$i_D = I_S\left(e^{\frac{u_D}{u_T}} - 1\right)$ $\quad u_D = u_T \ln\left(\frac{i_F}{I_S} + 1\right)$

a) Nein

b) $i_1 = G u_1 + I_S\left(e^{\frac{u_1 - u_2}{u_T}} - 1\right)$

$i_2 = I_S\left(e^{-\frac{u_2}{u_T}} - 2\right) - I_S\left(e^{-\frac{u_2}{u_T}} - 1\right) - I_S\left(e^{\frac{u_1 - u_2}{u_T}} - 1\right) =$

$= I_S e^{-\frac{u_2}{u_T}} - I_S - I_S e^{-\frac{u_2}{u_T}} + I_S - I_S e^{\frac{u_1 - u_2}{u_T}} + I_S =$

$= -I_S e^{\frac{u_1 - u_2}{u_T}}$

c) $\left.\frac{\partial i_1}{\partial u_1}\right|_{AP} = G_1 + \frac{I_S}{u_T} e^{\frac{u_{1AP} - u_{2AP}}{u_T}}$ $\qquad \left.\frac{\partial i_2}{\partial u_1}\right|_{AP} = -\frac{I_S}{u_T} e^{\frac{u_{1AP} - u_{2AP}}{u_T}}$

$\left.\frac{\partial i_1}{\partial u_2}\right|_{AP} = -\frac{I_S}{u_T} e^{\frac{u_{AP} - u_{2AP}}{u_T}}$ $\qquad \left.\frac{\partial i_2}{\partial u_2}\right|_{AP} = \frac{I_S}{u_T} e^{\frac{u_{1AP} - u_{2AP}}{u_T}}$

$$G_{AP} = \begin{bmatrix} G + \frac{I_S}{u_T} & -\frac{I_S}{u_T} \\ -\frac{I_S}{u_T} & \frac{I_S}{u_T} \end{bmatrix}$$

d) ESB für die Gegenwirkung

$i_1 = G u_1 + \frac{I_S}{u_T}(u_2 - u_2)$

$i_2 = \frac{I_S}{u_T}(u_2 - u_1)$