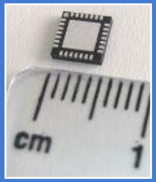

ELT 061 – Dispositivos e Circuitos Eletrônicos Básicos

Circuitos Comparadores & Osciladores Senoidais

Referência: Sedra Smith, 5 edição
Capítulo 13

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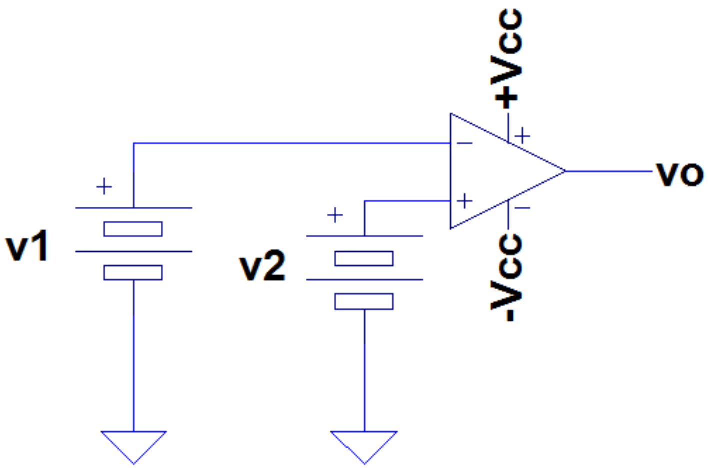
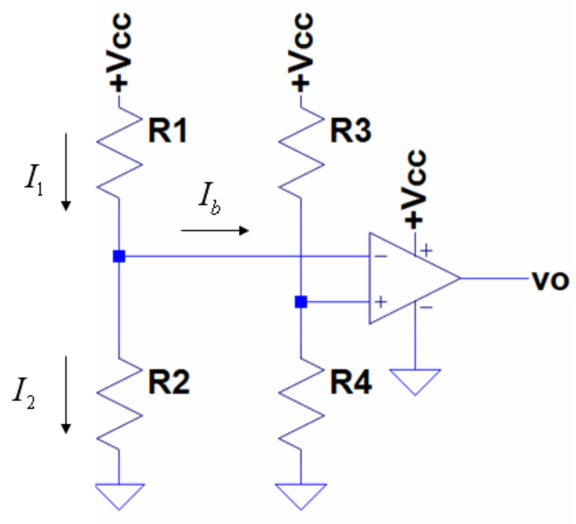
Circuitos Comparadores



$$v_0 = (v^+ - v^-) \cdot A_d$$

$$v_0 \rightarrow +Vcc, \;\; se \; v2 > v1$$

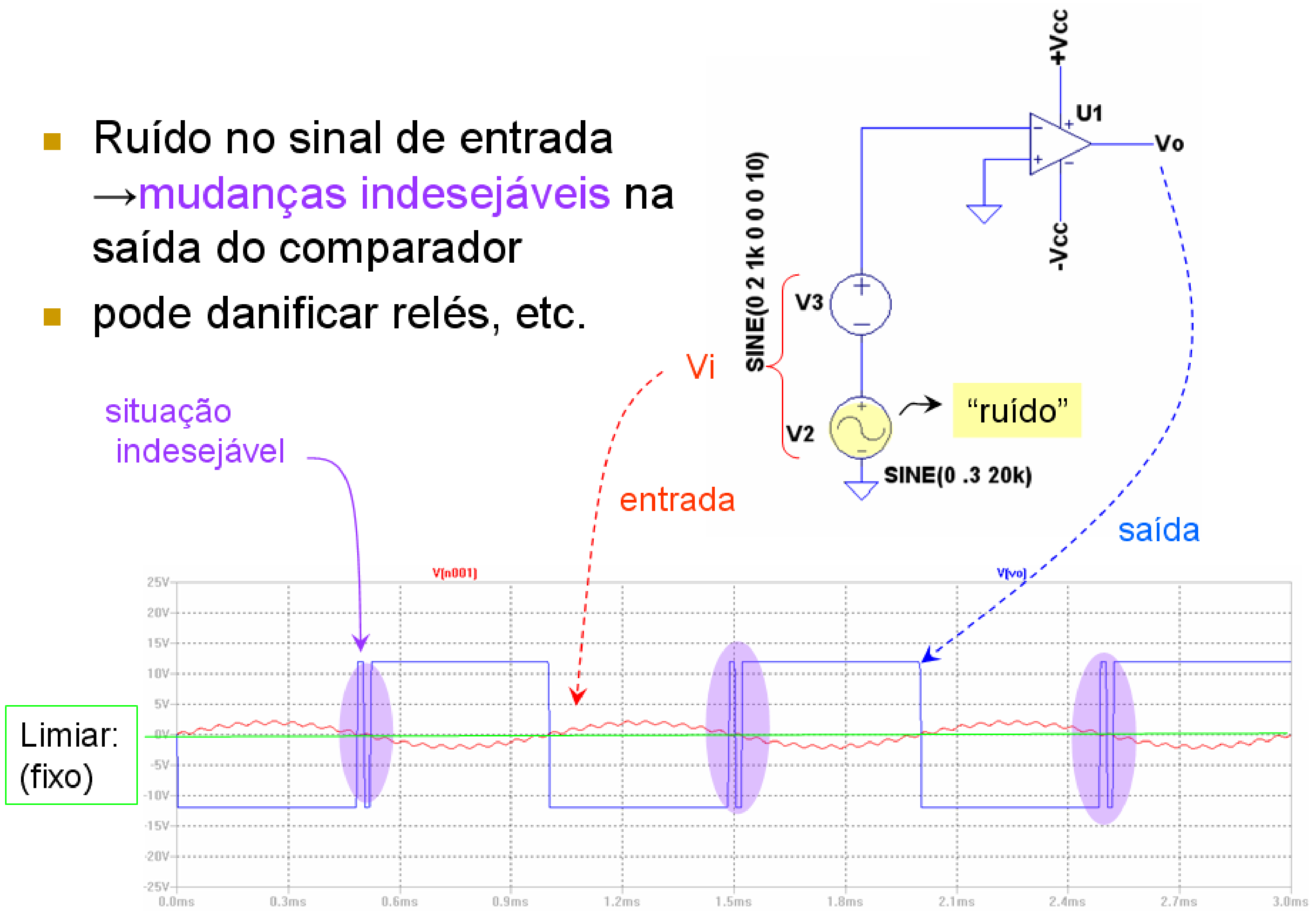
$$v_0 \rightarrow -Vcc, \;\; se \; v2 < v1$$



$$v^- \approx Vcc\frac{R_2}{R_1 + R_2}, \quad v^+ \approx Vcc\frac{R_4}{R_3 + R_4}$$

Circuitos Comparadores

- Ruído no sinal de entrada →mudanças indesejáveis na saída do comparador
- pode danificar relés, etc.



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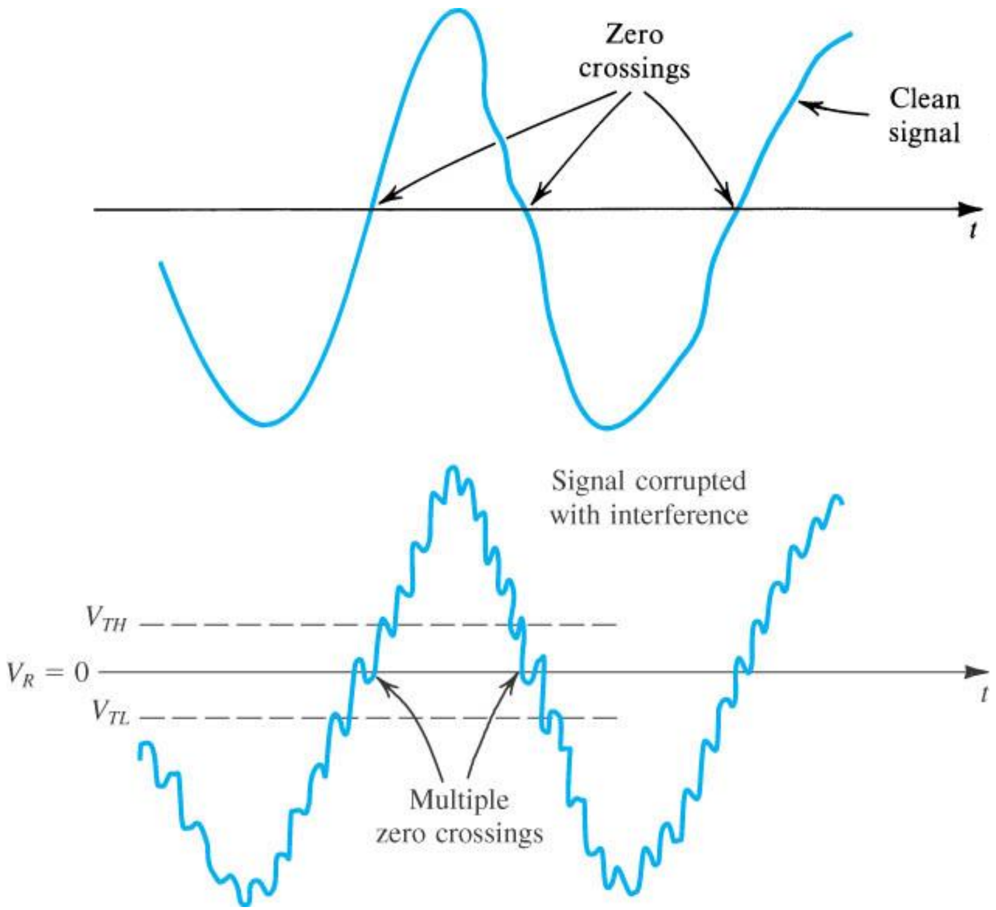
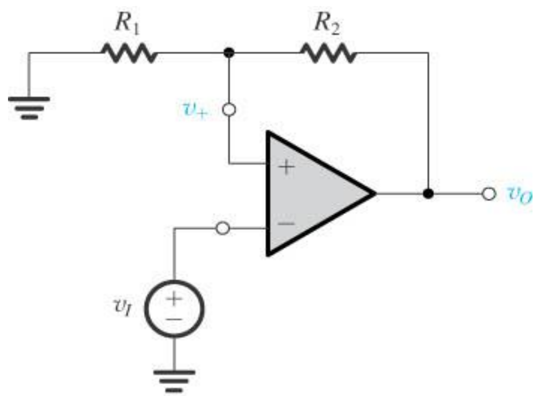
Circuitos Comparadores

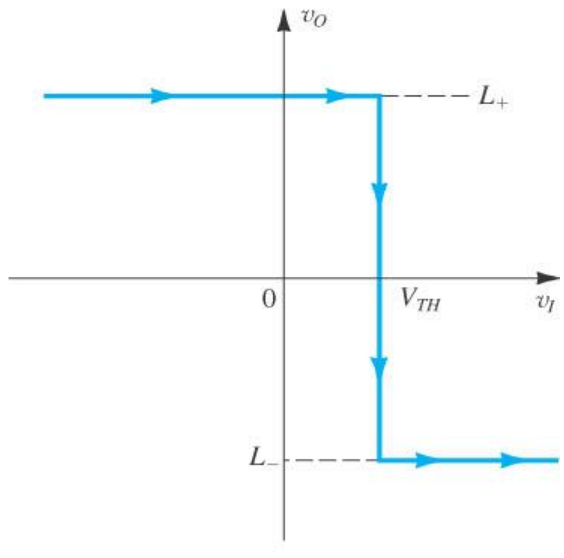


Circuitos Comparadores com histerese

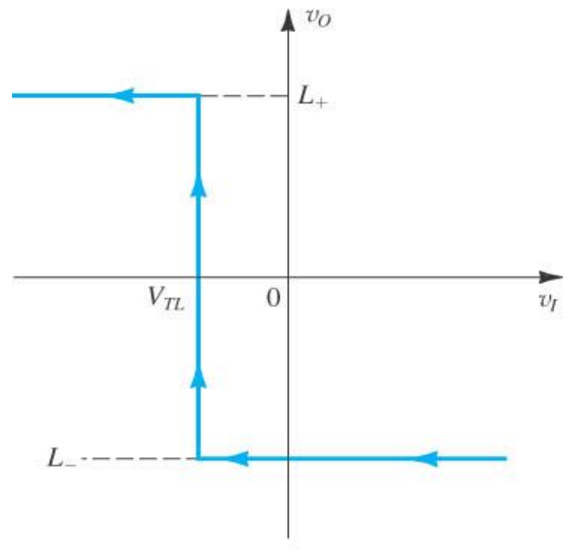
v^+ é comprado com vi

$$v^+ = \frac{R_1}{R_1 + R_2} v_0$$

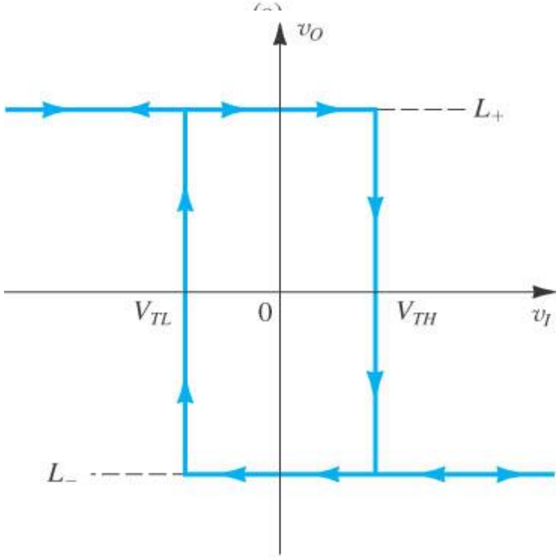




(b)



(c)

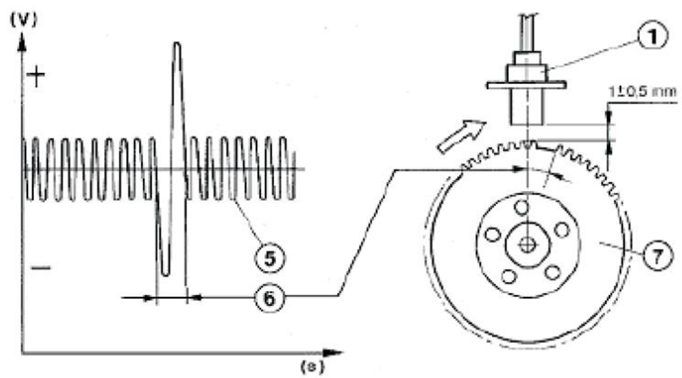


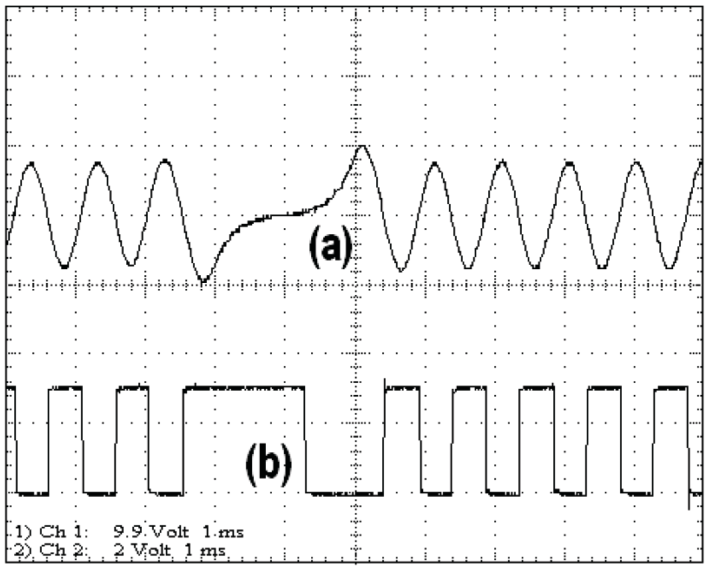
(d)

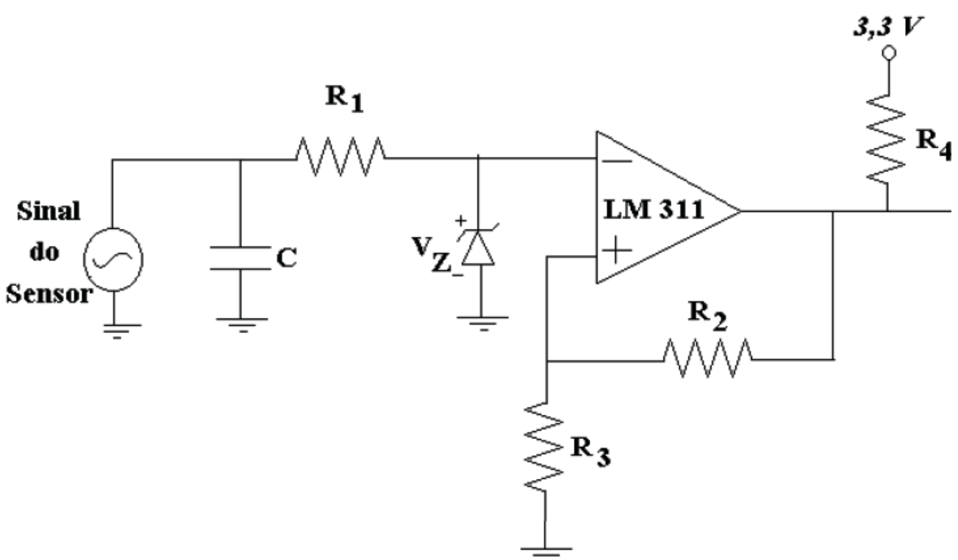
$$V_{TH} = \frac{R_1}{R_1 + R_2} L+$$

$$V_{TL} = \frac{R_1}{R_1 + R_2} L-$$

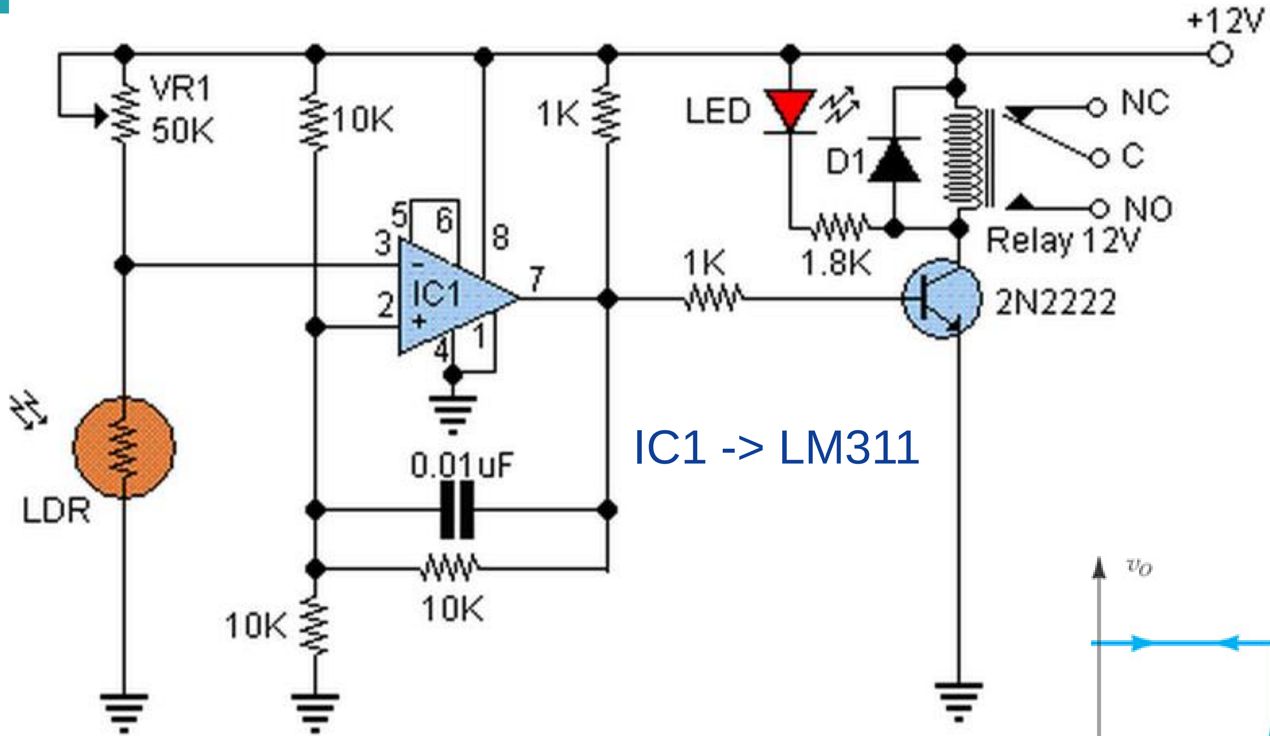
Circuitos Comparadores com histerese



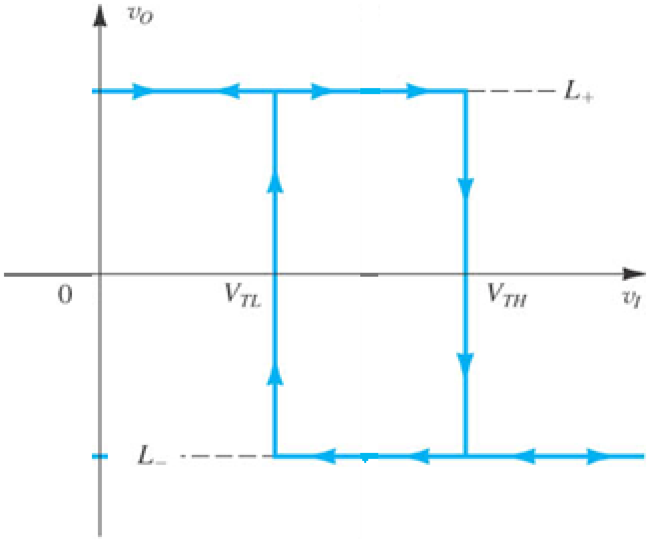




Circuitos Comparadores com histerese



IC1 -> LM311

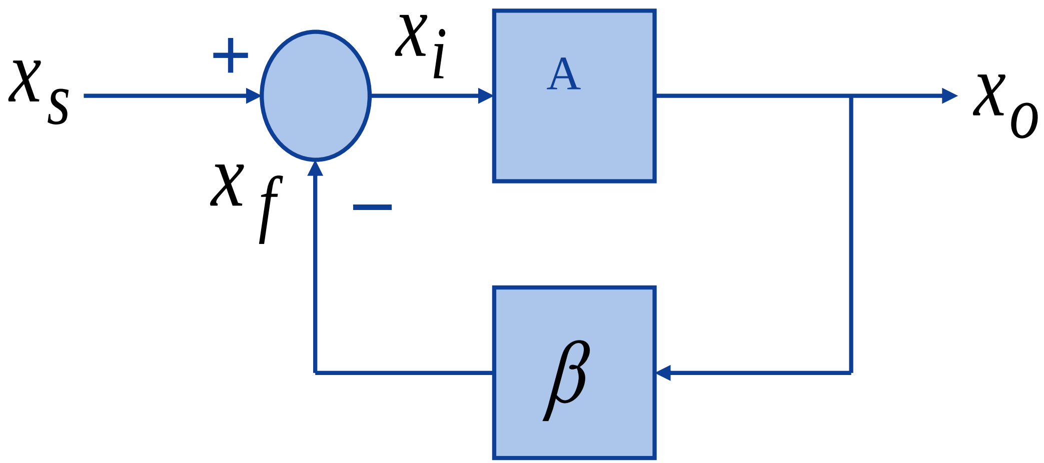


$$V_{TH} = \frac{10\text{k}\Omega}{15\text{k}\Omega} 12\text{V} = 8\text{V}$$

$$V_{TL} = \frac{5\text{k}\Omega}{15\text{k}\Omega} 12\text{V} = 4\text{V}$$

Osciladores Senoidal

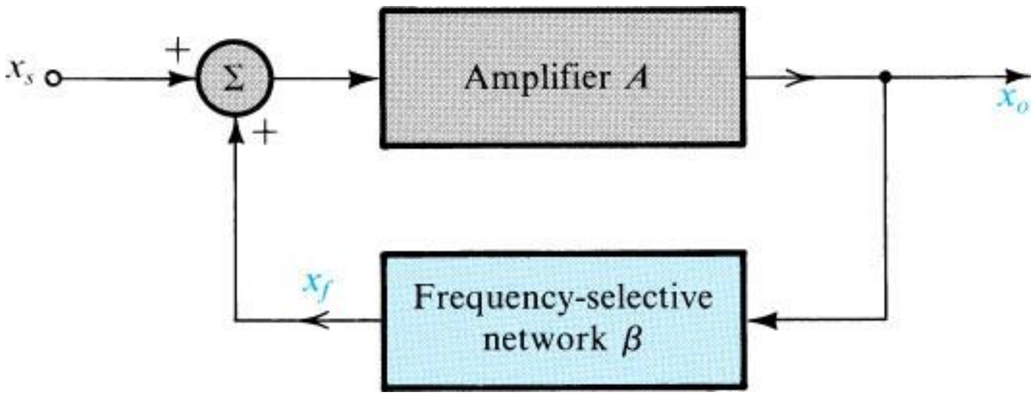
Realimentação negativa



$$A_f(s) = \frac{A(s)}{1+\beta(s)A(s)}$$

Critério de oscilação

Realimentação Positiva



$$A_f(s) = \frac{A(s)}{1 - \beta(s)A(s)}$$

$$L(s) \equiv \beta(s)A(s)$$

$$L(jw_o) \equiv \beta(jw_o)A(jw_o) = 1\angle 0^0$$

Em w_o a fase do ganho de malha deve ser zero e a amplitude deve ser unitário

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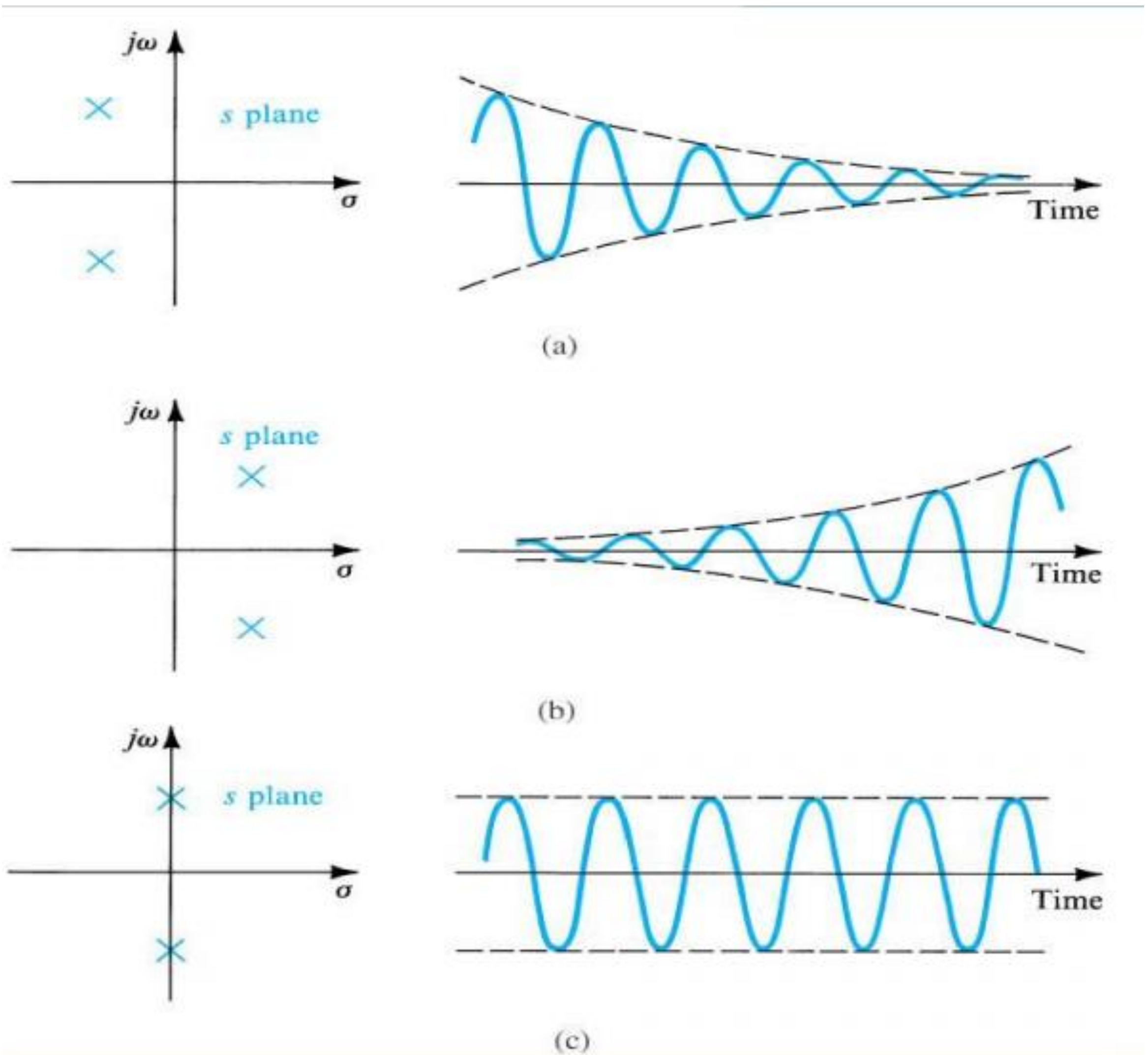
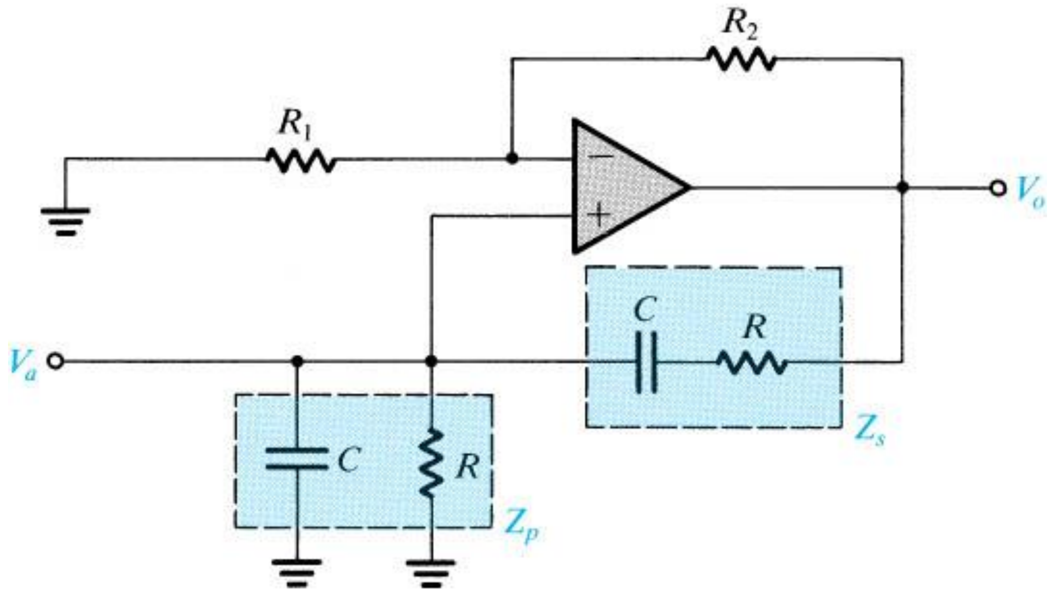
Critério de oscilação



Oscilador em ponte Wien



$$L(s) = \left[1 + \frac{R_2}{R_1}\right]\frac{Z_p}{Z_s + Z_p} = \frac{1 + R_2/R_1}{3 + sCR + 1/sCR}$$

Oscilador em ponte Wien

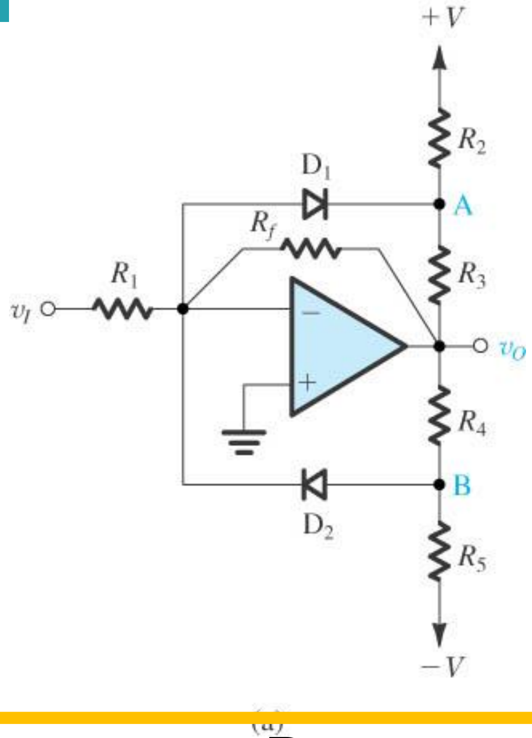
$$L(jw_o) \equiv \beta(jw_o)A(jw_o) = 1\angle 0^0$$

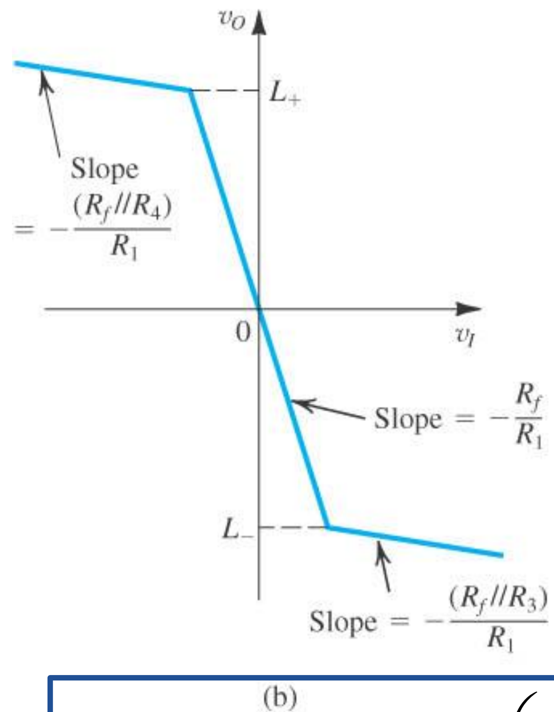
$$L(jw) = \frac{1 + R_2/R_1}{3 + j\left(wCR - 1/wCR\right)}$$

$$w_0 CR = \frac{1}{w_0 CR} \qquad w_0 = \frac{1}{CR}$$

$$R_2/R_1 = 2$$

Oscilador em ponte Wien





$$v_A = V\frac{R_3}{R_3+R_2} + v_o\frac{R_2}{R_3+R_2}$$

$$v_B = -V\frac{R_4}{R_4+R_5} + v_o\frac{R_5}{R_4+R_5}$$

$$L_- = -V\frac{R_3}{R_2} - v_D\left(1+\frac{R_3}{R_2}\right)$$

$$L_+ = V\frac{R_4}{R_5} + v_D\left(1+\frac{R_4}{R_5}\right)$$

Oscilador em ponte Wien

$$w_0 = \frac{1}{CR} = \frac{1}{16\text{nF} * 10\text{k}\Omega} = 6250\text{rad/sec}$$

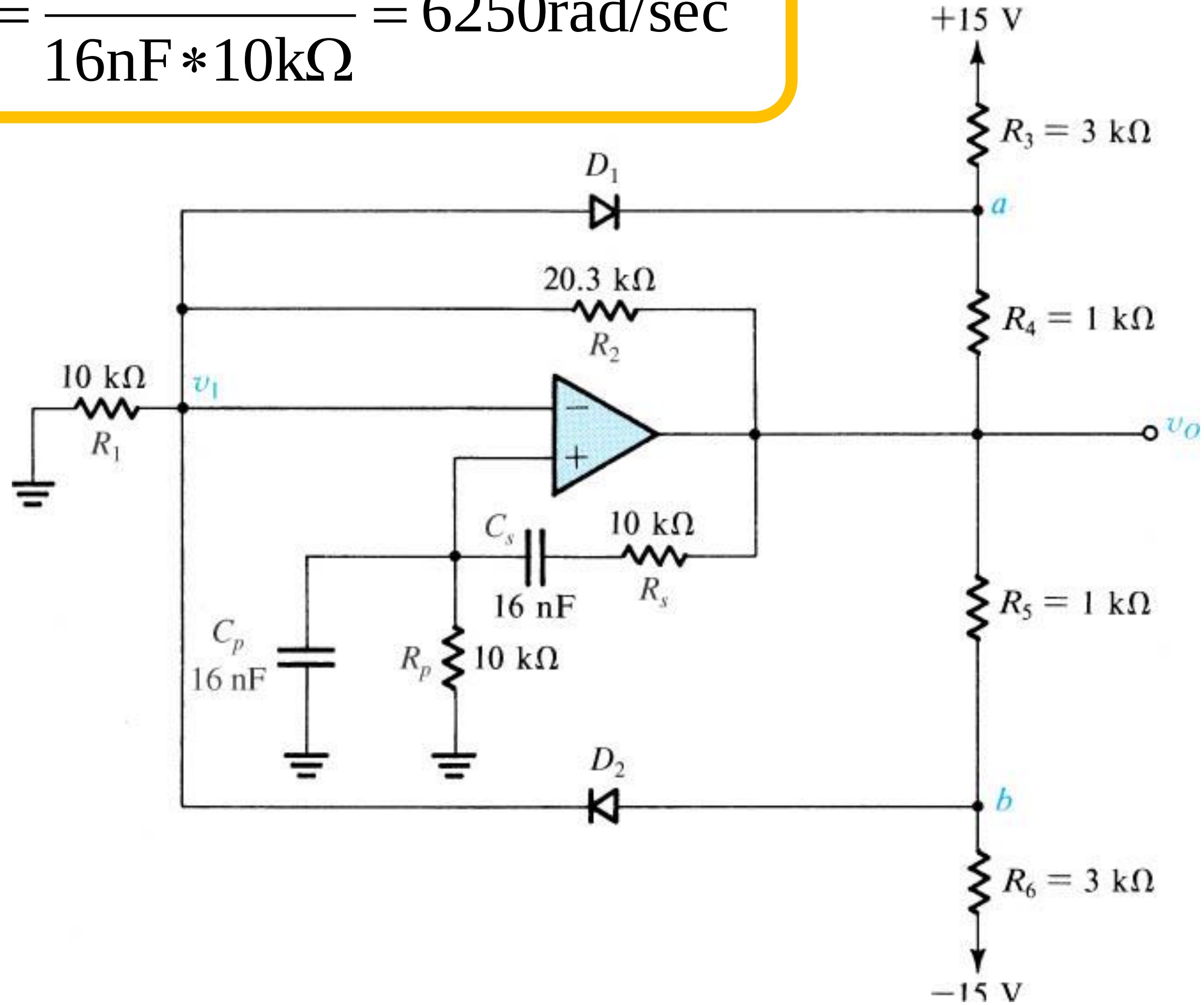
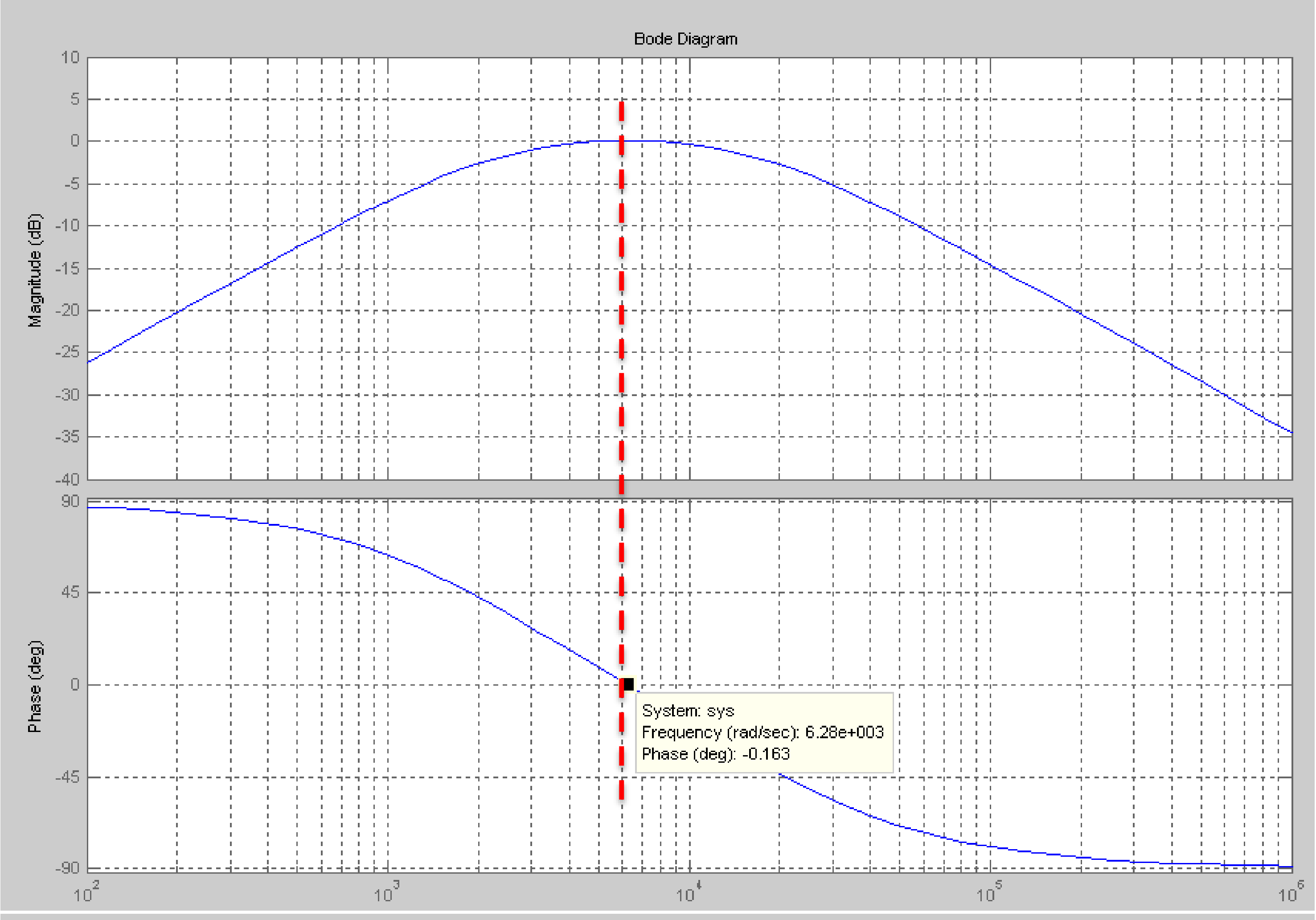
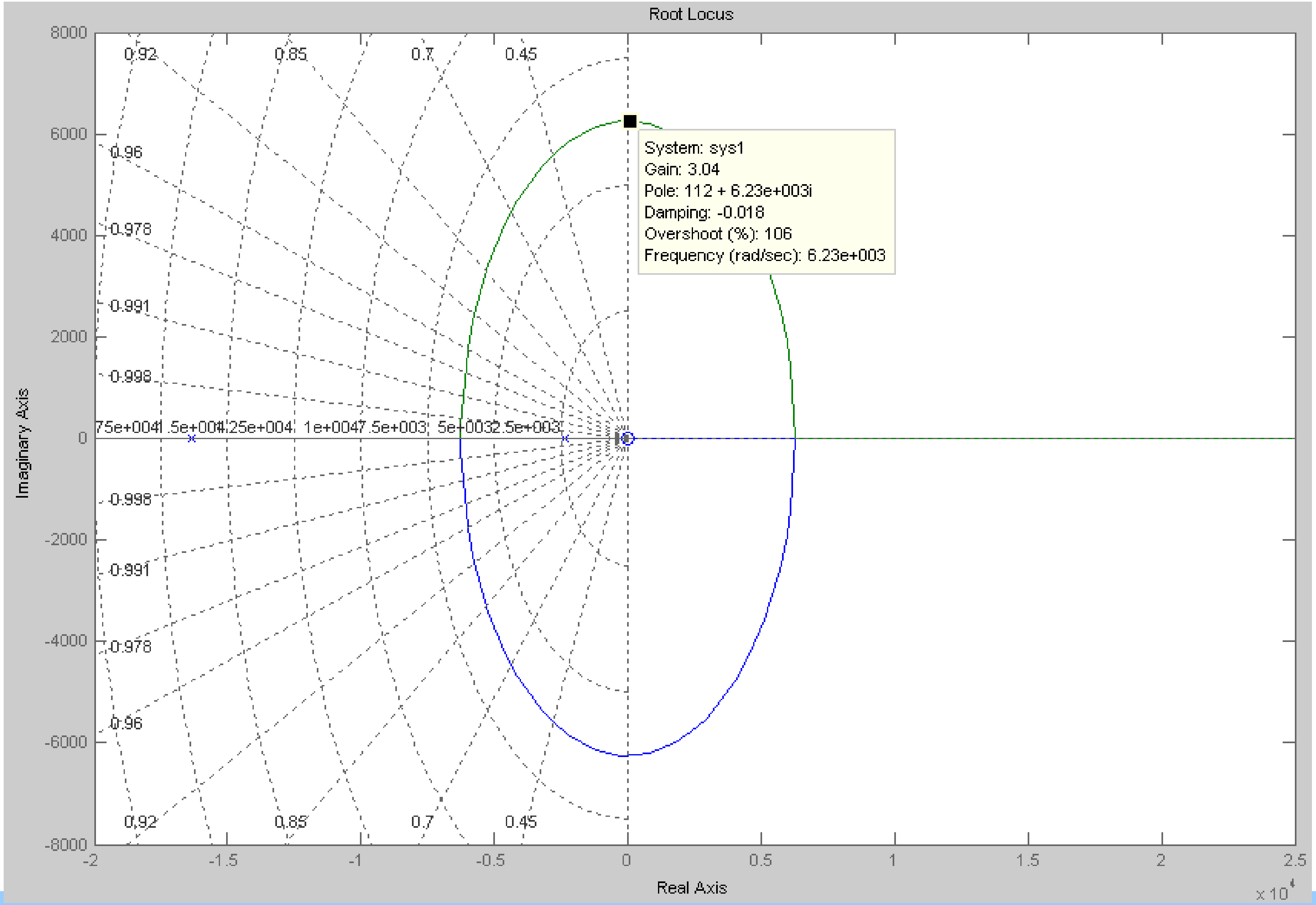


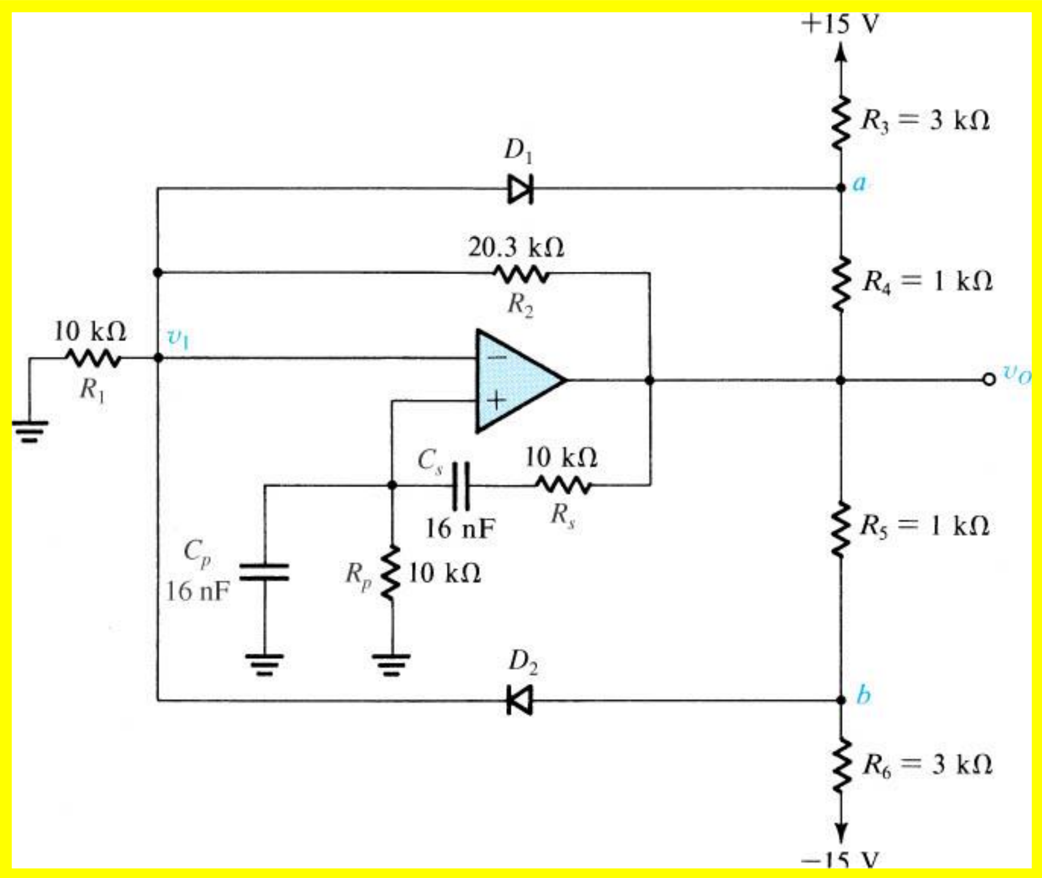
Diagrama de Bode



Lugar das raízes em malha fechada



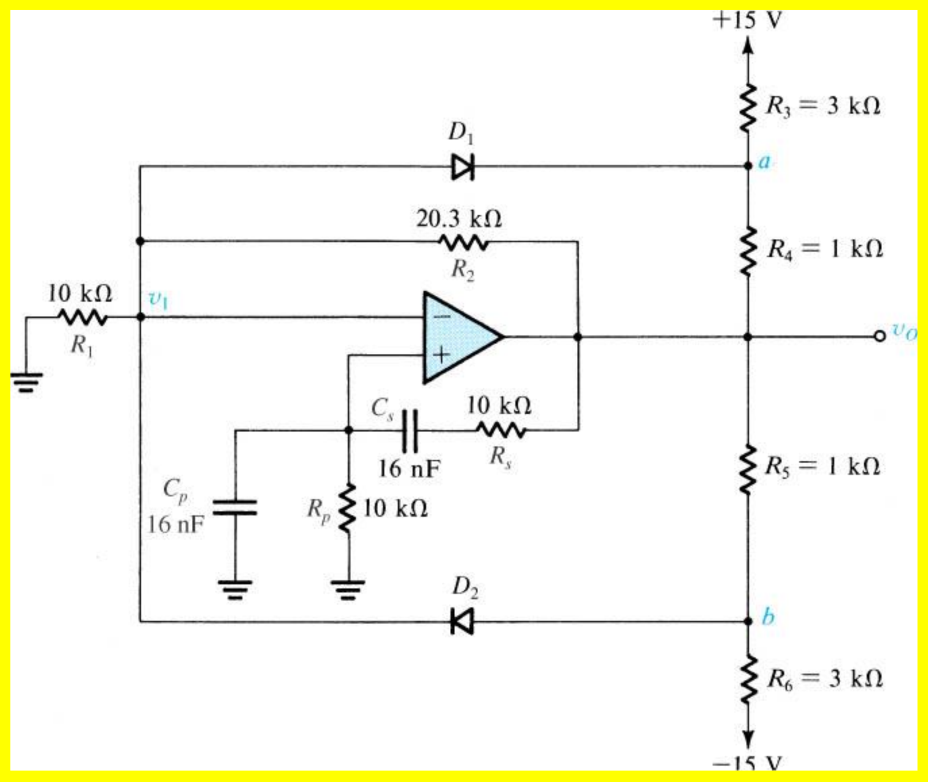
Oscilador em ponte Wien



$$\frac{v_{o\max} - v_b}{R_5} = \frac{v_b - (-V)}{R_6}$$

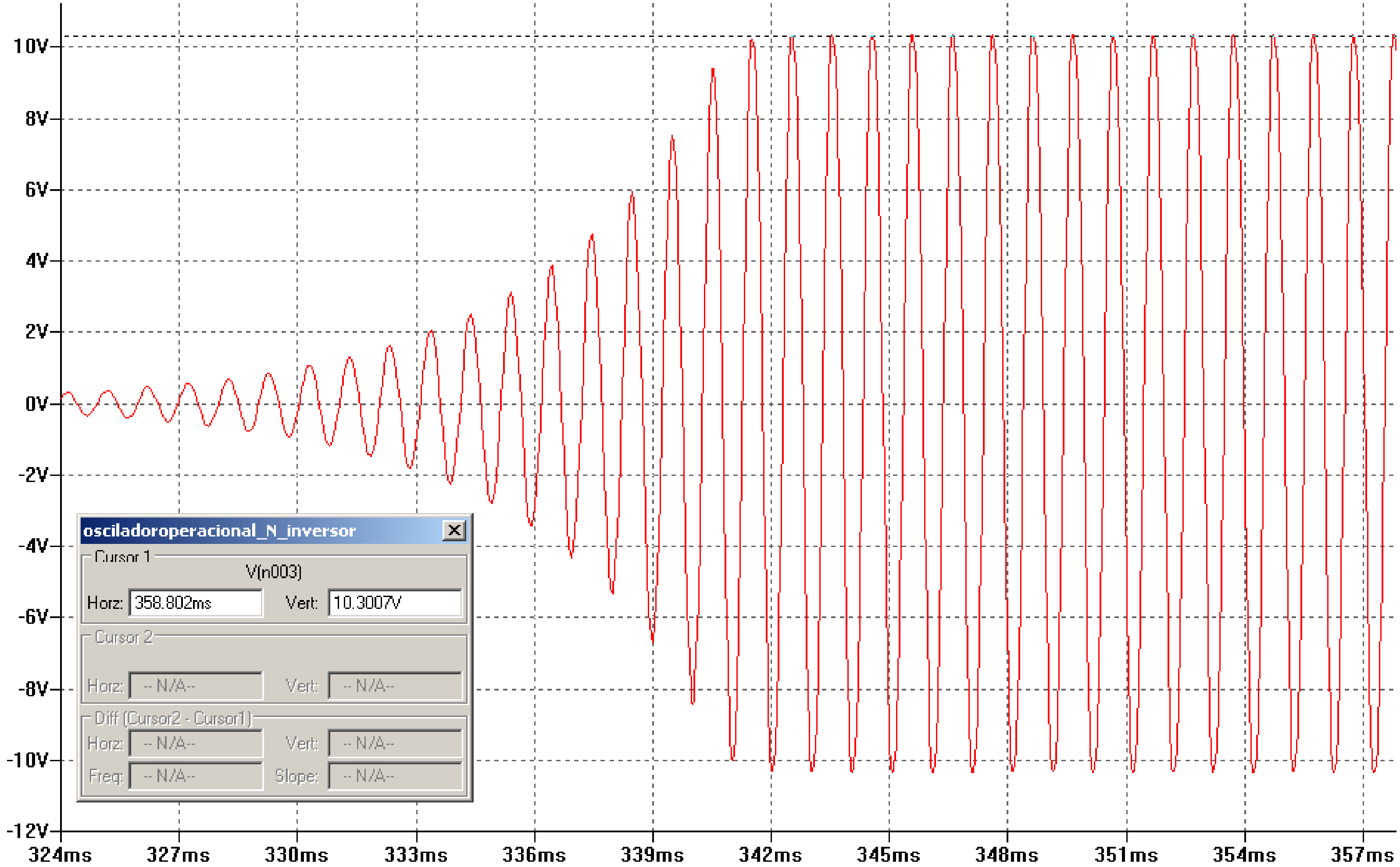
$$v_b = v_1 + v_{D2} = v_{o\max} \frac{R_1}{R_1 + R_2} + v_{D2}$$

Oscilador em ponte Wien



$$v_{o\max} \cong \frac{3\left[\left(1+\frac{R_6}{R_5}\right)v_{D2}+V\right]}{\left(\frac{2R_6}{R_5}+1\right)}$$

Oscilador em ponte Wien



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Oscilador em ponte Wien