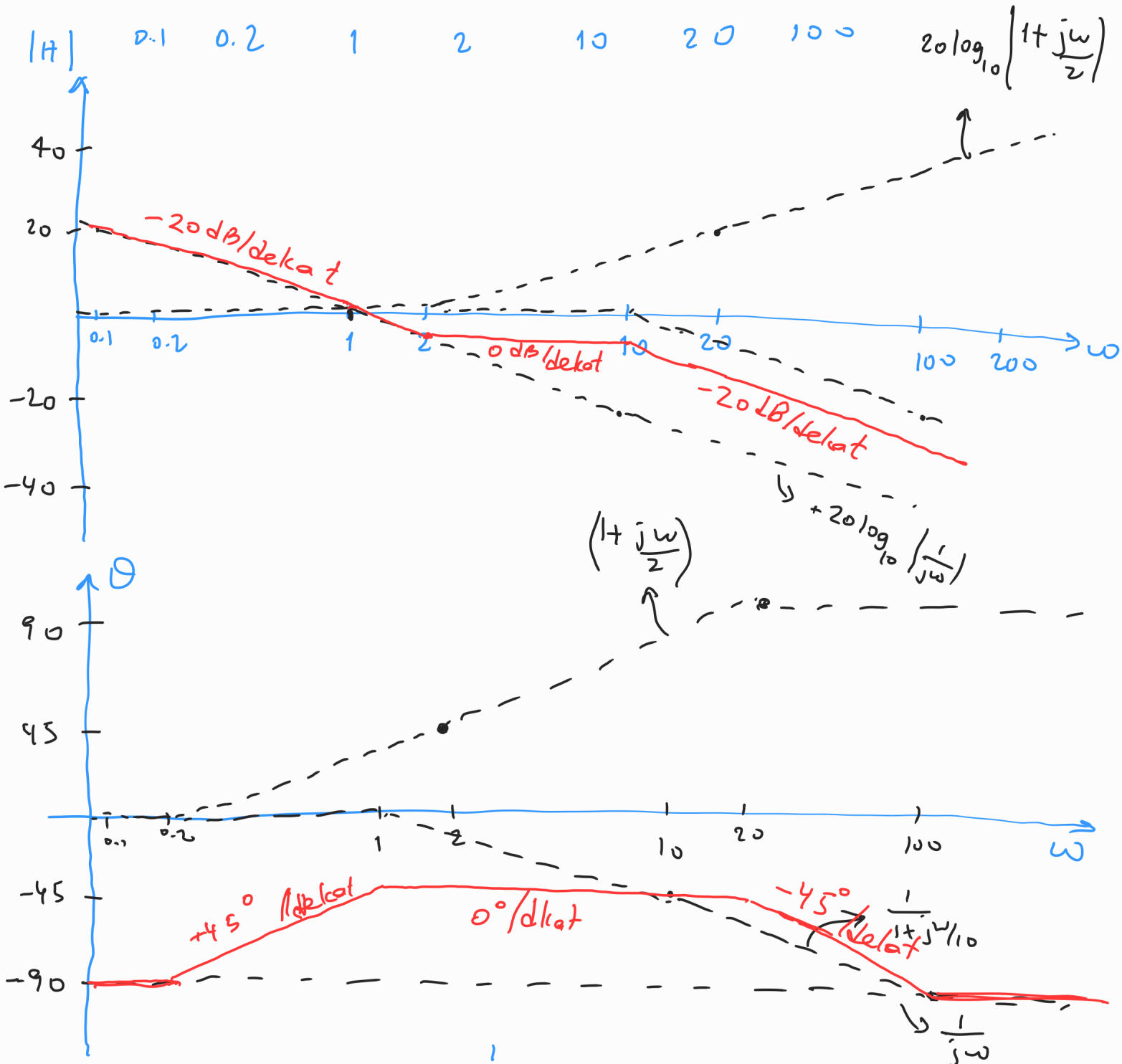


Problem 14.3

$$H(\omega) = \frac{5(j\omega + 2)}{j\omega(j\omega + 10)}$$

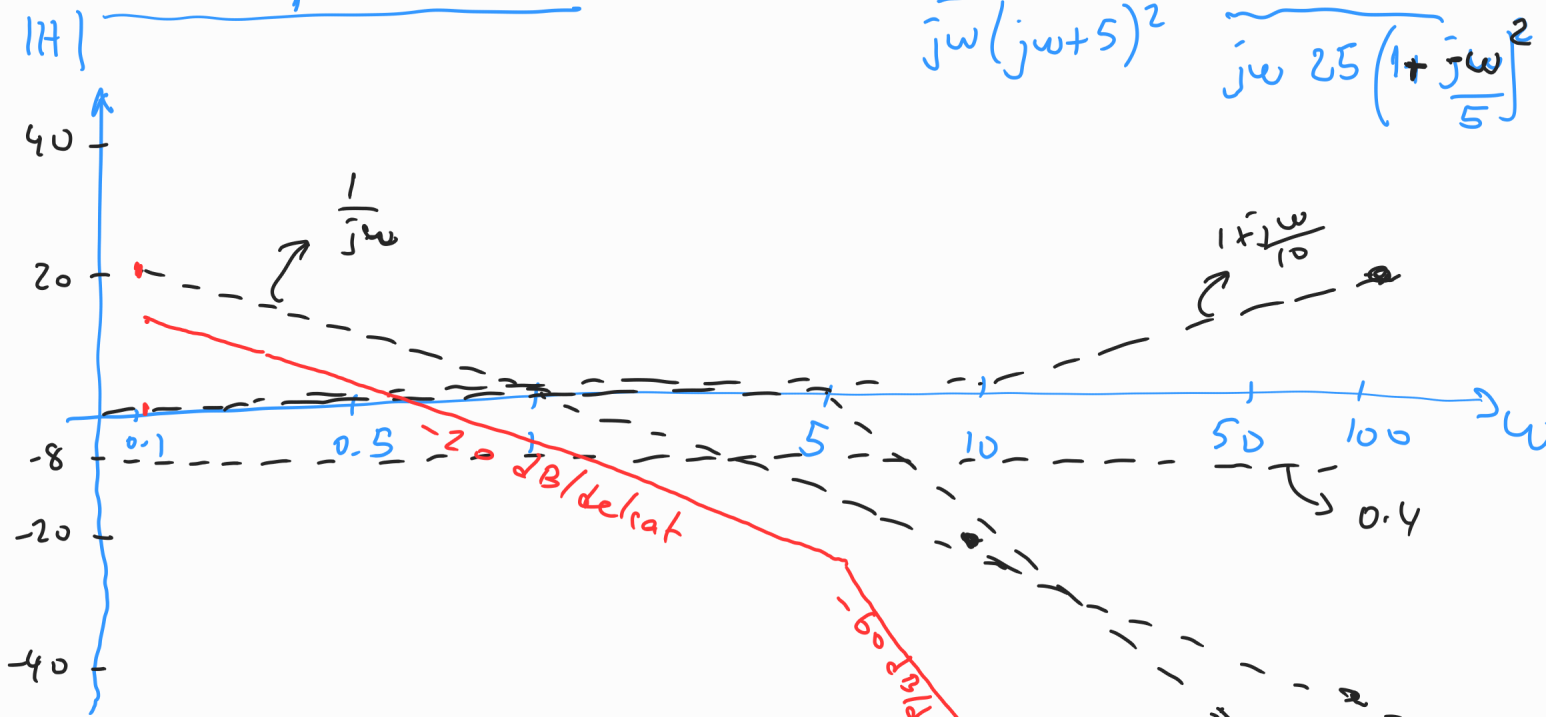
$$H(\omega) = \frac{5 \times 2 \times (1 + \frac{j\omega}{2})}{j\omega \times 10 (1 + \frac{j\omega}{10})} = \frac{1 + \frac{j\omega}{2}}{j\omega (1 + \frac{j\omega}{10})}$$

Kırılma noktaları 2 ve 10

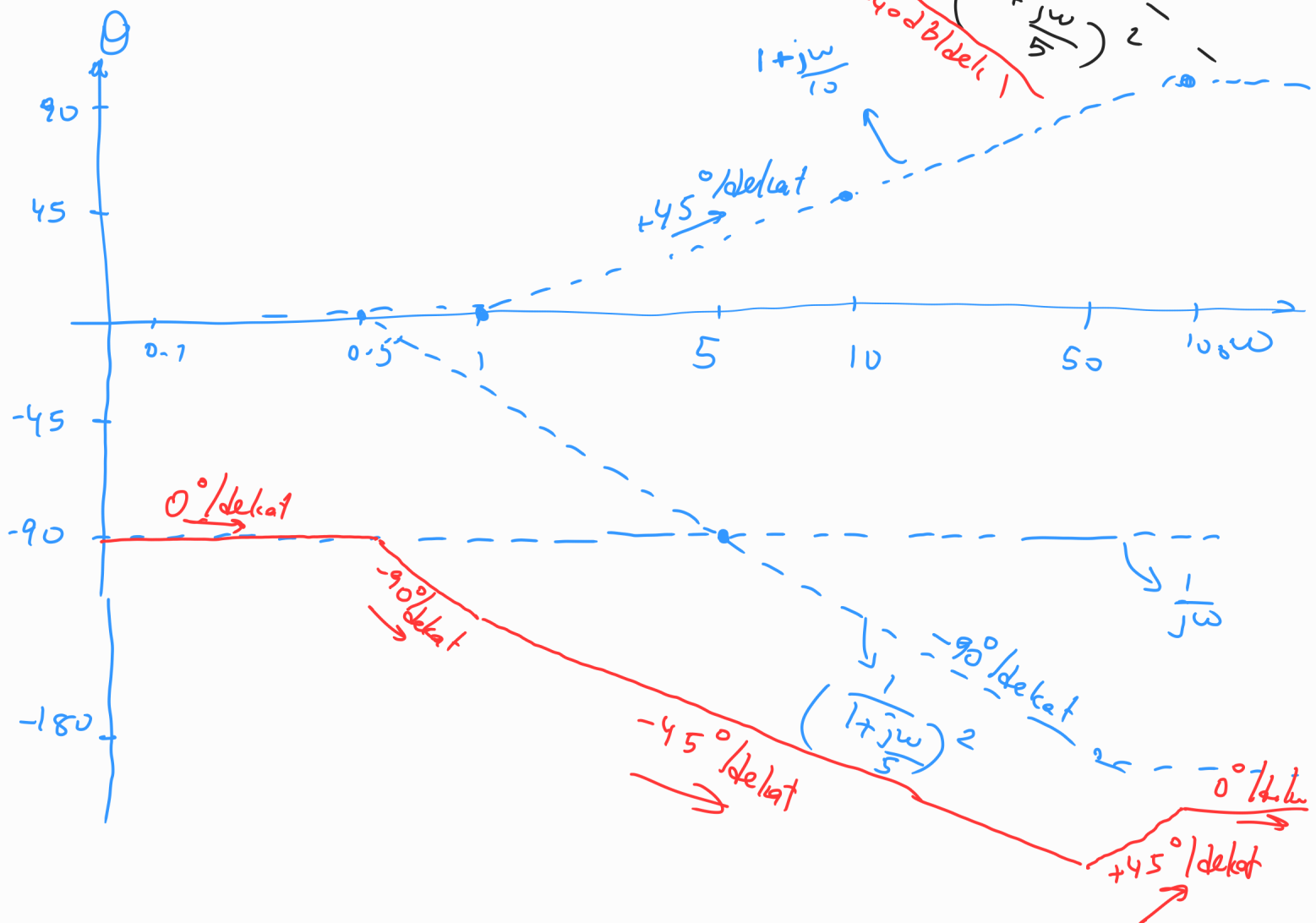


Example 14.4

$$H(\omega) = \frac{j\omega + 10}{j\omega(j\omega + 5)^2} = \frac{10 \left(1 + \frac{j\omega}{10}\right)}{j\omega 25 \left(1 + \frac{j\omega}{5}\right)^2}$$



Kırılma nok. 5, 10

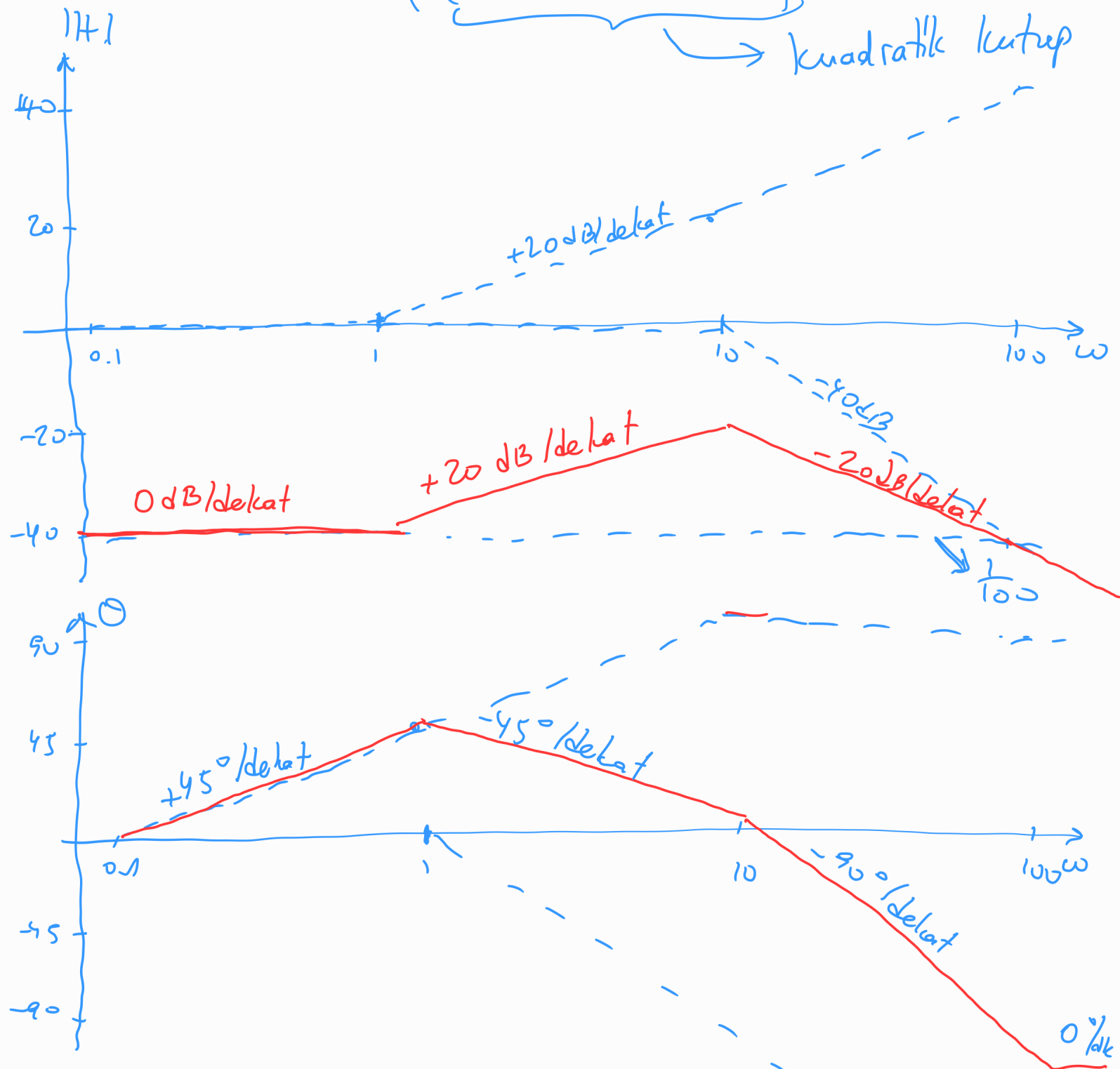


Example 14.5

$$H(s) = \frac{s+1}{s^2 + 12s + 100}$$

$$H(j\omega) = \frac{1+j\omega}{(j\omega)^2 + 12j\omega + 100}$$
$$= \frac{1+j\omega}{100 \left(\left(\frac{j\omega}{10} \right)^2 + \frac{12j\omega}{100} + 1 \right)}$$

→ kuadratik kutup



-180°

Example 14.6

$$H(\omega) = \frac{j\omega \cdot 100}{(1+j\omega) \left(1 + \frac{j\omega}{5}\right) \left(1 + \frac{j\omega}{20}\right)}$$

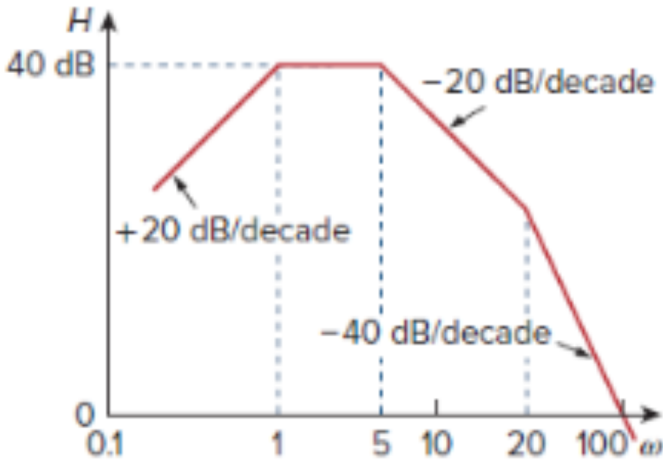


Figure 14.19
For Example 14.6.

14.7. Pasif Filtreler:

Filtreler istenen frekans bölgelerinde geçiren istenmeyenleri bloke eden frekans seçici devrelerdir. (ör. Radyo, TV, telsiz vs).

Pasif filtrelerde sadece R, L, C elemanları bulunur.

Aktif " ise OPAMP, transistör gibi elemanlar bulunur.

1) Düşük geçiren (Low pass filter)

2) Yüksek " (High pass filter)

3) Bant " (Bandpass filter)

4) Bant durdurucu (Band stop filter)

Düşük geçiren filtreler.

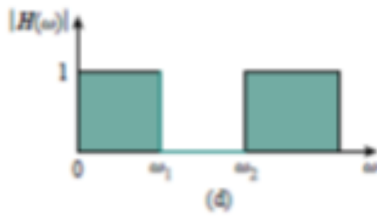
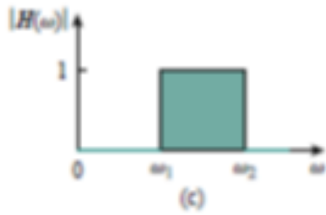
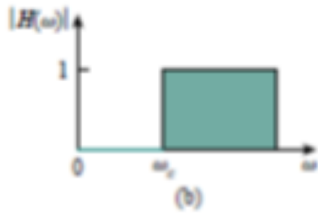
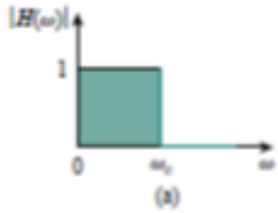
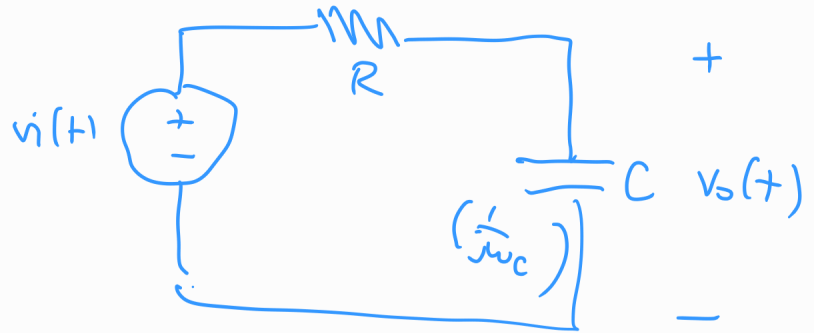


Figure 14.30 Ideal frequency response of four types of filter: (a) lowpass filter, (b) highpass filter, (c) bandpass filter, (d) bandstop filter.

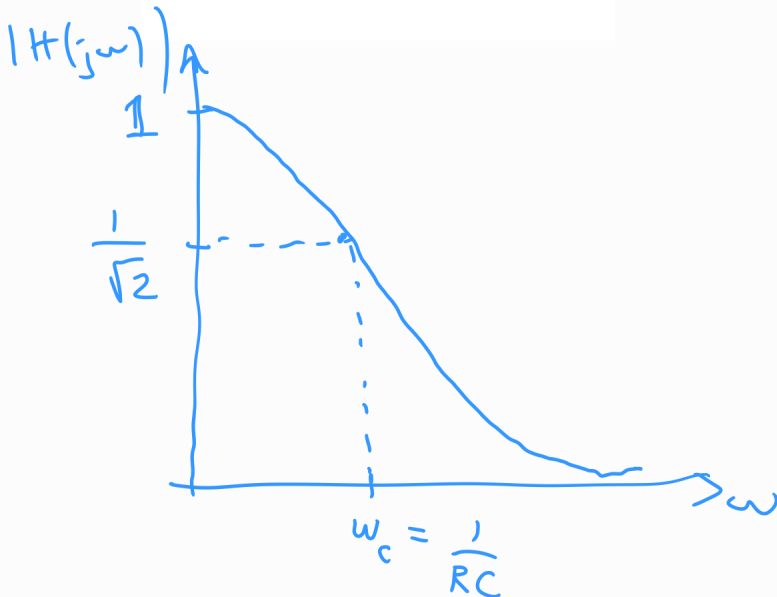


$$\bar{V}_o = \bar{V}_i \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}}$$

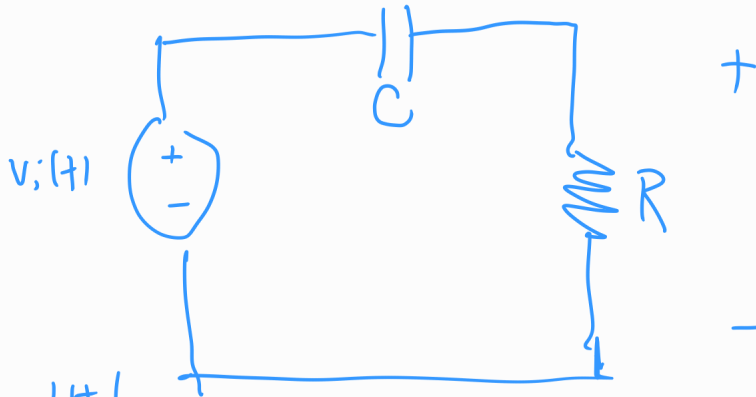
$$H(\omega) = \frac{\bar{V}_o}{\bar{V}_i} = \frac{\frac{1}{j\omega C}}{R + \frac{1}{j\omega C}} = \frac{1}{1 + j\omega RC}$$

$$= \frac{1/RC}{\frac{1}{RC} + j\omega}$$

$$|H(\omega)| = \frac{1}{\sqrt{1 + \omega^2 R^2 C^2}}$$

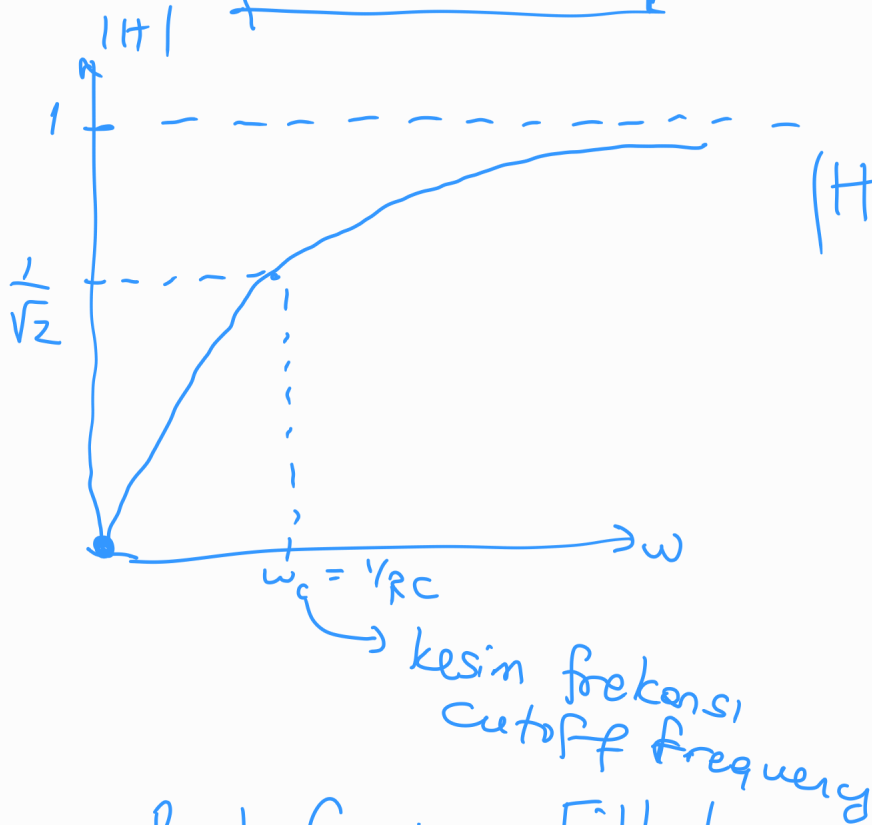


Yüksek geçiren filtre:



$$\bar{V}_o = \bar{V}_i \frac{R}{R + \frac{1}{j\omega C}}$$

$$H(\omega) = \frac{R}{R + \frac{1}{j\omega C}} = \frac{j\omega RC}{1 + j\omega RC}$$

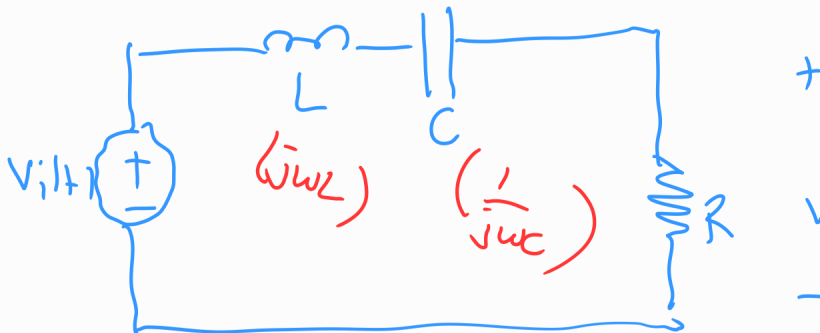


$$|H(\omega)| = \frac{\omega RC}{\sqrt{1 + \omega^2 R^2 C^2}}$$

$$\omega_c = \frac{1}{RC}$$

Bant Geçiren Filtreler:

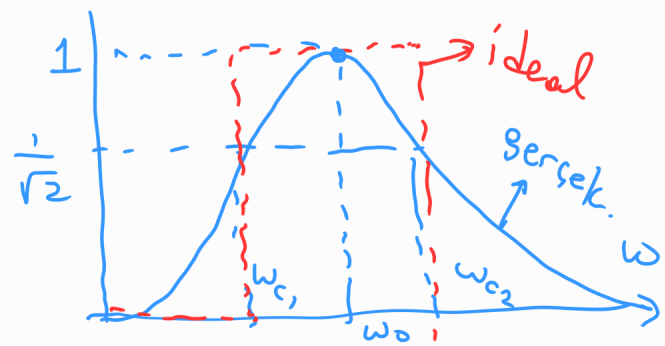
Seri RLC



$$\begin{aligned} \omega &\rightarrow 0 & (\text{akım geçmez}) \\ \omega &\rightarrow \infty & v_o \Rightarrow 0 \end{aligned}$$

$$\omega = \omega_0$$

$$j\omega L + \frac{1}{j\omega C} = 0 \text{ olur.}$$



$$V_o = V_i \frac{R}{R + j\omega L - \frac{j}{\omega C}} \Rightarrow H(\omega) = \frac{V_o}{V_i} = \frac{R}{R + j\left(\omega L - \frac{1}{\omega C}\right)}$$

$$|H(\omega)| = \frac{R}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

$$|H(\omega_0)| = 1 \Rightarrow \omega_0 L - \frac{1}{\omega_0 C} = 0$$

$$\omega_0 = \frac{1}{\sqrt{LC}} \Rightarrow \text{merkezi frekansı}$$

Kesim frekansları : ω_{c1}, ω_{c2}

$$\frac{1}{\sqrt{2}} = \frac{R}{\sqrt{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2}}$$

$$\frac{1}{2} = \frac{R^2}{R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2} \Rightarrow R^2 + \left(\omega L - \frac{1}{\omega C}\right)^2 = 2R^2$$

$$\left(\omega L - \frac{1}{\omega C}\right)^2 = R^2$$

$$\omega L - \frac{1}{\omega C} = \pm R$$

$$\omega^2 LC - 1 = \pm \omega RC$$

$$\omega^2 LC \mp \omega RC - 1 = 0$$

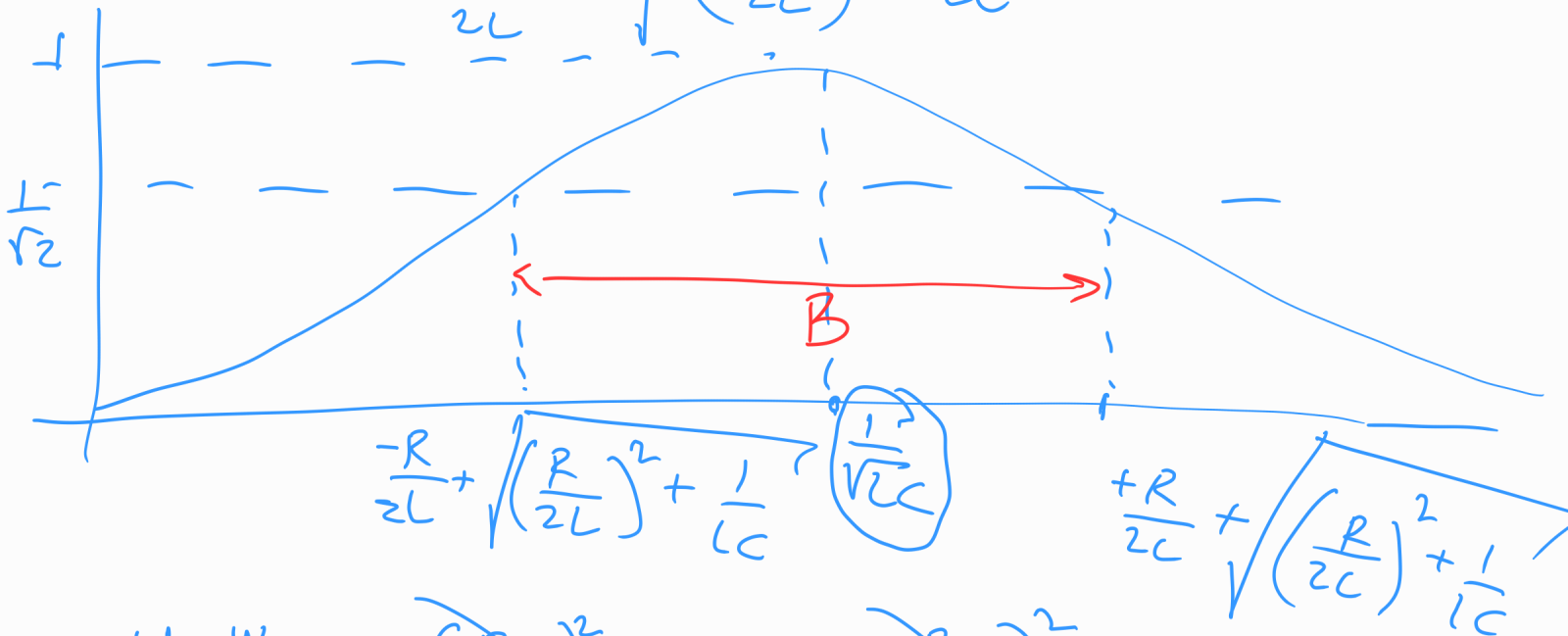
$$\omega^2 \mp \omega \frac{R}{L} - \frac{1}{LC} = 0$$

$$\omega_{1,2} = \frac{\pm \frac{R}{L} \mp \sqrt{\frac{R^2}{L^2} + \frac{4}{LC}}}{2}$$

sadece + olabilir -

$$\omega_{1,2} = \frac{\pm \frac{R}{L} + \sqrt{\frac{R^2}{L^2} + \frac{4}{LC}}}{2} \rightarrow \text{kesin frekanslar}$$

$$= \pm \frac{R}{2L} + \sqrt{\left(\frac{R}{2L}\right)^2 + \frac{1}{LC}}$$



$$\omega_c, \omega_{c2} = \left(\frac{R}{2L}\right)^2 + \frac{1}{LC} - \left(\frac{R}{2L}\right)^2 = \frac{1}{LC} = \omega_0^2$$

$$\boxed{\omega_0^2 = \omega_{c1} \omega_{c2}}$$

$$\omega_0 = \sqrt{\omega_{c1} \omega_{c2}}$$

$$B \text{ (Bandwidth)} = \omega_{c2} - \omega_{c1} = \frac{R}{L}$$

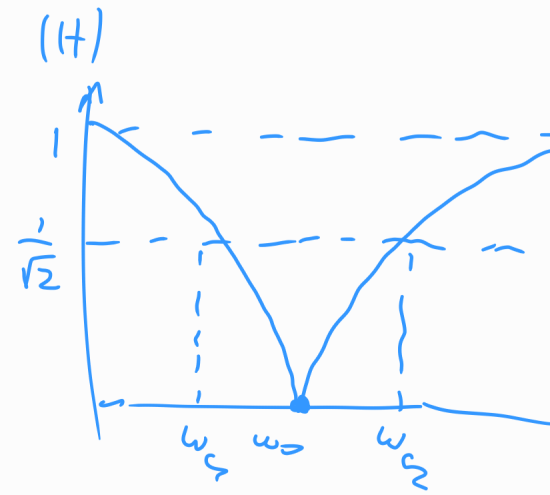
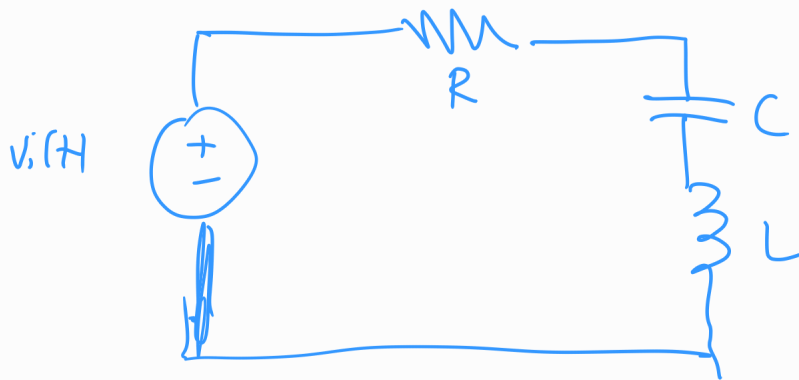
Rezonansın keskinliği : Kalite faktörü

$$\boxed{Q = \frac{\omega_0}{B}}$$

Yüksek Q : $Q > 10$

$$Q = \frac{\sqrt{\frac{1}{LC}}}{\frac{R}{L}} = \frac{1}{R} \sqrt{\frac{L}{C}}$$

Bant Durduran Filtre



$$H(\omega) = \frac{j\omega L - \frac{j}{\omega C}}{R + j\omega L - \frac{j}{\omega C}} = \frac{j\left(\omega L - \frac{1}{\omega C}\right)}{R + j\left(\omega L - \frac{1}{\omega C}\right)}$$

$\omega = \frac{1}{\sqrt{LC}}$ olduğunda ne olur?

$H(\omega) = 0$ olur.

$$\boxed{\omega_0 = \frac{1}{\sqrt{LC}}}$$

$$\boxed{B = \frac{R}{L}}$$