

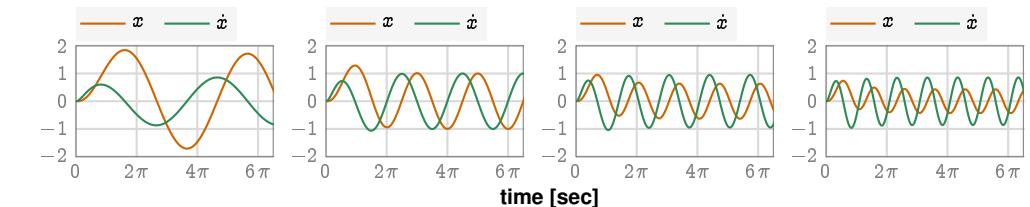
# The $\gamma(\Delta)$ Plots As a Frequency-like Analytic Tool For Complex Systems

## a. Linear System

(Macro structure present)

$$2.5\dot{x} + x = 2.5 \sin(\omega t)$$

$$\omega = [0.5 \quad 1.0 \quad 1.5 \quad 2.0.]$$

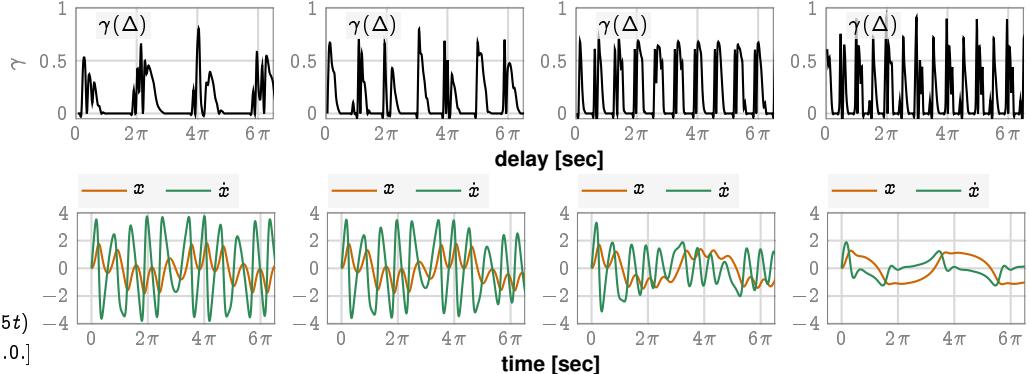


## b. Duffing Oscillator

(Macro structure present)

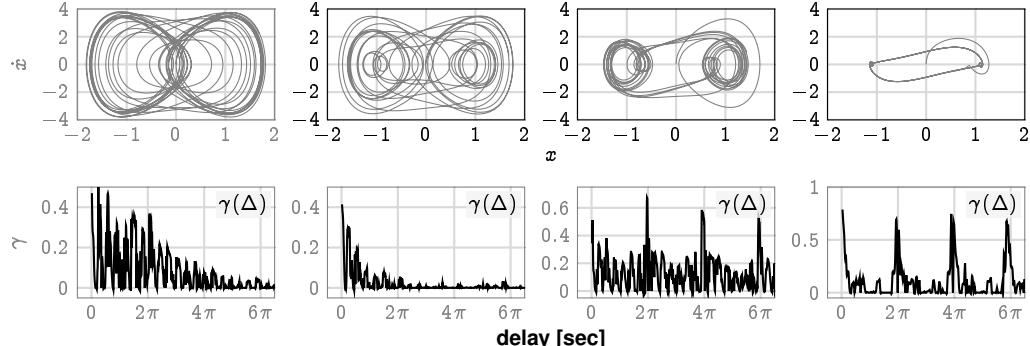
$$\ddot{x} + \delta\dot{x} + x + 5x^3 = 8 \cos(.5t)$$

$$\delta = [0.003 \quad 0.03 \quad 0.3 \quad 3.0.]$$



Periodic structure or

Decay in  $\gamma(\Delta)$  shows up in simple systems



## C. Real-world & Simulated Complex Systems

Periodic structure or

Decay in  $\gamma(\Delta)$  shows up in simulated complex systems only

