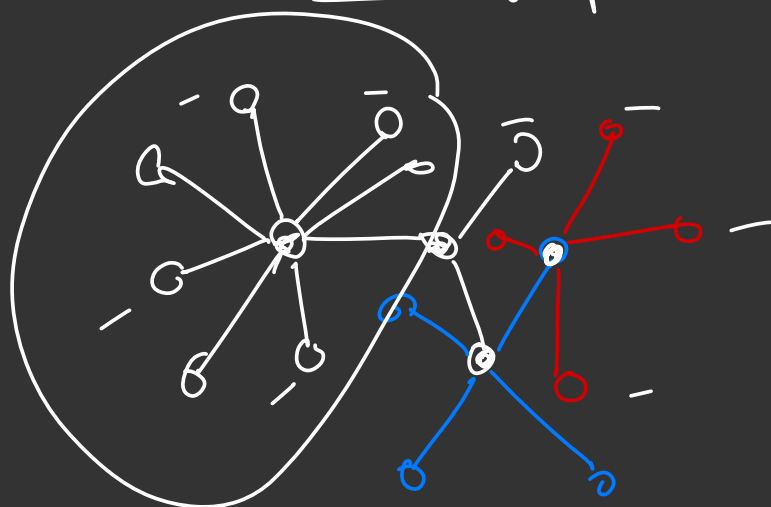
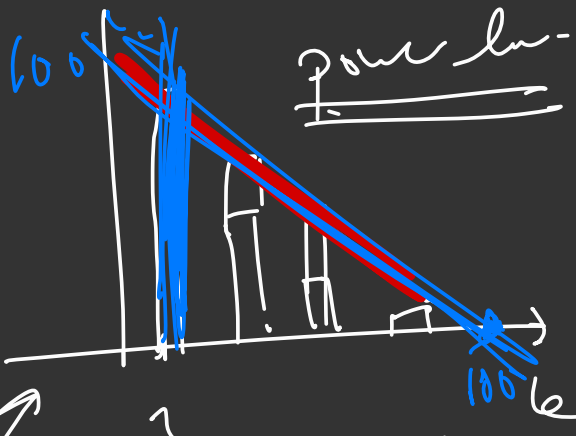


star graph



$P(k)$

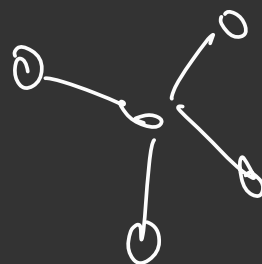
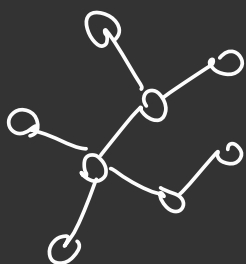


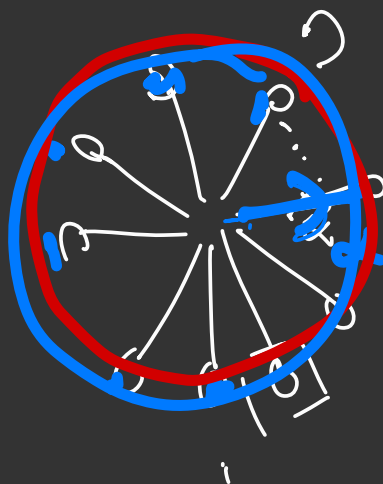
scale-free

$\beta = 3$

$\beta = 3$

Barabási





$N+1$ node

$\alpha \ll 1$ N : low-degree

1 : hubs

$$A = \begin{bmatrix} 0 & 1 & 1 & \dots & 1 \\ \vdots & & & & \\ i & & & & 0 \end{bmatrix}$$

$$x_i(t+1) = f(x_i(t)) + \alpha \sum_j A_{ij} H(x_i^{(H)}, x_j^{(H)})$$

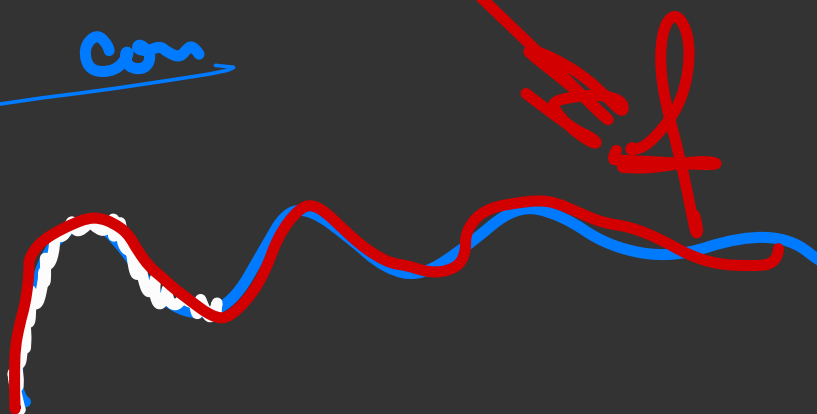
α : weak.

~~1. RNN ESN~~

low degree

②. $A_{hi} H(x_i, x_j) \sim 0$ \rightarrow exp.

$\alpha \ll 1$ con



$$\boxed{x_i(t+1)} = \boxed{RC(x_i(t))} + \underline{\text{Coupling}}$$

The diagram illustrates the update rule for $x_i(t+1)$. It shows a sequence of points $x_i(t)$ and $x_i(t+1)$ connected by arrows. A red box highlights the transition from $x_i(t)$ to $x_i(t+1)$, and a blue box highlights the transition from $RC(x_i(t))$ to $x_i(t+1)$.

$$x_i(t+1) - RC(x_i(t)) = \text{Coupling}$$

Coupling

hub

$$\sum_{i \neq j} A_{ij} H(x_i, x_j) =$$

↓
reduces to

$$\int V(x_i) dx$$

n.h.

→ proof
exp

$$x_i(t+1) = \underbrace{RC_f(x_i, t)}_{\alpha} \int \sqrt{d\mu}$$

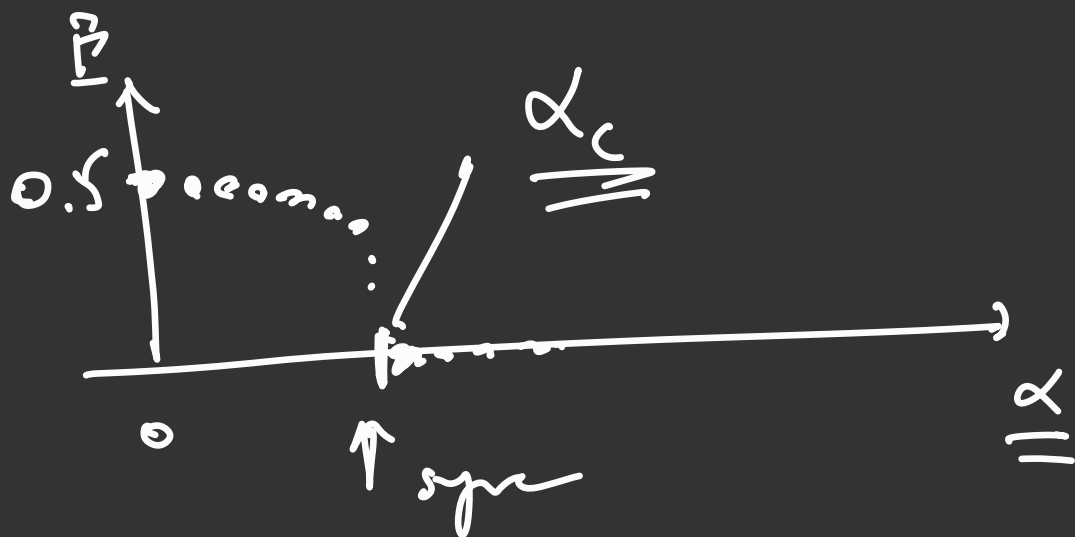
\downarrow
 RC_f

$$x_i(t+1) = \underbrace{RC_f(x_i)}_{\alpha} + \underbrace{\beta}_{\text{learning rate}} \underbrace{RC_n(x_i)}_{\text{noise}}$$

\downarrow

learning rate

noise = 1



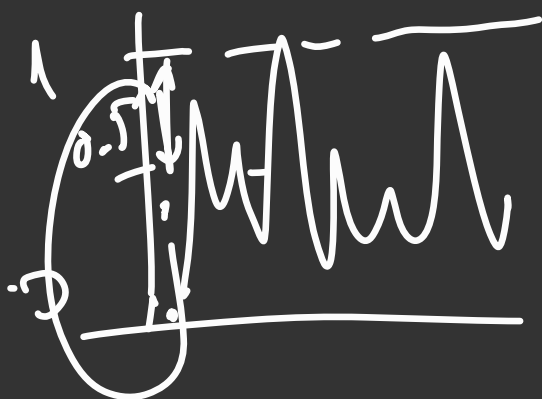
$$E = \frac{1}{N} \sum_i \sum_j (x_j - x_i)$$

Sync Error.

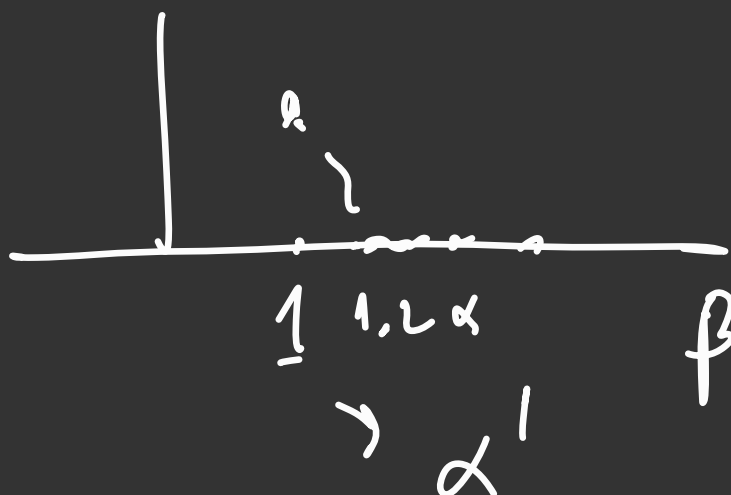
0.0000015

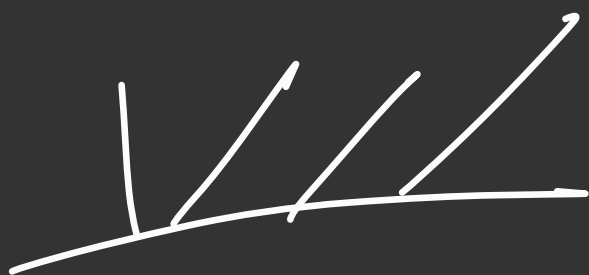
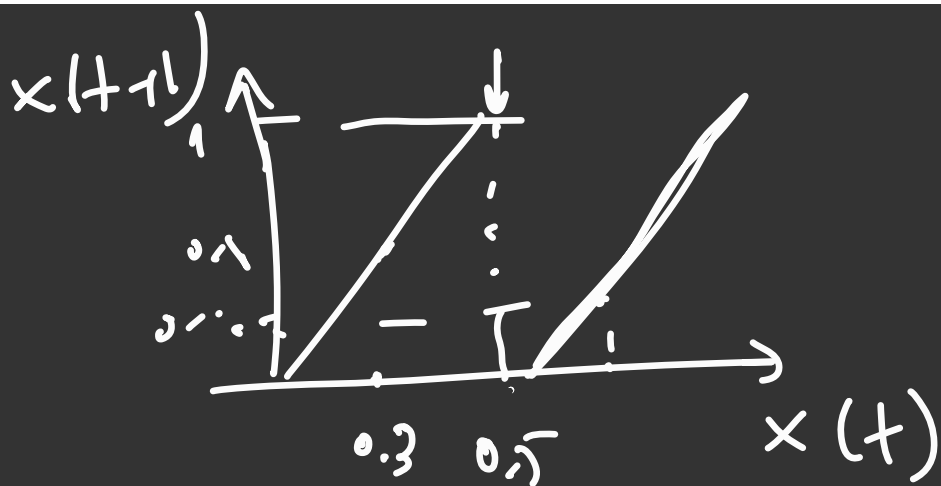
double

$$x(t+1) = (2x(t) + \text{mod } 1)$$



$$\lambda = 2$$





expand.

