Synchronization of Chaotically Oscillating TWTs

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Data Communications

Need for higher data flow

Resistance to noise and other distortions

In a linear system, data is transmitted through phase and amplitude of signal

Linear regime has its limits
TWTs for Chaotic Synchronization

Modulate the parameters of the chaotic system to encode data in its dynamics

Requires synchronization of transmitter to the receiver to decode

Using two coupled TWTs for data transmission

Setup

TWT Master

Time Delay

0-16 dB

Coupling: Step Attenuator 0-69 dB

TWT Slave

Time Delay

0-16 dB
Model v. Experiment

Ideal system: no inherent differences between transmitter and receiver

Reality: nonlinear characteristics are inherently different between manufactured TWTs
Frequency Characteristics

Gain: Master

Gain: Slave
Synchronization in Experimental Data

Master: Magnitude v. Time

Slave: Magnitude v. Time

Master v. Slave: Amplitude/Phase Locking
Research

- Simulated a system of coupled TWTs with differing nonlinear characteristics to determine minimum coupling necessary to synchronize
- Measured phase synchronization of two coupled non-identical TWTs
- Examined the system at three stages of drive power to determine optimum synchronization
- Compared simulated and measured results