Amplitude Control in Chaotic Systems
Chunbiao Li and J.C. Sprott

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.

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 2. Moore and Spiegel System (TAC)
     \[ \ddot{x} = -9x + 5x - 9\dot{x}^2 \]
   - Example 3. Lorenz System (PAC)
     \[\begin{align*}
     \dot{x} &= y - x, \\
     \dot{y} &= -xz, \\
     \dot{z} &= fxy - R.
     \end{align*}\]