

Supplement

Wong and Wang's dynamics

$$\frac{ds_i}{dt} = -\frac{s_i}{\tau_s} + (1 - s_i)\gamma H_i \quad (14)$$

$$H_i = \frac{ax_i - b}{1 - \exp[-d(ax_i - b)]} \quad (15)$$

$$x_1 = J_{N,11}s_1 - J_{N,12}s_2 + I_0 + I_1 \quad (16)$$

$$x_2 = J_{N,22}s_2 - J_{N,21}s_1 + I_0 + I_2 \quad (17)$$

$$I_i = J_{A,ext}\mu_0 \left(1 \pm \frac{c}{100\%}\right) \quad (18)$$

where $i = 1, 2$, $a = 270(\text{VnC})^{-1}$, $b = 108\text{Hz}$, $d = 0.154\text{s}$, $\gamma = 0.641$, $\tau_s = 100\text{ms}$, $J_{N,11} = J_{N,22} = 0.2609\text{nA}$, $J_{N,12} = J_{N,21} = 0.0497\text{nA}$, $J_{A,ext} = 0.00052\text{nA} \cdot \text{Hz}^{-1}$, $\mu_0 = 30\text{Hz}$.

$$\begin{aligned} \frac{d\mathbf{g}(\mathbf{x})}{d\mathbf{x}} &= \mathbf{W} \frac{d\phi(\mathbf{x})}{d\mathbf{x}} \\ \frac{d\mathbf{B}(\mathbf{x})\mathbf{u}}{d\mathbf{x}} &= \begin{bmatrix} \mathbf{u}^\top \mathbf{W}_{B1} \frac{d\phi(\mathbf{x})}{d\mathbf{x}} \\ \vdots \\ \mathbf{u}^\top \mathbf{W}_{Bd} \frac{d\phi(\mathbf{x})}{d\mathbf{x}} \end{bmatrix} \end{aligned} \quad (19)$$

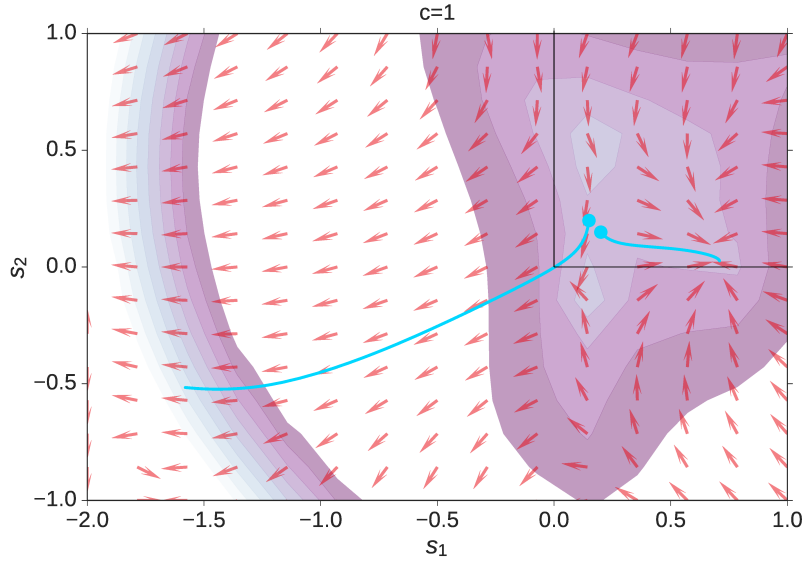


Figure 6: Failure mode of unregularized locally linear model: 1 s simulation from $\mathbf{x}_{t+1} = \mathbf{A}(\mathbf{x}_t)\mathbf{x}_t + \mathbf{B}(\mathbf{x}_t)\mathbf{u}_t + \mathbf{x}_t$ model.

Ring attractor

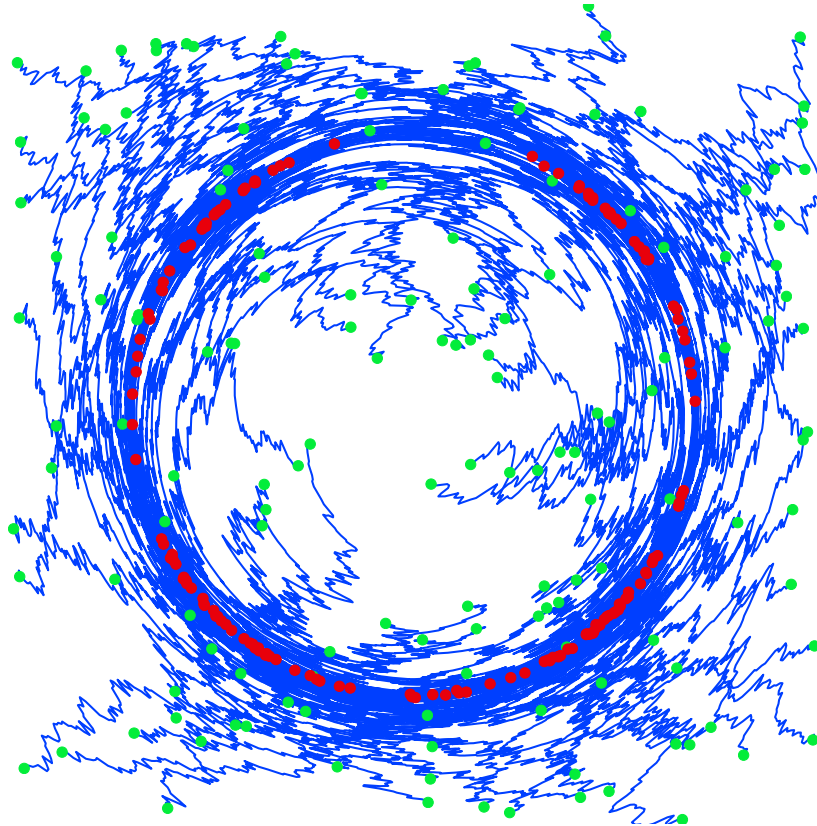


Figure 7: 150 training trajectories for the ring attractor. Green circles are initial states and red circles are final states.