Section 1: Try oscillator network solver

➢ Select oscillator and press button in red rectangle.
➢ The oscillation state and initial random conditions will be shown.

Simulate network of MEMS oscillator

Simulate a oscillator network with random initial phase and random coupling weights

Section 2: Image convolution

➢ Press the convolution simulation button to simulate convolution using oscillator network.

Simulate Convolution

• Notice the regression is performed over the range (-0.05,0.05). We need to preprocess the number before convolution.

Section 3: Pattern recognition

➢ Step 1: Select the patterns to be remembered by the network. Interact with the red area
Step 2:
- Reconstruct the noisy image or half of the image.
➢ Play with the network energy function.
➢ The pattern is located at the local minimum of the energy function.

**Hopfield energy function:**

\[
E = -\frac{1}{2} \sum_{i=1}^{n} \sum_{j=1}^{n} w_{ij} x_i x_j
\]

Let's pretend that vector \( \mathbf{a} = (a_1, a_2) \) and \( \mathbf{b} = (b_1, b_2) \) is stored in the network.

And as you can see in the figure, \( \mathbf{a} \) and \( \mathbf{b} \) are located as the local minimum.