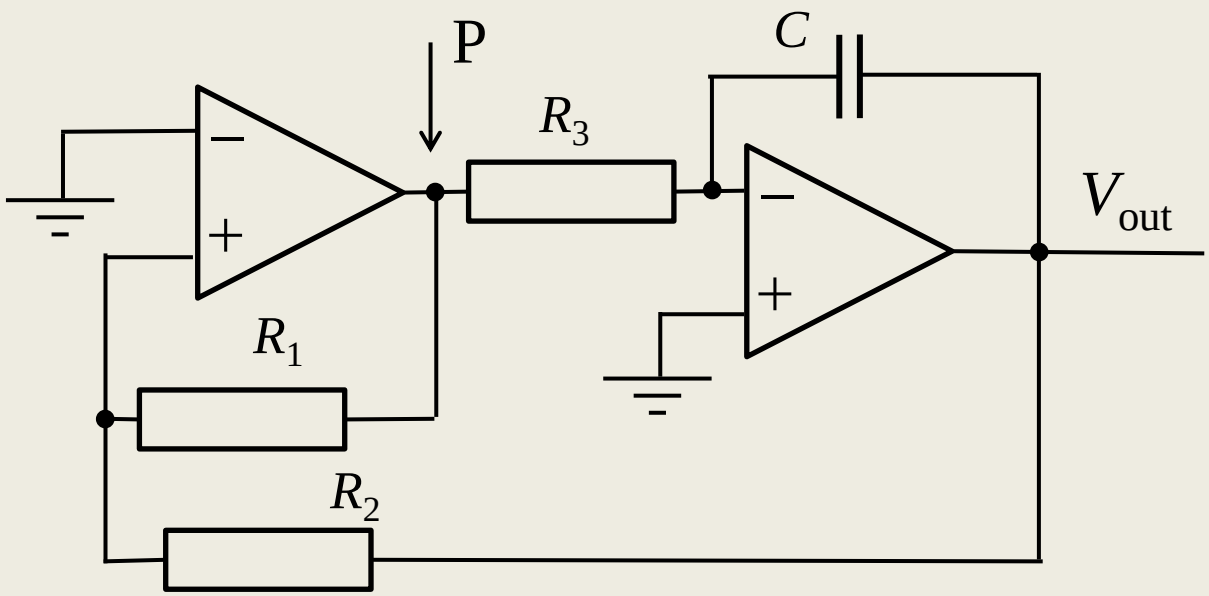
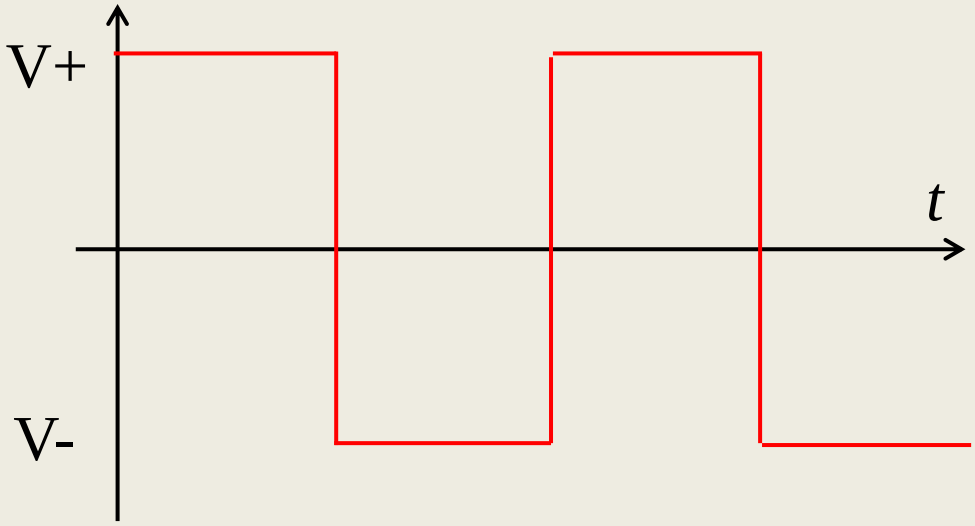
Exercise C-1



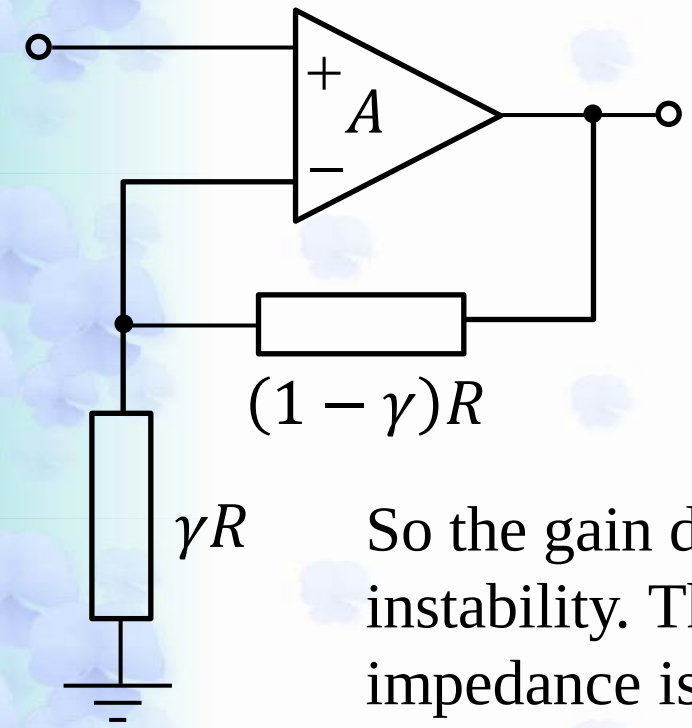


In the circuit shown in the left, at point P, a waveform in the lower panel was observed. Here V+ and V- are power source voltages for + and – respectively.

Draw a rough sketch of the waveform for V_{out}.

“Rough sketch” should contain the levels and the timing of folding points. Write a short comment why V_{out} should be in such a form.

Exercise C-2



Consider a differential amplifier with the open loop gain

$$A(s) = \frac{A_0\omega_1\omega_2}{s(s+\omega_1)(s+\omega_2)}.$$

So the gain diverges with $s \to 0$ but here we ignore this instability. The input impedance is ∞, and the output impedance is 0.

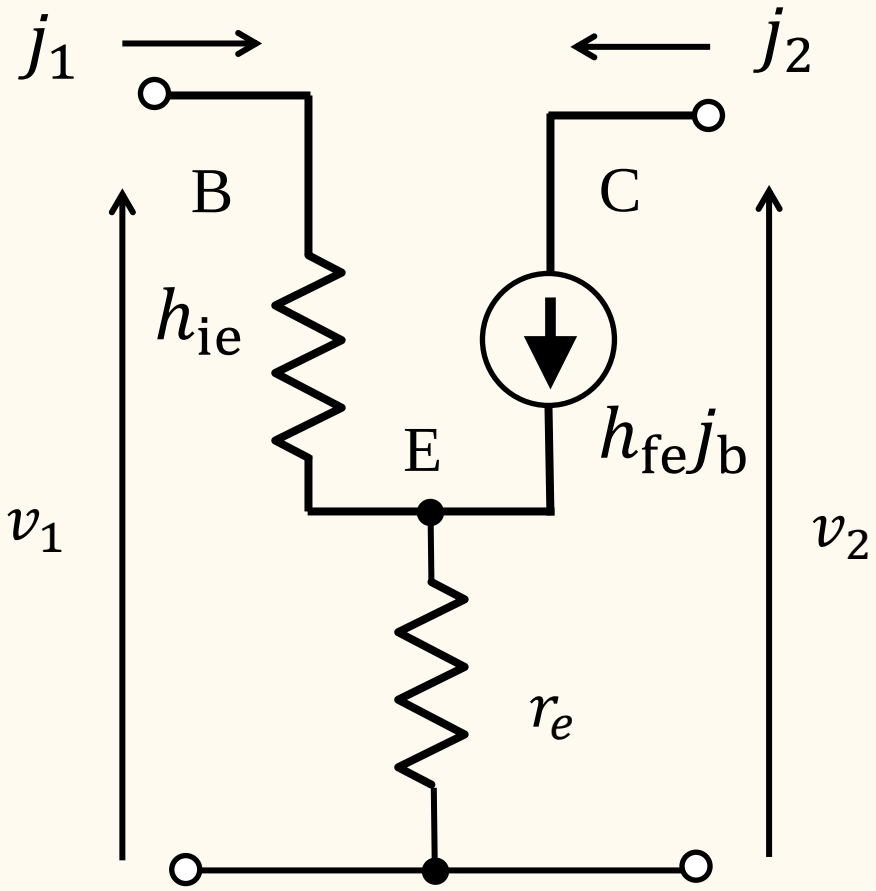
It is now placed in a circuit with a feedback shown in the left.

Obtain the stability condition for γ.

(hint) Apply the Hurwitz criterion for zeros of even and odd parts of the denominator.

Or just calculate H_2.

Exercise C-3



Let us view a bipolar transistor plus an emitter resistance as a four terminal circuit as shown in the left figure.
Obtain the Y (admittance) matrix defined below for this circuit.

Calculate each element in the Y matrix for
r_e =25Ω, h_{ie} =500 Ω, h_{fe}= 200

$$\begin{pmatrix} j_1 \\ j_2 \end{pmatrix} = \begin{pmatrix} Y_{11} & Y_{12} \\ Y_{21} & Y_{22} \end{pmatrix} \begin{pmatrix} v_1 \\ v_2 \end{pmatrix}$$