Communication using Synchronized Chaotic Systems

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Introduction

- Two optoelectronic chaotic oscillators may synchronize when coupled together
- Chaotic synchronization has attracted attention for uses in secure communications
- Such systems are sensitive to perturbations in the communication channel
- We explore the benefits of implementing an adaptive strategy on a chaotic communication system

Communication

The phenomenon of synchronization may be exploited to recover a masked message from a chaotic transmitter.

Transmitter (closed loop) Receiver (open loop)

m(t) → m'(t)

When a digital message is sent as an added modulation,
- Sending “zero” causes no change; systems stay in sync
- Sending “one” creates mismatch between parameters of the transmitter and receiver loops; systems go out of synchrony
- The difference between the signals from the two loops (shown in pink below) can be rectified to reconstruct the original message

Adaptive Synchronization

A pseudorandom bit sequence is transmitted over a time-varying communication channel. We examine cases with and without the adaptive strategy implemented.

Bit error rate improved by a factor of ten.

We simulate how the bit error rate is improved by the adaptive strategy.

Conclusions

- Demonstrated communication with optoelectronic feedback loop including DSP
- How well they synchronize depends on how closely their parameters are matched

Future Work

- Experimentally validate the results of the numerical simulations performed
- Further investigate parameter regimes for which the adaptive strategy improves recovery

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