EE 434
02/25/08

$$\frac{du}{dt} = -\underset{G}{u} + W \overset{f(u)}{\tanh u} + I$$

$$u = \frac{1}{s}\left\{-u + W \tanh u + I\right\} \qquad \frac{1}{s}x = \int_0^t x(\tau)\,d\tau + x(0)$$

$$u_{eq_1} = \begin{bmatrix} 1 \\ 0 \end{bmatrix}, \quad u_{eq_2} = \begin{bmatrix} 0 \\ -1 \end{bmatrix}, \quad u_{eq_3} = \begin{bmatrix} -1/2 \\ +1/2 \end{bmatrix}$$

Stability: Lyapunov function; Energy function = power in a circuit

$\mathcal{L}(u)$: $\quad \mathcal{L}(u(t)) >$ constant $= 0$ if passive

$$\frac{d\mathcal{L}(u(t))}{dt} \le 0 \quad \text{(always decreasing)}$$

$\therefore$ goes to a fixed (stable) point

Power in an electric circuit is $v^T(t)\, i(t)$

$a = \tanh u$

$$\mathcal{L}(u) = -a^T \frac{W}{2} a - a^T I + \sum_{i=1}^{N} G_i \int_0^{a_i} f^{-1}(x_i)\,dx_i$$

≥ 0 if $G_i \ge 0$

integrating here

here $\mathcal{L}(u)$ is bounded since $-1 \le a_i \le 1$

$\therefore$ the key is $\dfrac{d\mathcal{L}(u)}{dt}$.