

2) two-time scales dynamical system

$$\left\{ \begin{array}{l} \varepsilon \dot{\mathbf{v}}(t) = -\mathbf{v}(t) + \mathbf{g}(\mathbf{x}(t)) \\ \varepsilon \dot{\mathbf{w}}(t) = -\mathbf{w}(t) + \mathbf{h}(\mathbf{x}(t)) \\ \varepsilon \dot{\mathbf{y}}(t) = -K\mathbf{y}(t) + (I - K)[\mathbf{g}(\mathbf{x}(t)) - \mathbf{v}(t)] \\ \varepsilon \dot{\mathbf{z}}(t) = -K\mathbf{z}(t) + (I - K)[\mathbf{h}(\mathbf{x}(t)) - \mathbf{w}(t)] \\ \hline \dot{\mathbf{x}}(t) = -\mathbf{x}(t) + \frac{\mathbf{y}(t)}{\mathbf{z}(t)} \end{array} \right.$$

If ε is sufficiently small ...

- first subsystem is much faster than second one
- first subsystem is globally exponentially stable