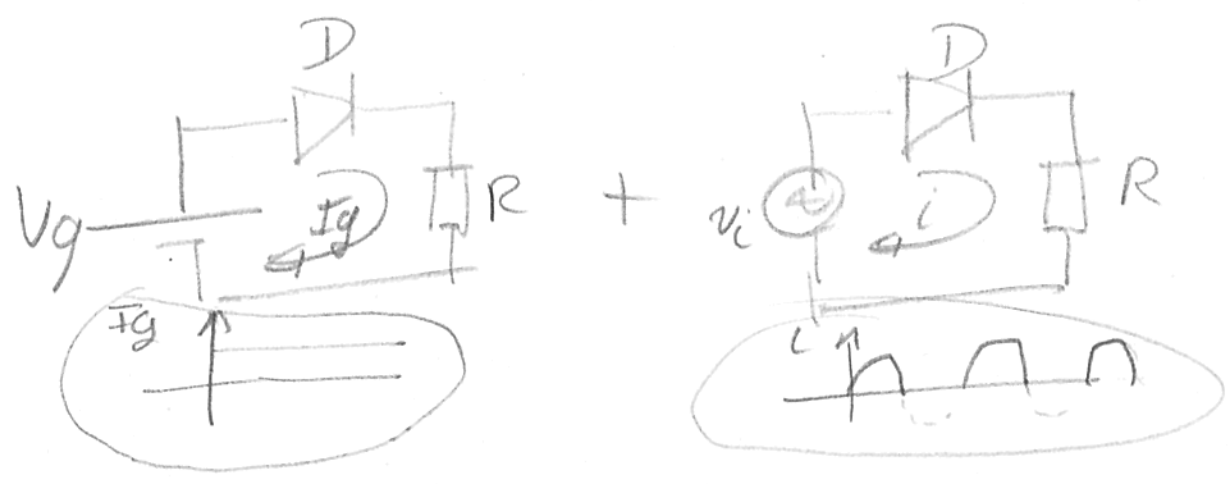


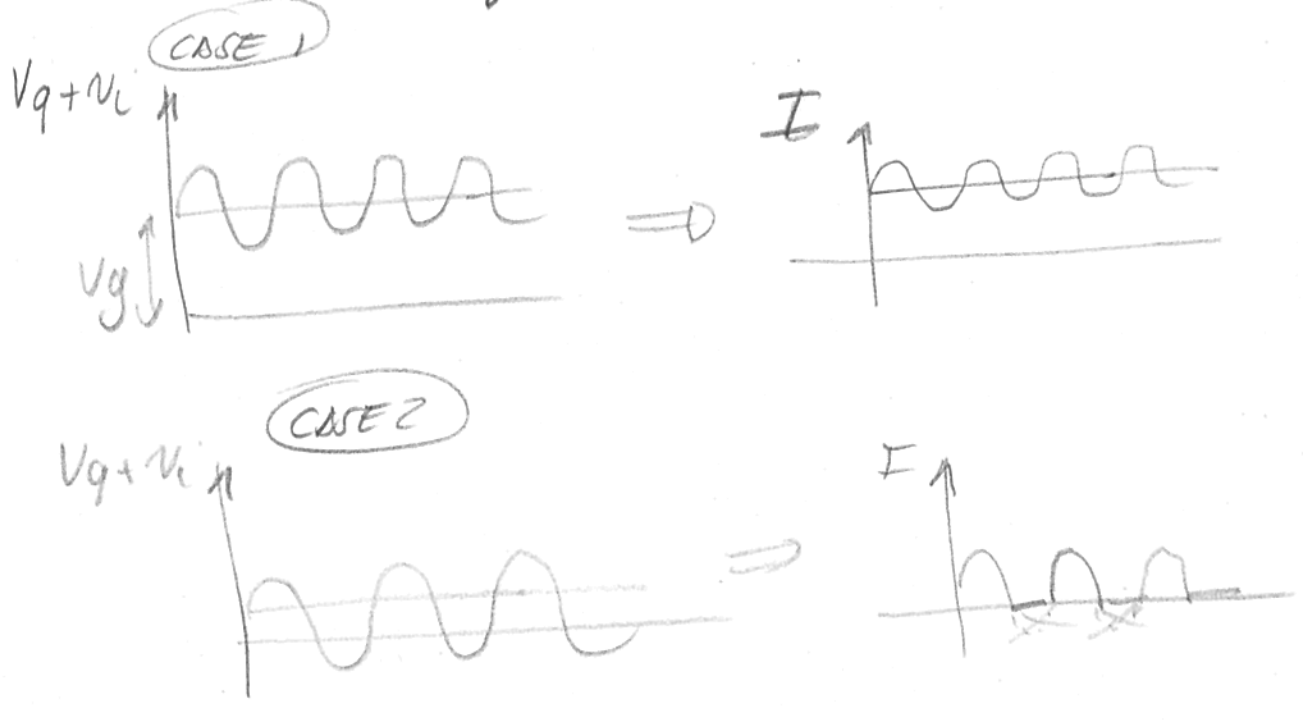
Superposition doesn't apply with diodes:

Analog Systems
 23/2/2012 (1)
 Small signal models



obviously $I \neq I_g + i$

let's see why:



• There is "some kind" of superposition?

Analog Systems

13/12/2012 (2)

Small signal models

Taylor's series provides a solution....

$$I_D = I_0 \left(e^{\frac{V_D}{V_T}} - 1 \right) \Rightarrow$$

$$I_D|_Q = I_0 \left(e^{\frac{V_D|_Q}{V_T}} - 1 \right) = I_D|_{V_D = V_D|_Q}$$

$$I_D|_{V_D} = I_D|_{V_D|_Q} + \frac{\partial I_D}{\partial V_D} \Big|_{V_D|_Q} (V_D - V_D|_Q) \Rightarrow$$

$$I_D|_Q + i_d = I_D|_{V_D|_Q} + \frac{\partial I_D}{\partial V_D} \Big|_{V_D|_Q} v_d \Rightarrow$$

$$i_d = \frac{\partial I_D}{\partial V_D} \Big|_{V_D|_Q} v_d = \frac{v_d}{R_d}$$

$$R_d = \frac{1}{\frac{\partial I_D}{\partial V_D} \Big|_{V_D|_Q}}$$

For a standard diode:

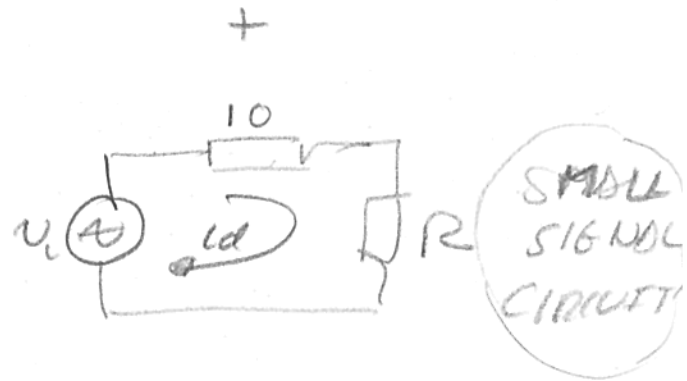
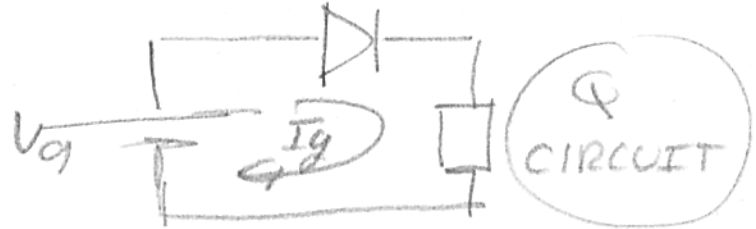
$$R_D = \frac{\Delta}{I_0 \cdot \frac{1}{V_T} e^{\frac{V_{DQ}}{V_T}}} \approx 10 \Omega$$

Analog Systems

13/1/2017 (3)

Small signal models

hence:



As long as $i_d \ll I_g$