My research combines *modeling*, *theoretical analysis*, *and numerical simulations* to study real world systems.

I am often interested in understanding how patterns, coordination, and order arise in complex systems.





**Suggested prerequisites:** MAT 326 (Differential equations), experience/interest in MATLAB programming

## Spontaneous synchronization

## **Observation:**

Source: Ikeguchi Laboratory

## Kuramoto model:

$$\ddot{u}_i + \alpha \dot{u}_i = \omega_i + \frac{\kappa}{N} \sum_{j=1}^N \sin(u_j - u_i), \ \ i = 1, \dots, N$$

## Questions:

- What patterns can arise in the system?
- What parameters give rise to which patterns?