電子回路論 第6回
Electric Circuits for Physicists 6th

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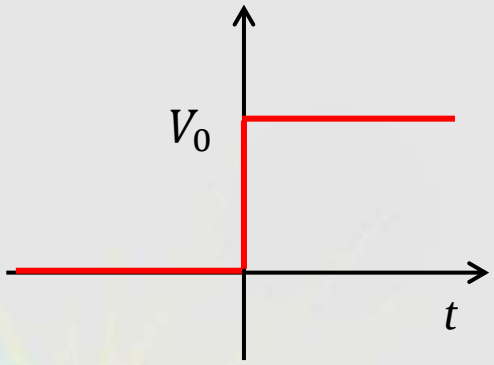
東京大学理学部・理学系研究科
(物性研究所)
勝本信吾
Shingo Katsumoto

過渡応答 (Transient Response)

$$w(t) = \int_{-\infty}^{\infty} \Xi(i\omega) U(i\omega) e^{i\omega t} \frac{d\omega}{2\pi}$$

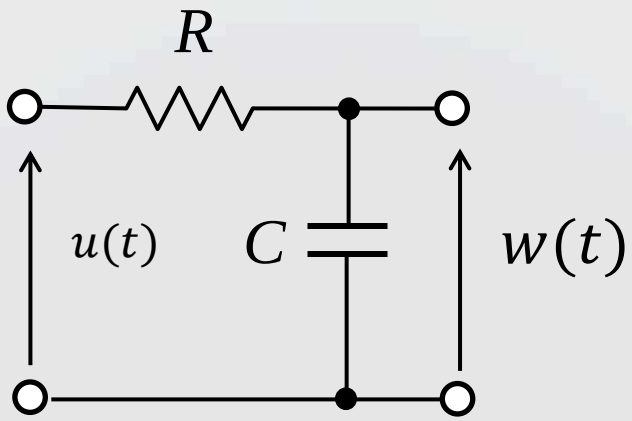


Heaviside

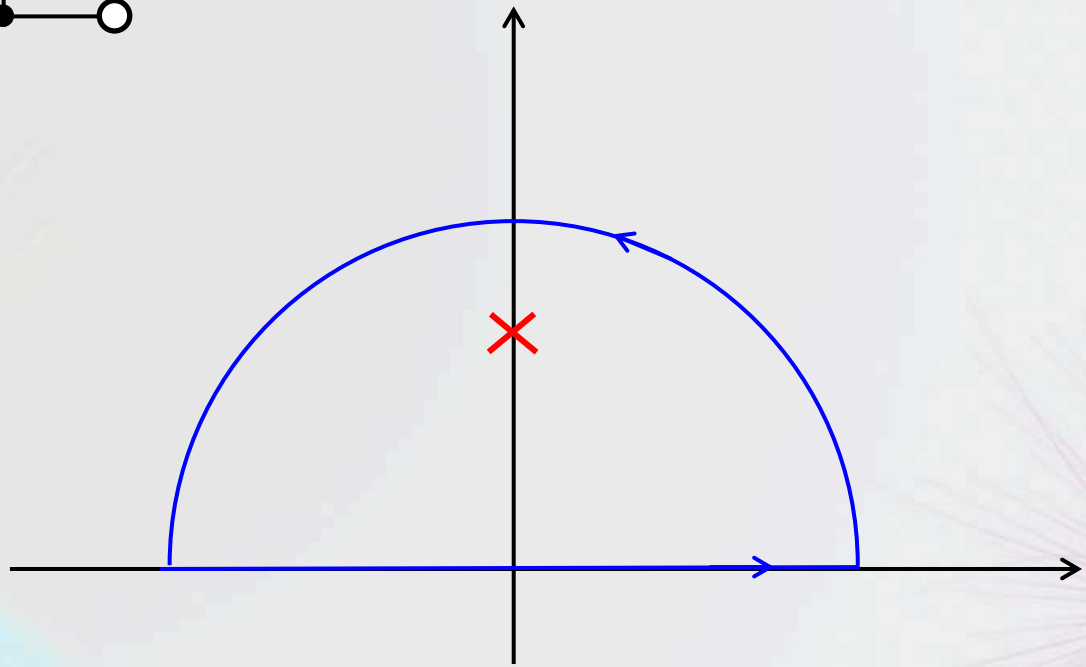
$$H(t) = \begin{cases} 0 & t < 0, \\ 1/2 & t = 0, \\ 1 & t > 0 \end{cases}$$

$$\mathcal{F}\{H(t)\} = \frac{1}{i\omega} + \pi\delta(\omega)$$

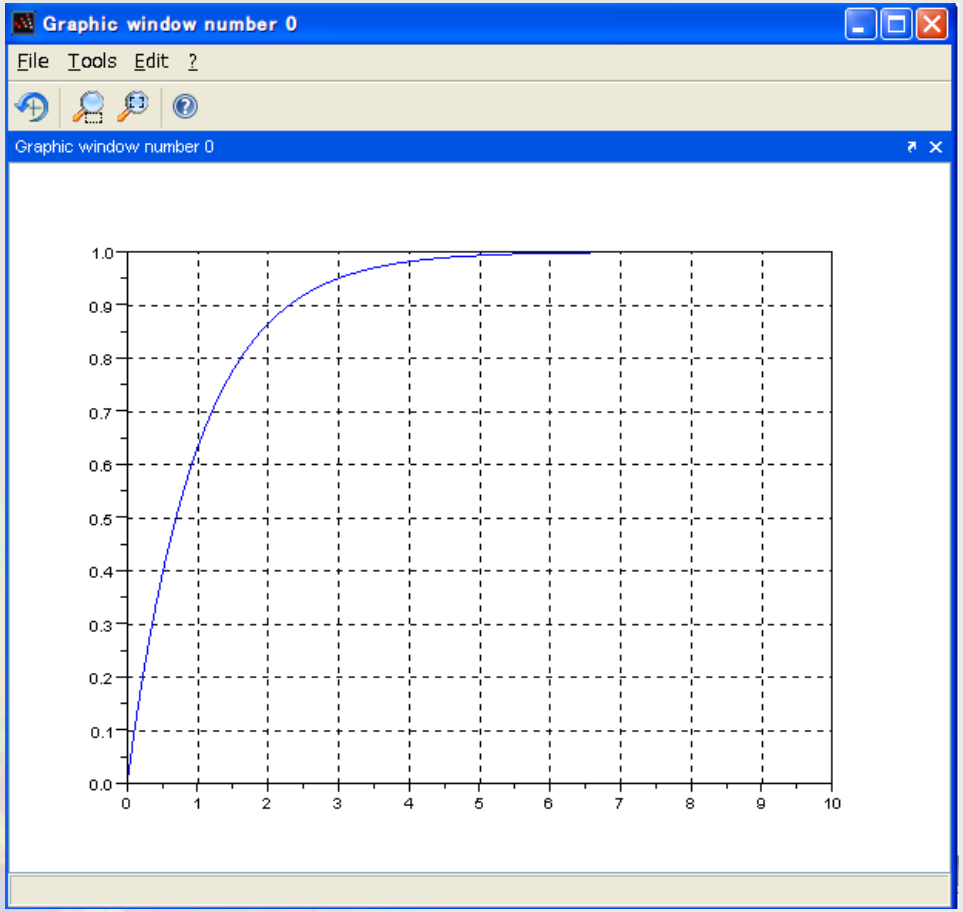
Simple application



$$V = V_0 \left[1 - \exp\left(-\frac{t}{CR} \right) \right]$$

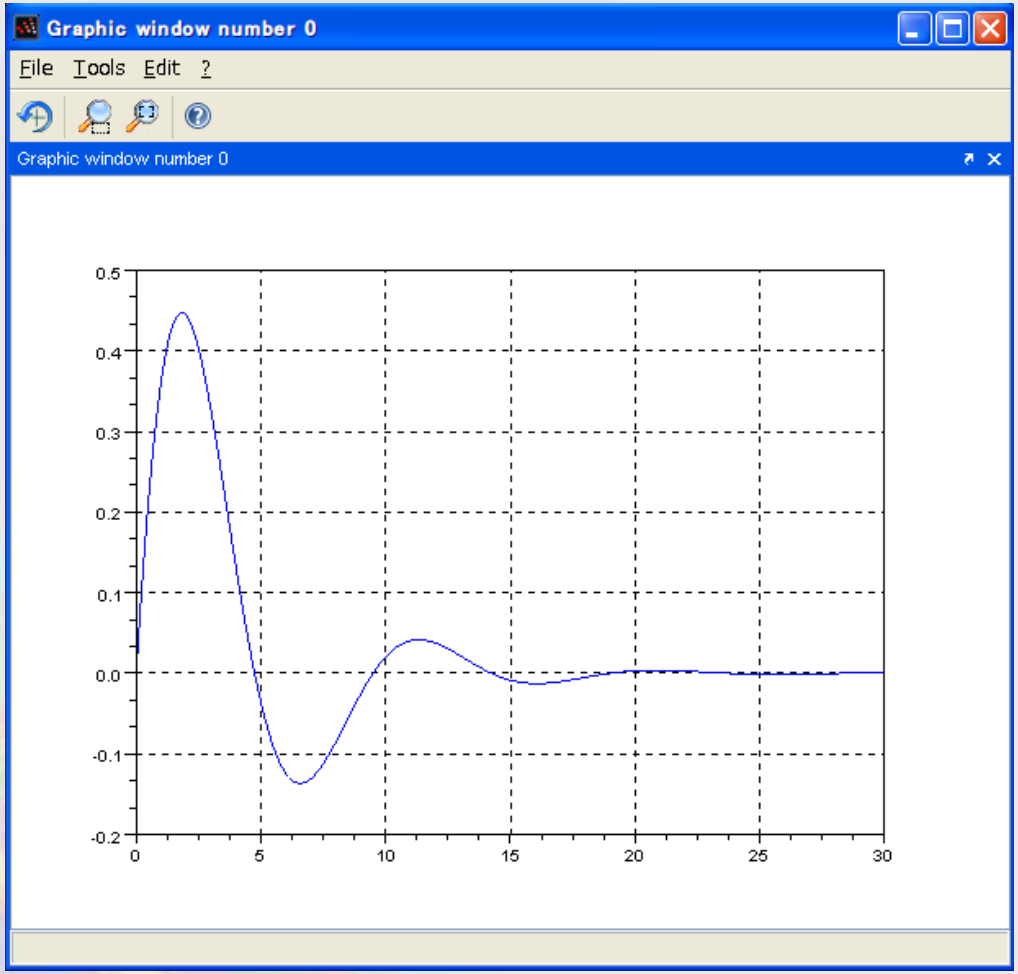


Transient response: Use of Scilab



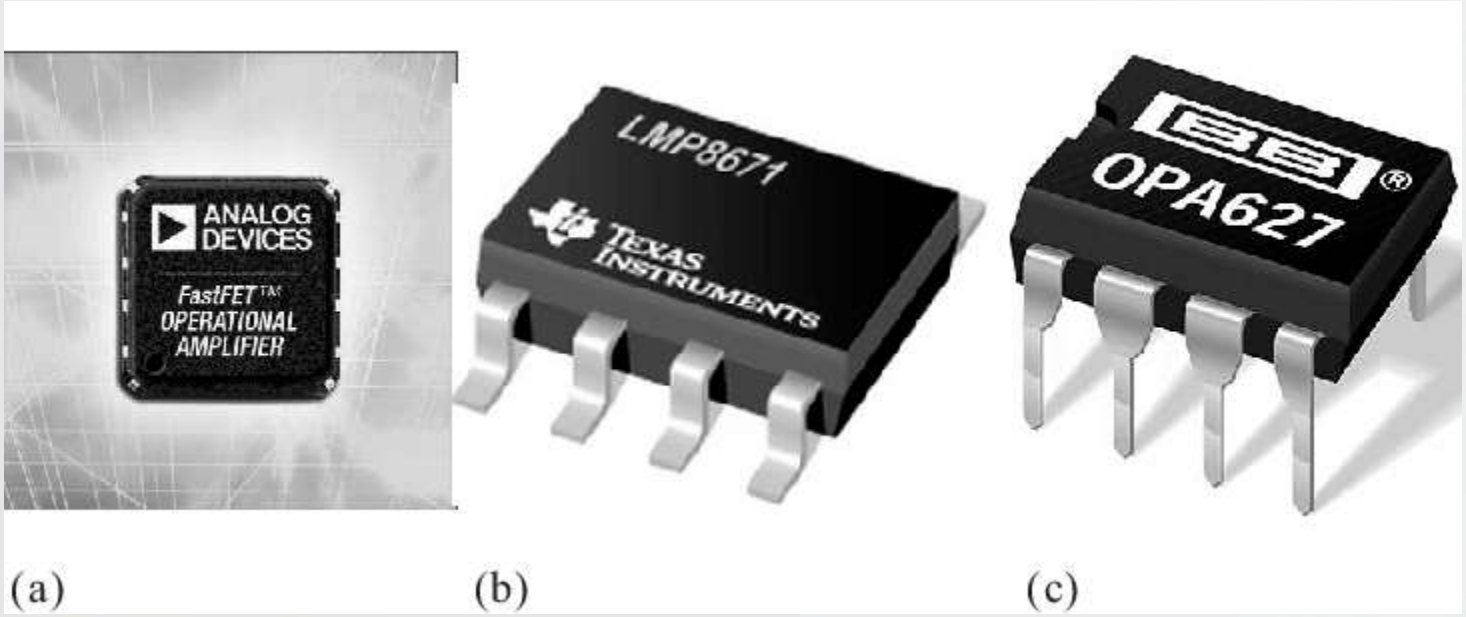

```
-->s=poly(0,'s');

-->G=1/(1+s);

-->sys=syslin('c',G);

-->t=linspace(0,10,100);

-->y=csim('step',t,sys);

-->plot(t,y)

-->xgrid()
```

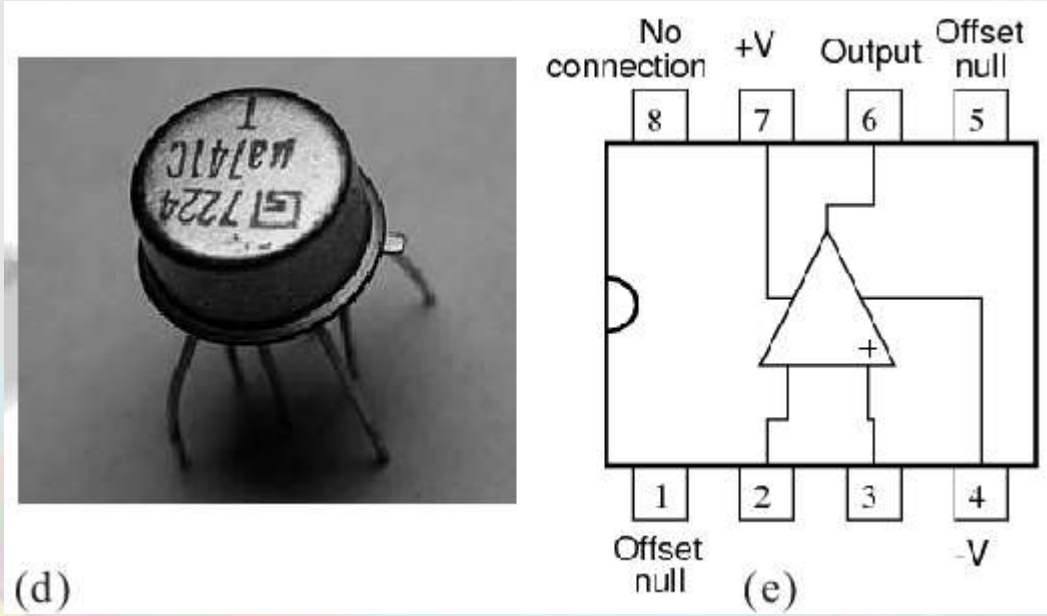
Transient response: Use of Scilab



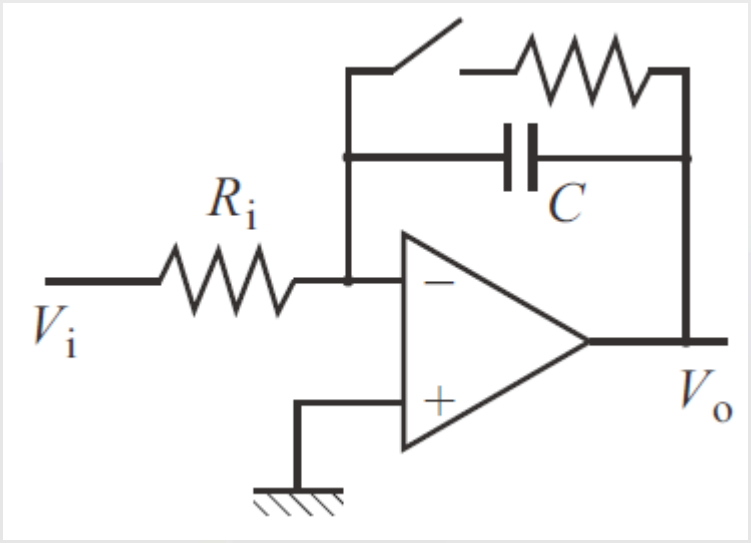

```
-->G=s/(1+s+2*s*s);

-->sys=syslin('c',G);

-->y=csim('step',t,sys);

-->plot(t,y)
```

OPampのパッケージング

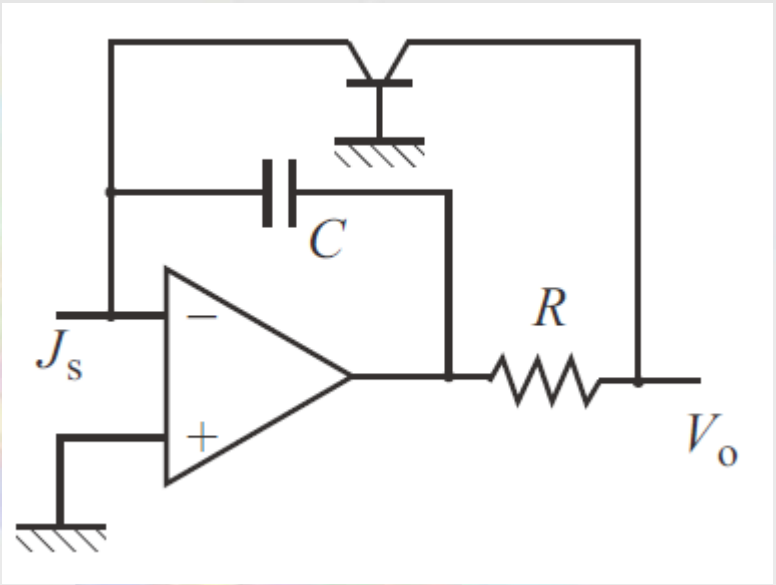




Various applications for OP amps

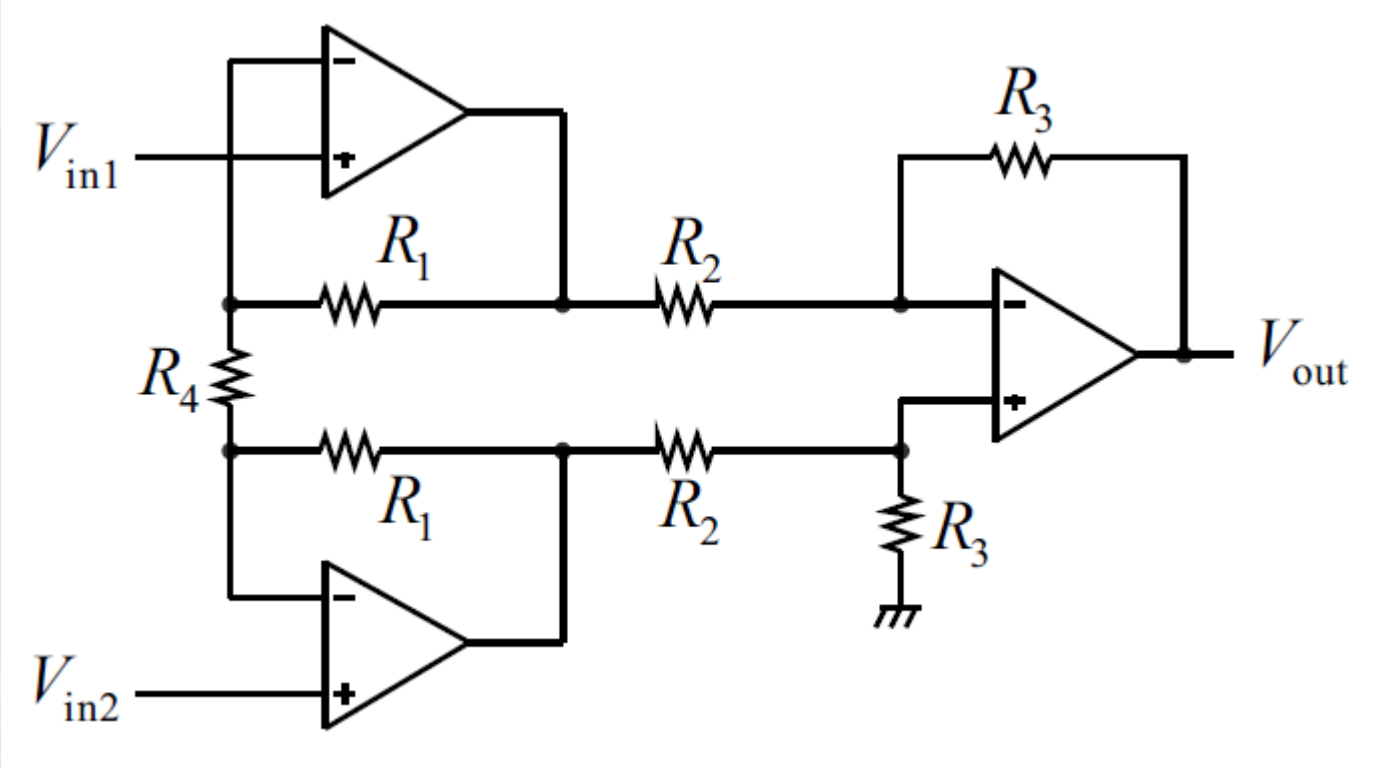


$$V_o(t) = -\frac{Q}{C} = -\frac{1}{C}\int_0^t \frac{V_i(\tau)}{R_i}d\tau$$
$$= -\frac{1}{CR_i}\int_0^t V_i(\tau)d\tau$$



$$V_o = -V_{BE} = -\frac{k_B T}{e}\ln\left(\frac{J_s}{J_0}+1\right)$$

Instrumentation amplifier



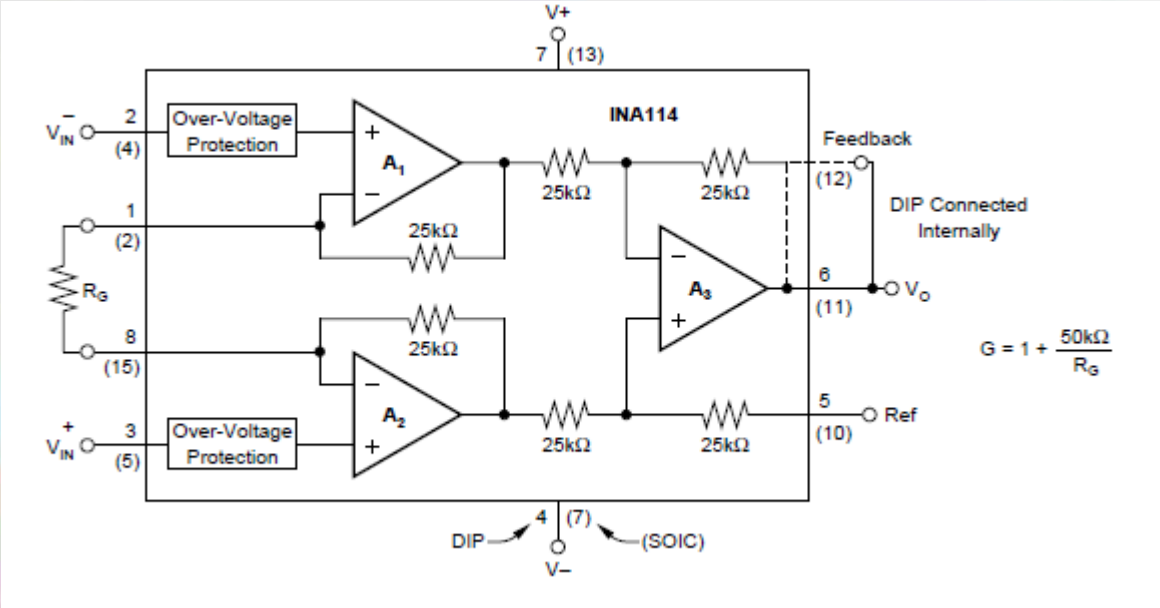
$$V_{\text{out}} = -\frac{R_3}{R_2}\left(\frac{2R_1 + R_4}{R_4}\right)(V_{\text{in1}} - V_{\text{in2}})$$

Instrumentation amplifier

BURR-BROWN®

INA114

Precision
INSTRUMENTATION AMPLIFIER

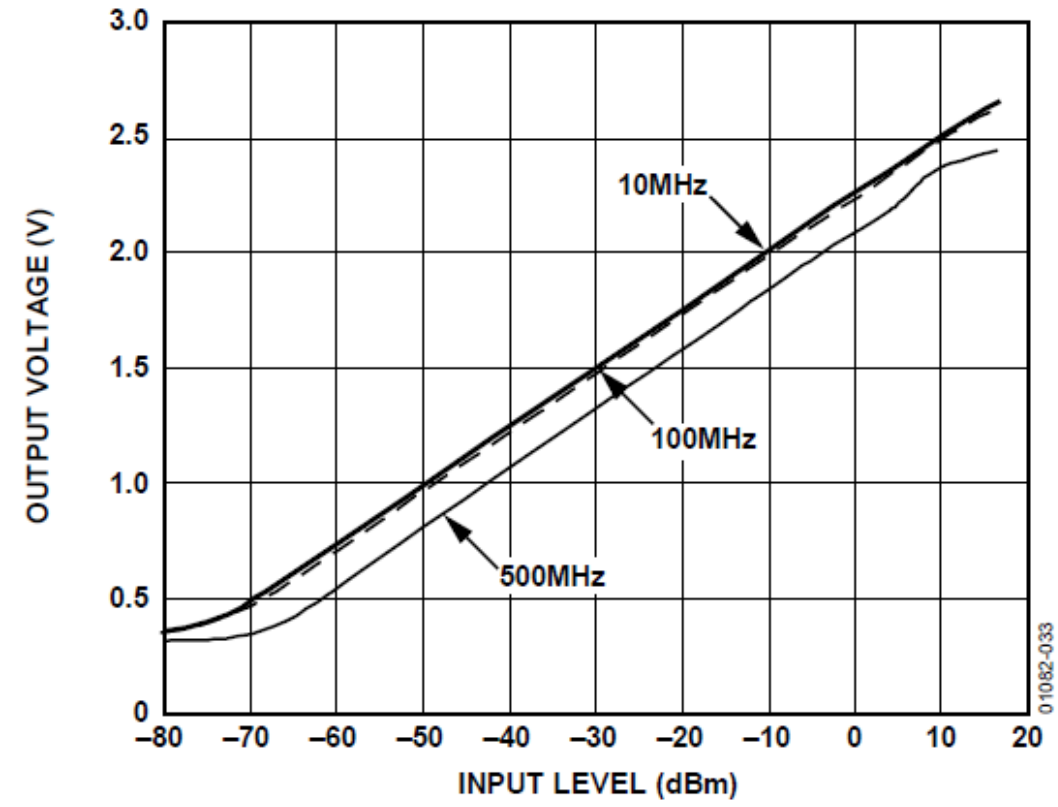


Logarithmic Amplifier

ANALOG DEVICES

Low Cost, DC to 500 MHz, 92 dB Logarithmic Amplifier

Data Sheet **AD8307**



Opamp data sheet

ANALOG DEVICES

Ultralow Offset Voltage Operational Amplifier

Data Sheet **OP07**

FEATURES

- Low V_{OS}: 75 µV maximum
- Low V_{OS} drift: 1.3 µV/°C maximum
- Ultrastable vs. time: 1.5 µV per month maximum
- Low noise: 0.6 µV p-p maximum
- Wide input voltage range: ±14 V typical
- Wide supply voltage range: ±3 V to ±18 V
- 125°C temperature-tested dice

PIN CONFIGURATION

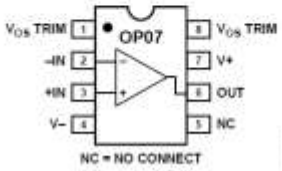
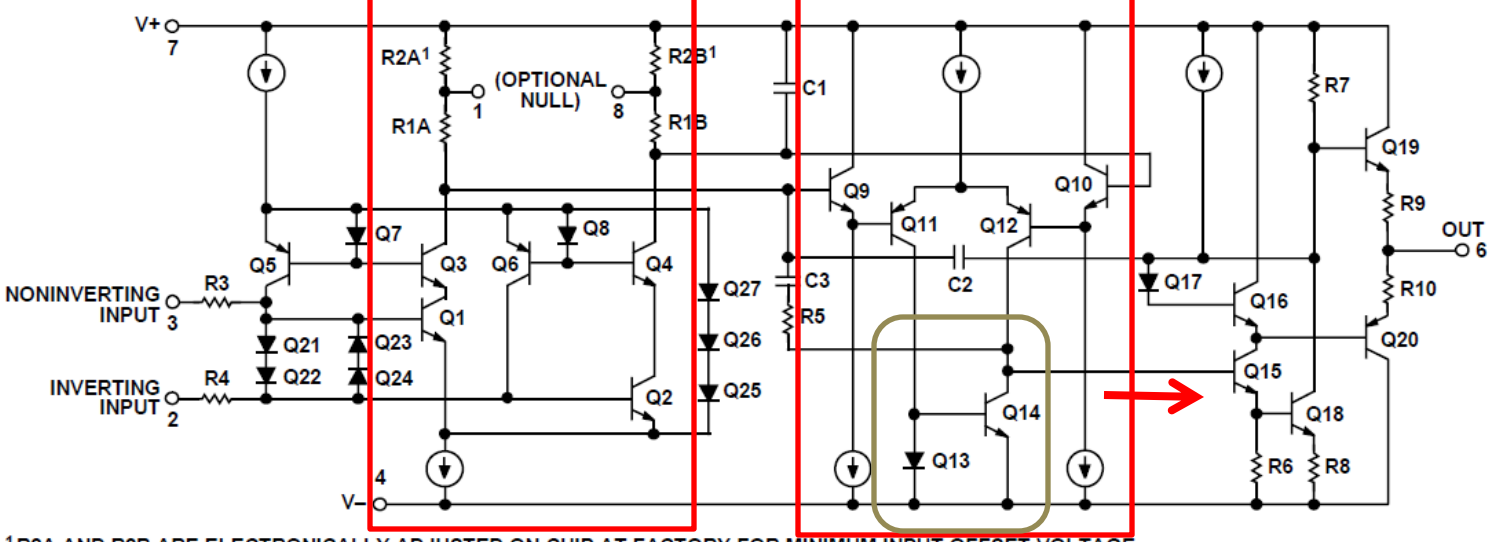


Figure 1.

1st

2nd differential



[1] R2A AND R2B ARE ELECTRONICALLY ADJUSTED ON CHIP AT FACTORY FOR MINIMUM INPUT OFFSET VOLTAGE.

Figure 2. Simplified Schematic

Opamp data sheet

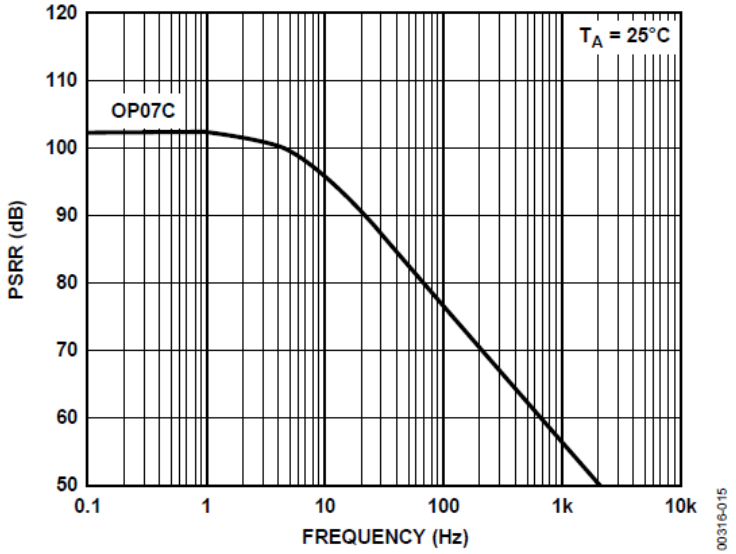


Figure 15. PSRR vs. Frequency

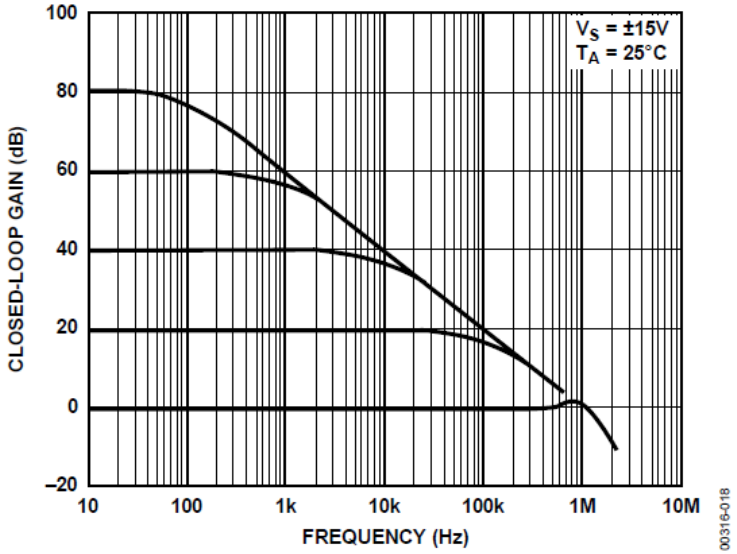


Figure 18. Closed-Loop Frequency Response for Various Gain Configurations

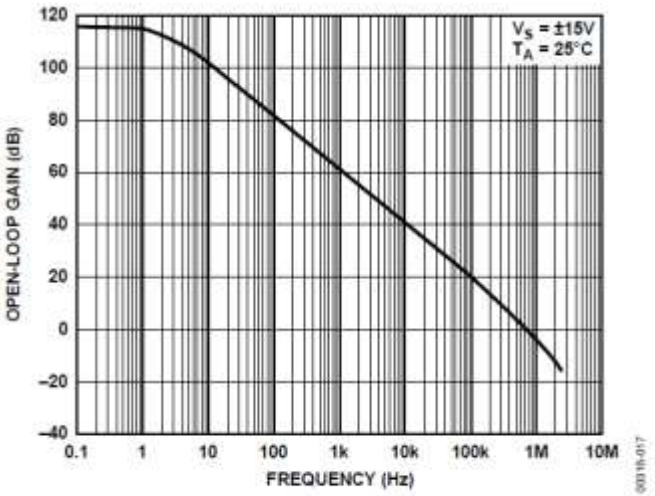
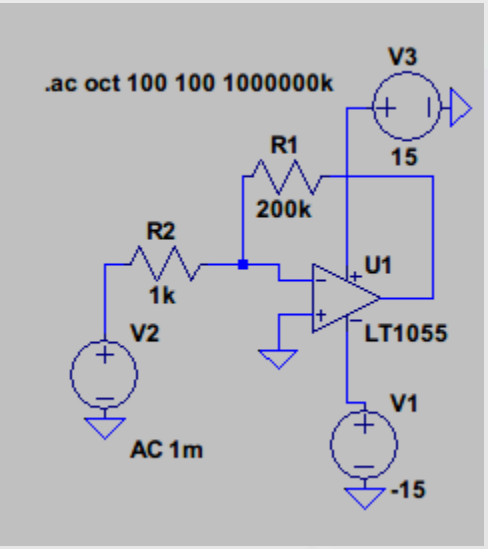
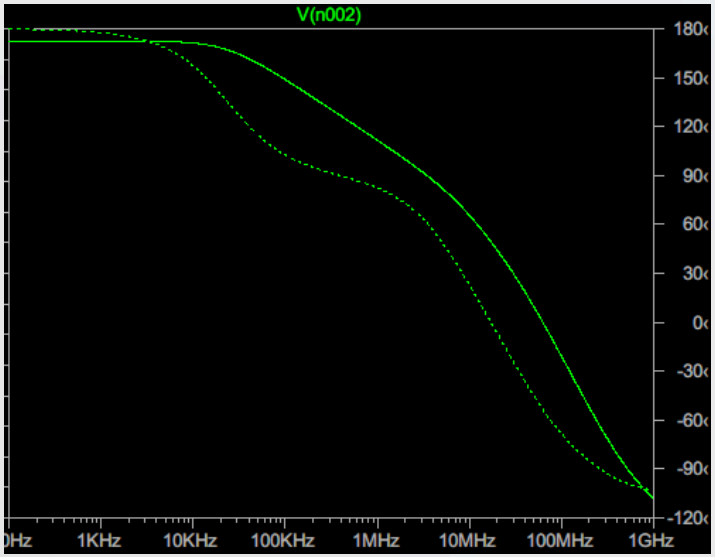


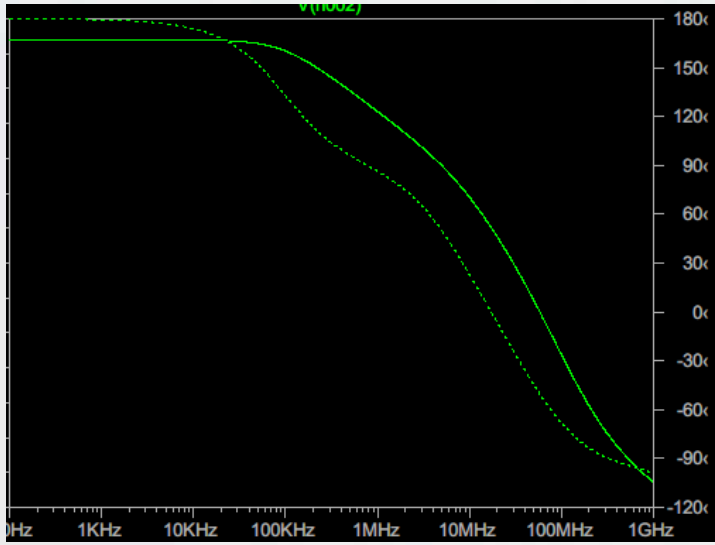
Figure 17. Open-Loop Frequency Response

反転増幅回路と遮断周波数

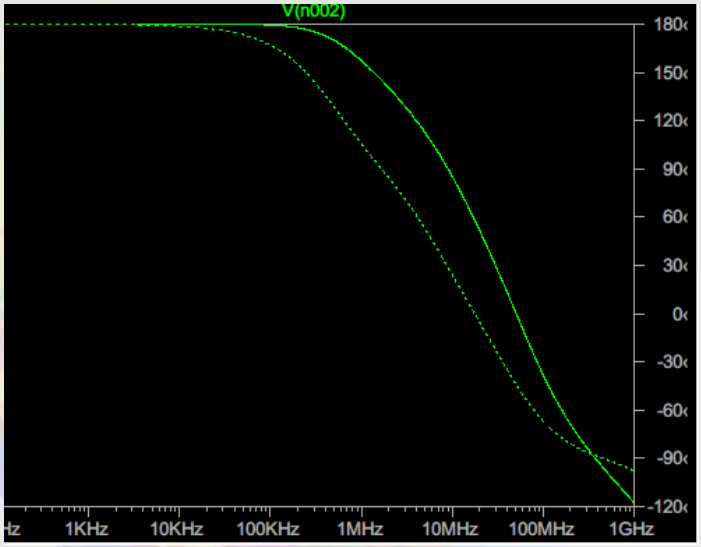




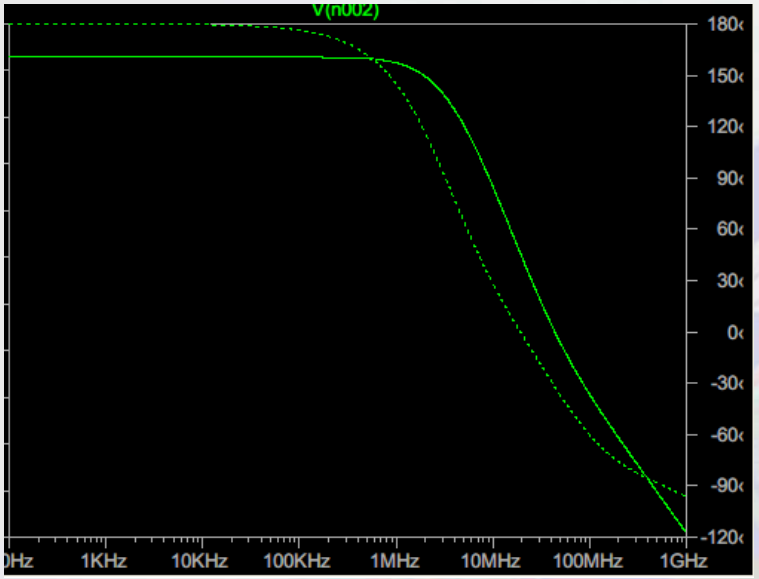
G =200 f_T =30kHz



G =50 f_T =90kHz

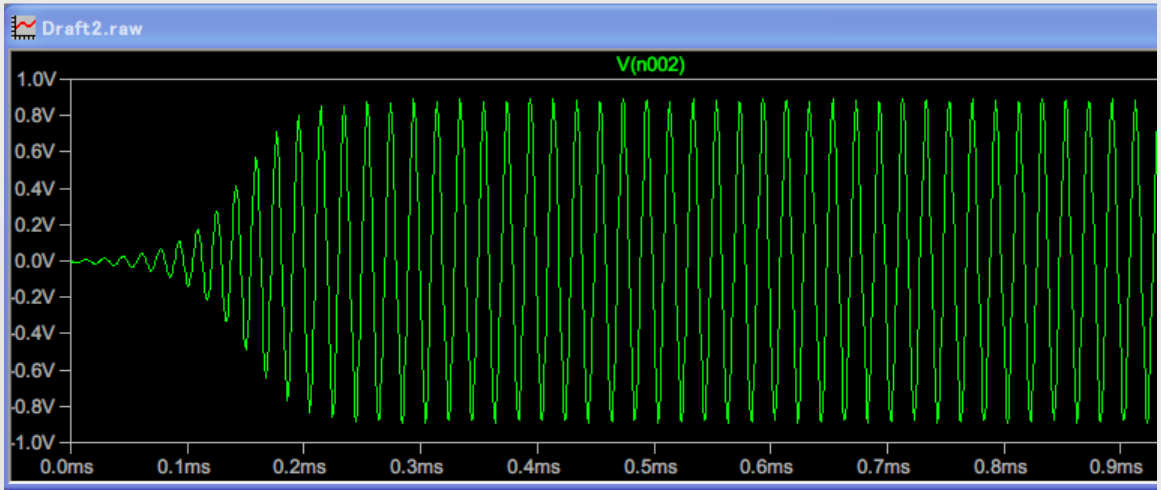


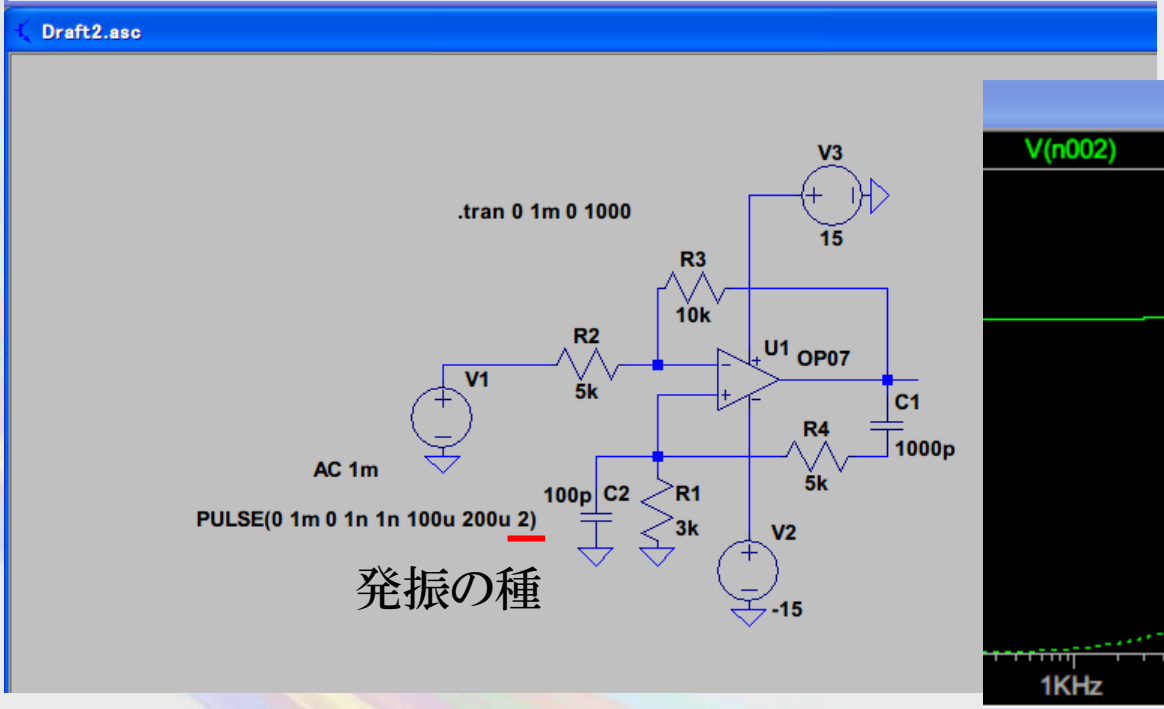
G =10 f_T =300kHz



G =2 f_T =2MHz

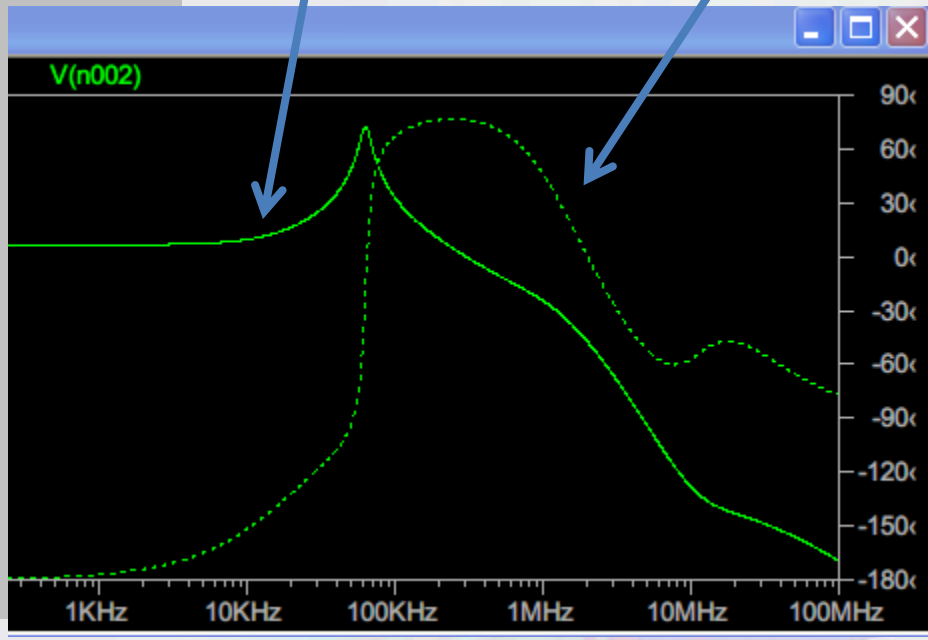
OPamp回路の発振



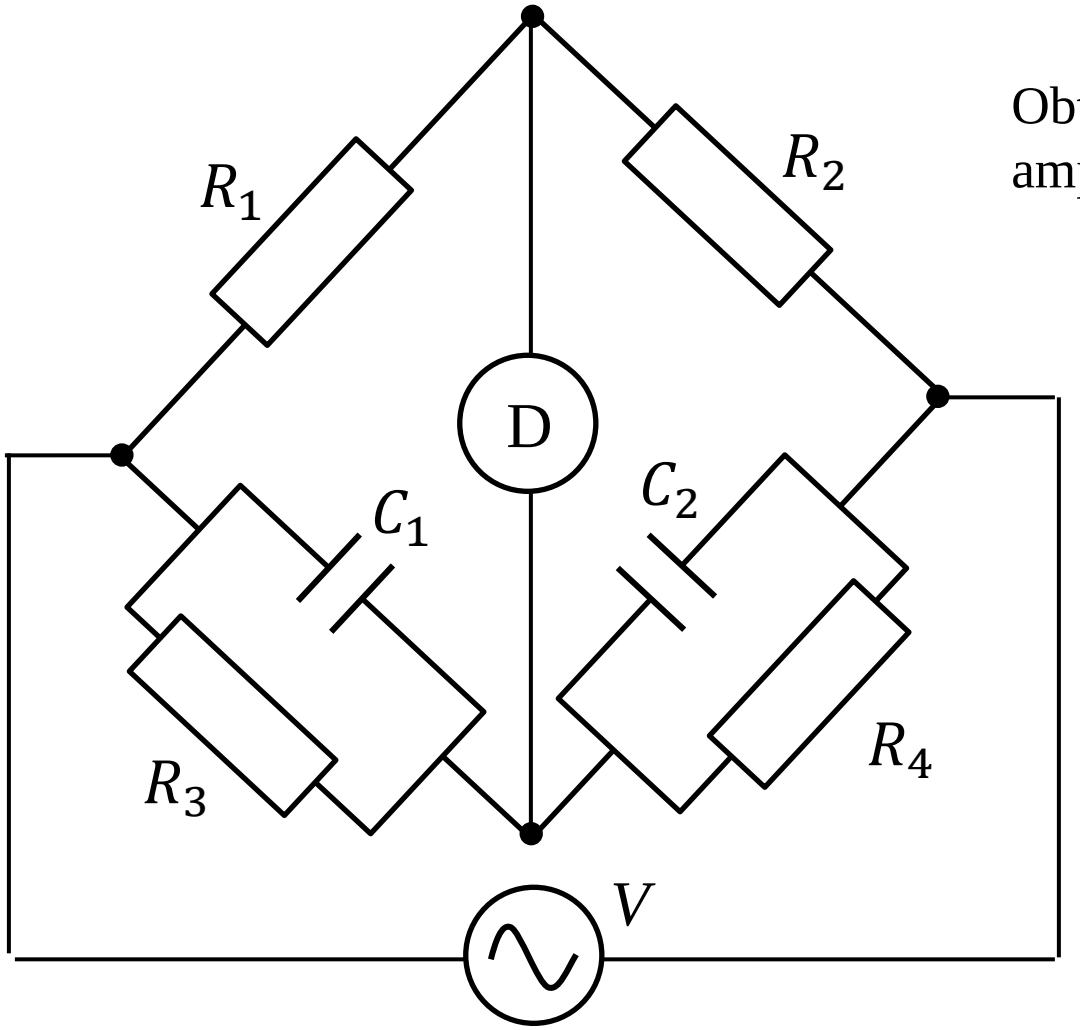


ゲイン

位相

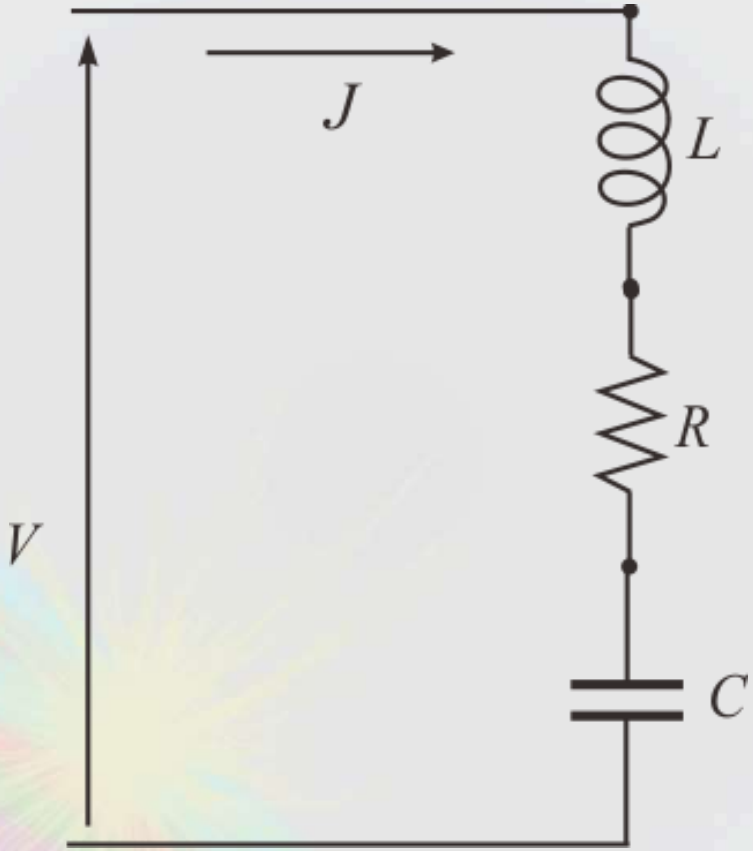


Exercise 3-1



Obtain the condition for the ampere meter D indicates zero.

Exercise 3-2



Voltage: $V(t) = V_0 H(t)$
$H(t)$ is Heaviside function

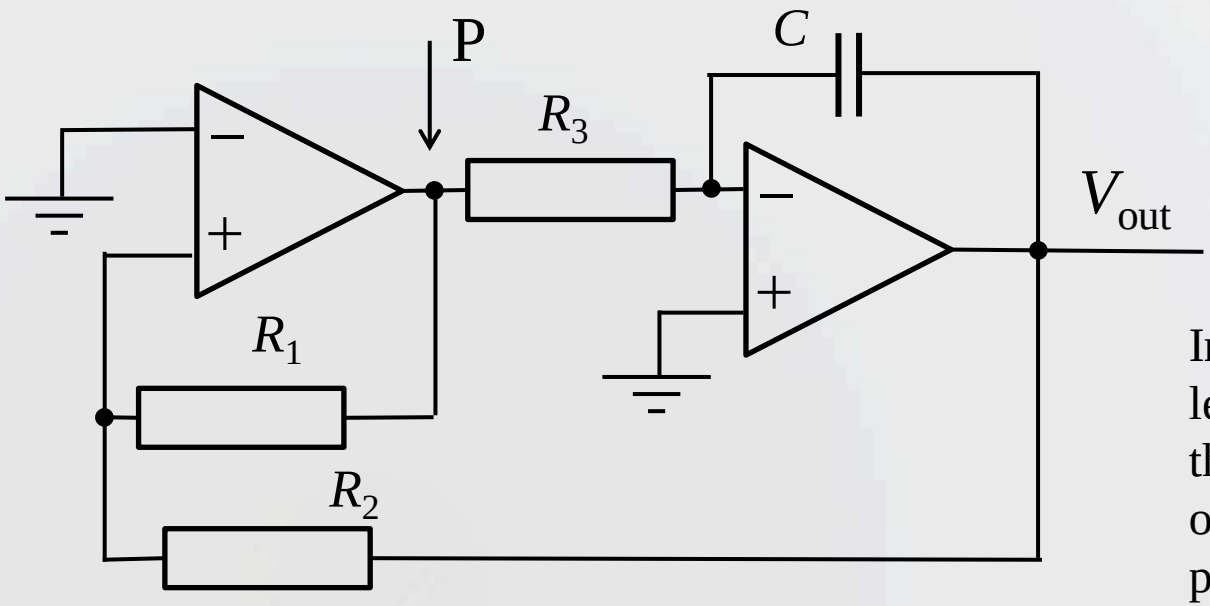
is applied.
Obtain the current response for the following conditions.

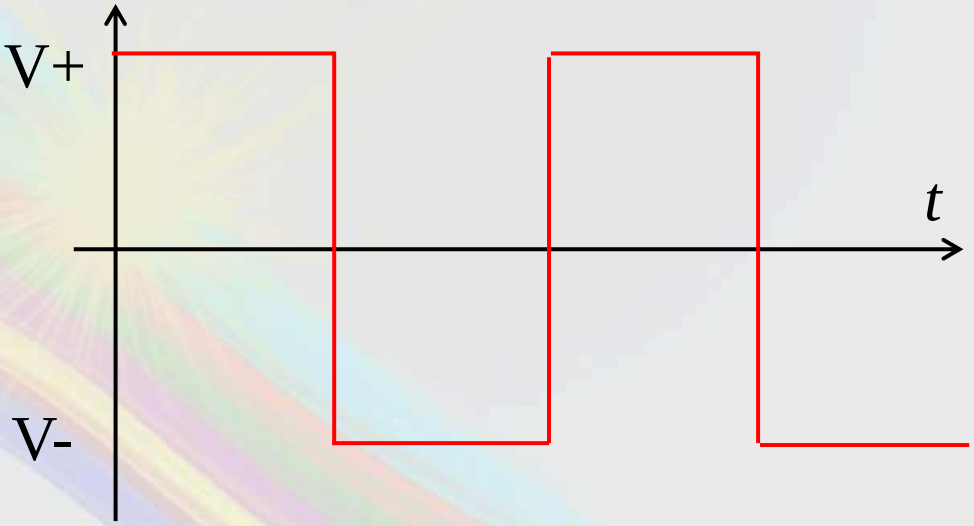
(i) $(R/2L)^2 > 1/LC$

(ii) $(R/2L)^2 = 1/LC$

(iii) $(R/2L)^2 < 1/LC$

Exercise 3-3





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}.