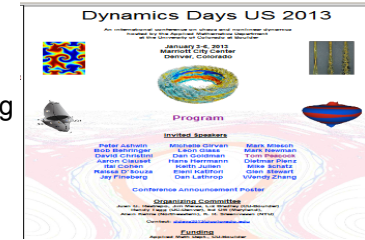


Amplitude Control in Chaotic Systems

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1. Background and motivation

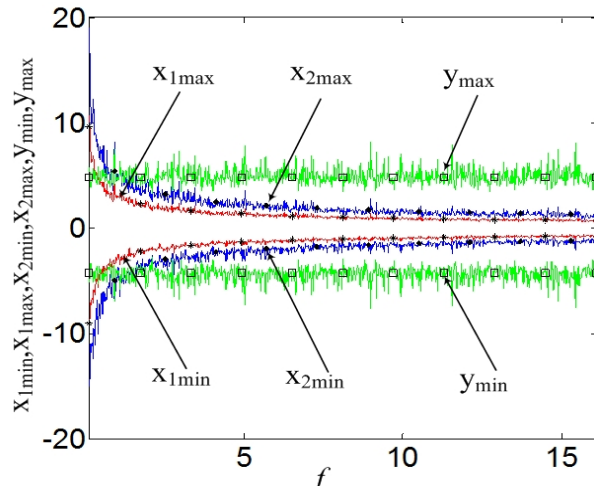
- Difficult to amplify a chaotic signal for broadband frequency characteristics.
- Eliminating extra hardware devices, and for flexibility.
- The amplitude controller may substitute for an amplifier or represent a new security key.

2. Definition of amplitude control

- Amplitude control: variables are controlled proportionally by Amplitude Parameter (AP)
- PAC: Partial Amplitude Control, only some variables controlled
- TAC: Total Amplitude Control, all variables controlled.

3. Piecewise linear systems

the constant term can realize TAC.



Example 1. Diffusionless Lorenz System (PAC)

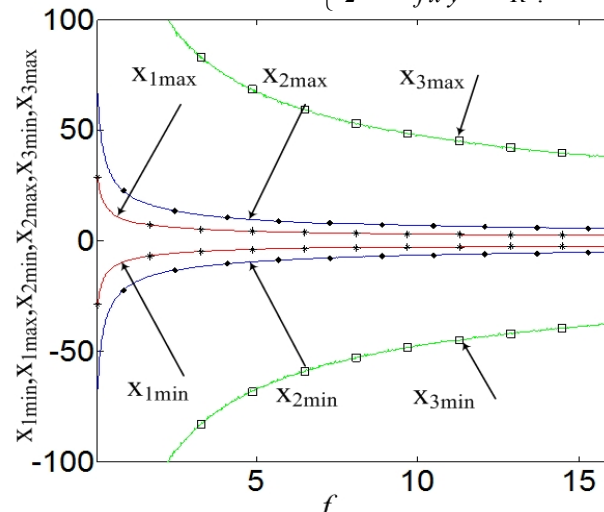
4. Polynomial systems

- ❖ There is no single AP for TAC in chaotic systems of polynomial nonlinearity with constant terms.
- ❖ Only a few examples with a constant term can provide AP for PAC.
- ❖ For a single nonlinearity without constant terms, the AP for TAC can always be obtained.
- ❖ For chaotic systems even with a constant term, two or more nonlinear terms can allow AP for PAC.

5. Examples

- ❖ Example 1. Diffusionless Lorenz System (PAC)

$$\begin{cases} \dot{x} = y - x, \\ \dot{y} = -xz, \\ \dot{z} = fxy - R. \end{cases}$$



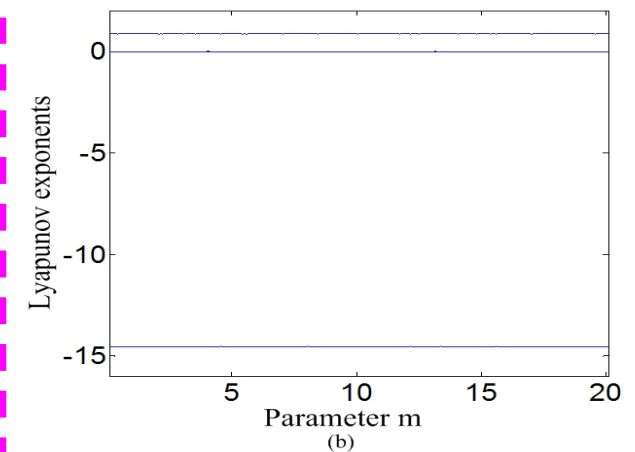
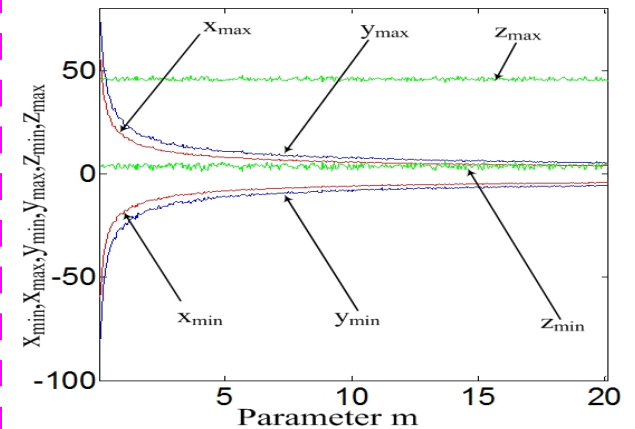
Example 2. Moore and Spiegel System (TAC)

5. Examples

- ❖ Example 2. Moore and Spiegel System (TAC)

$$\ddot{x} = -\ddot{x} + 9\dot{x} - 5x - fx^2\dot{x}.$$

- ❖ Example 3. Lorenz System (PAC)



Example 3. Lorenz System (PAC)