

choose equilibria for S vectors & a free one EE 434
03/07/07
free one choose to get $W = W^T$

Ex: $S = 2$

$$C_1 \frac{dn_1}{dt} = -G_1 n_1 + I_1 + [w_{11} \ w_{12}] \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$$

$$n = \begin{bmatrix} n_1 \\ n_2 \end{bmatrix}$$

$$C_2 \frac{dn_2}{dt} = -G_2 n_2 + I_2 + [w_{21} \ w_{22}] \begin{bmatrix} a_1 \\ a_2 \end{bmatrix}$$

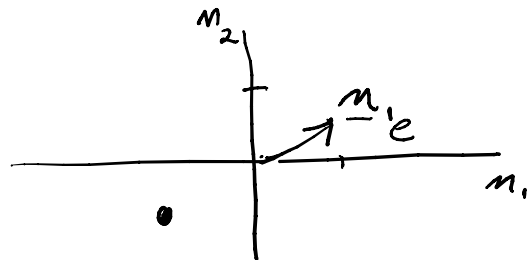
$$I = \begin{bmatrix} I_1 \\ I_2 \end{bmatrix}$$

$$G = \begin{bmatrix} G_1 & 0 \\ 0 & G_2 \end{bmatrix}, \quad C = \begin{bmatrix} C_1 & 0 \\ 0 & C_2 \end{bmatrix} \quad G_i > 0, \quad C_i > 0 \quad i=1, 2$$

$$W = \begin{bmatrix} w_{11} & w_{12} \\ w_{21} & w_{22} \end{bmatrix}, \quad \text{desire } W = W^T \Rightarrow w_{21} = w_{12}$$

$$a = \begin{bmatrix} f_1(n_1) \\ f_2(n_2) \end{bmatrix}$$

assume $f(x) = \tanh(x)$



$$\underline{n}_{1e} = \begin{bmatrix} 0.5 \\ 0.25 \end{bmatrix}$$

$$\underline{n}_{2e} = \begin{bmatrix} -0.25 \\ -0.5 \end{bmatrix}$$

choose $\underline{n}_{3e} = \begin{bmatrix} x_1 \\ x_2 \end{bmatrix}$ to get $W = G X Y^{-1}$ symmetric

$$X = \begin{bmatrix} \frac{1}{2} - x_1 & -\frac{1}{4} - x_1 \\ \frac{1}{4} - x_2 & -\frac{1}{2} - x_2 \end{bmatrix}$$

$$Y \Rightarrow \underline{a}_{1e} = \begin{bmatrix} \tanh(1/2) \\ \tanh(1/4) \end{bmatrix}, \quad \underline{a}_{2e} = \begin{bmatrix} \tanh(-1/4) \\ \tanh(-1/2) \end{bmatrix}$$

$$Y = \begin{bmatrix} \tanh(1/2) - \tanh(x_1) & \tanh(-1/4) - \tanh(x_1) \\ \tanh(1/4) - \tanh(x_2) & \tanh(-1/2) - \tanh(x_2) \end{bmatrix}$$

have 2 unknowns, x_1 & x_2 and one eq. $w_{21} = w_{12}$

$$w_{12} \times \det Y = G_1 \left[\left(\frac{1}{2} - x_1 \right) \left(-\frac{1}{4} - x_1 \right) \right] \begin{bmatrix} (-1) [\tanh(-1/4) - \tanh(x_1)] \\ [\tanh(1/2) - \tanh(x_1)] \end{bmatrix} \leftarrow \begin{matrix} (1,2) \text{ entry} \\ \text{of } Y^{-1} \\ = (2,1) \\ \text{cofactor of } Y \end{matrix}$$

$$w_{21} \times \det Y = G_2 \left[\left(\frac{1}{4} - x_2 \right) \left(-\frac{1}{2} - x_2 \right) \right] \begin{bmatrix} [\tanh(-1/2) - \tanh(x_2)] \\ (-1) [\tanh(1/4) - \tanh(x_2)] \end{bmatrix} \leftarrow \begin{matrix} (2,1) \text{ entry} \\ \text{of } Y^{-1} \\ = (1,2) \text{ cofactor} \\ \text{of } Y \end{matrix}$$

$$W = \begin{bmatrix} 2.15568 & -0.035206 & 0 & 0 \\ -0.035213 & 2.1522 & 0 & 0 \\ 0 & 0 & 2.15568 & -0.035206 \\ 0 & 0 & -0.035213 & 2.1522 \end{bmatrix}, \quad I = \begin{bmatrix} 0.012446 \\ -0.010841 \\ 0.012446 \\ -0.010841 \end{bmatrix}$$

$$G = \begin{bmatrix} 2 & & & \\ & 2 & & \\ & & 2 & \\ & & & 2 \end{bmatrix} \quad C = \begin{bmatrix} 5 & & & \\ & 5 & & \\ & & 5 & \\ & & & 5 \end{bmatrix}$$