



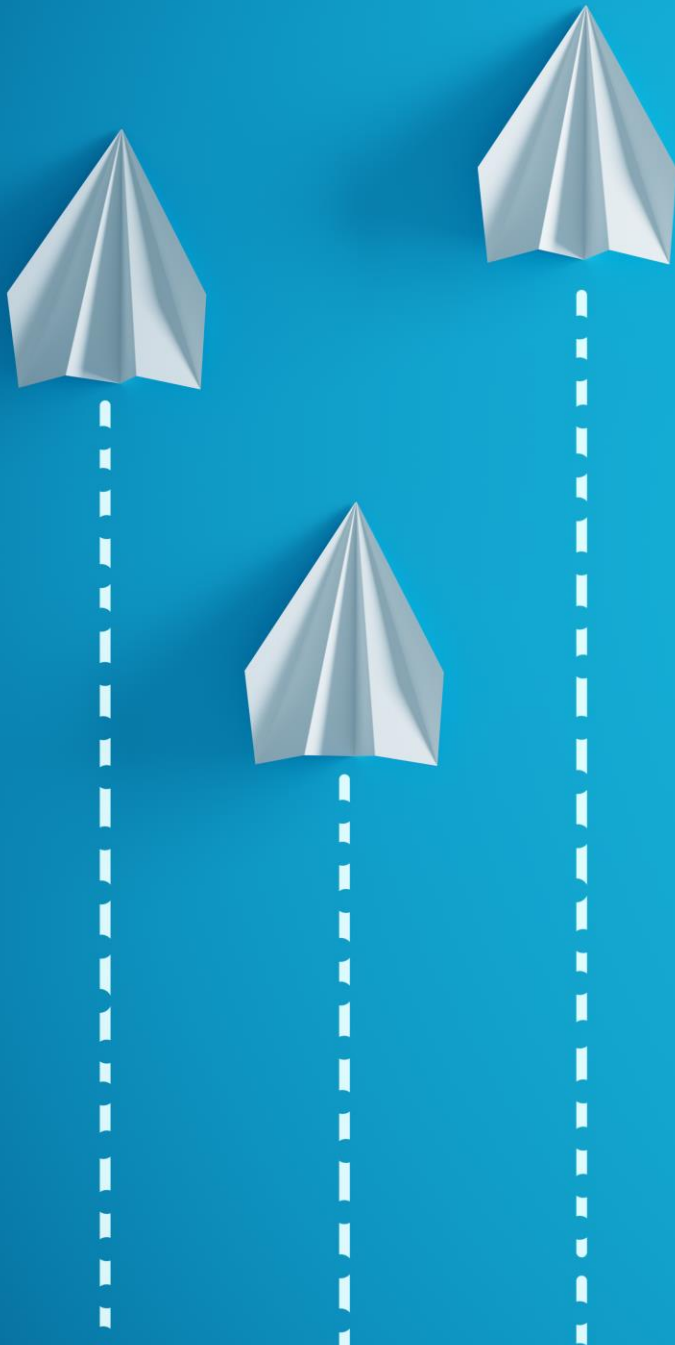
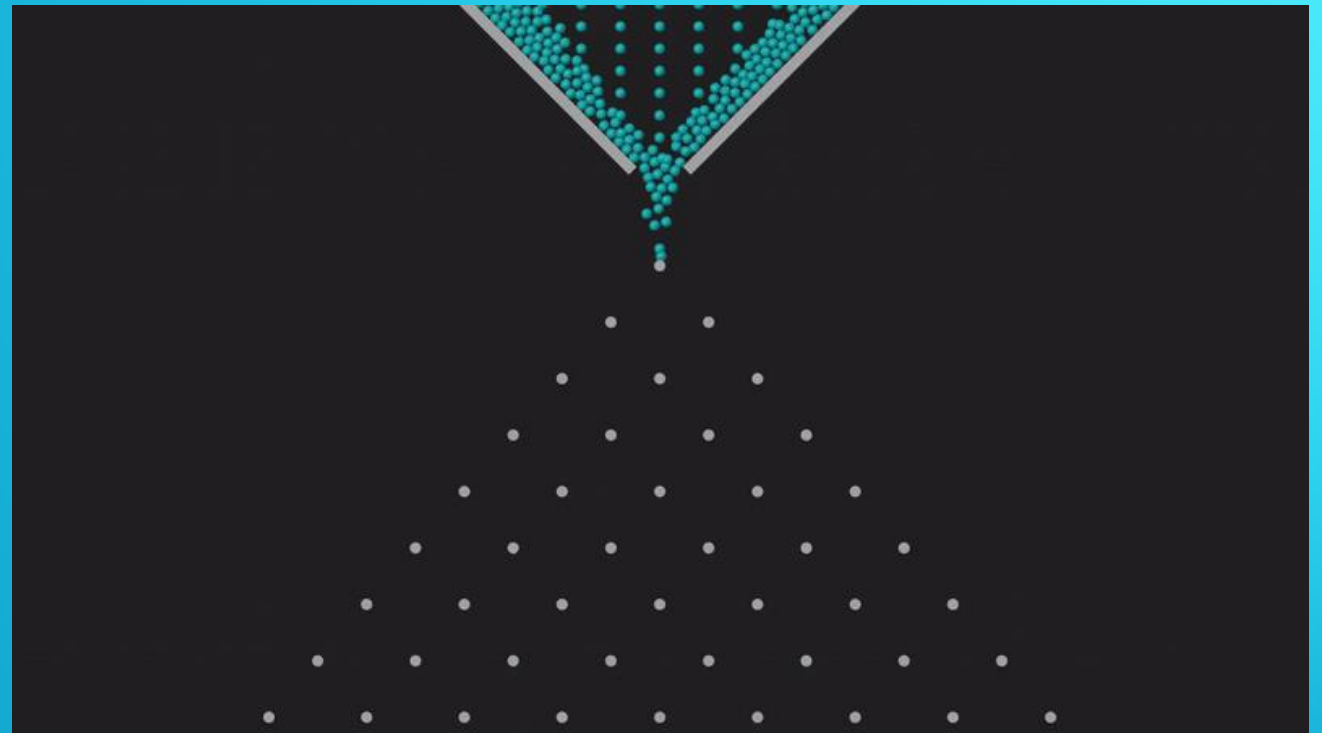
Learning Enhancement Project

UCD Teaching & Learning

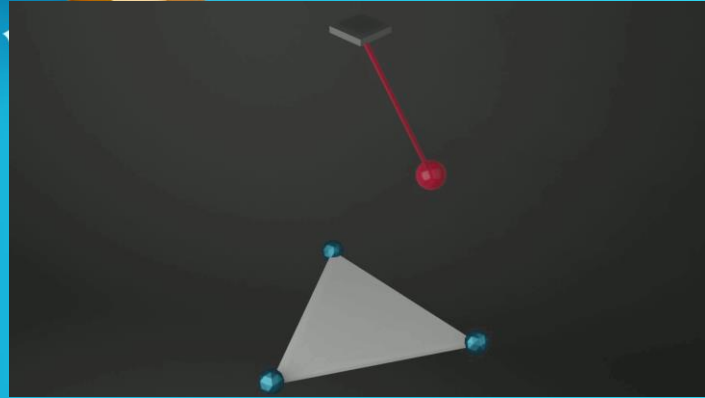
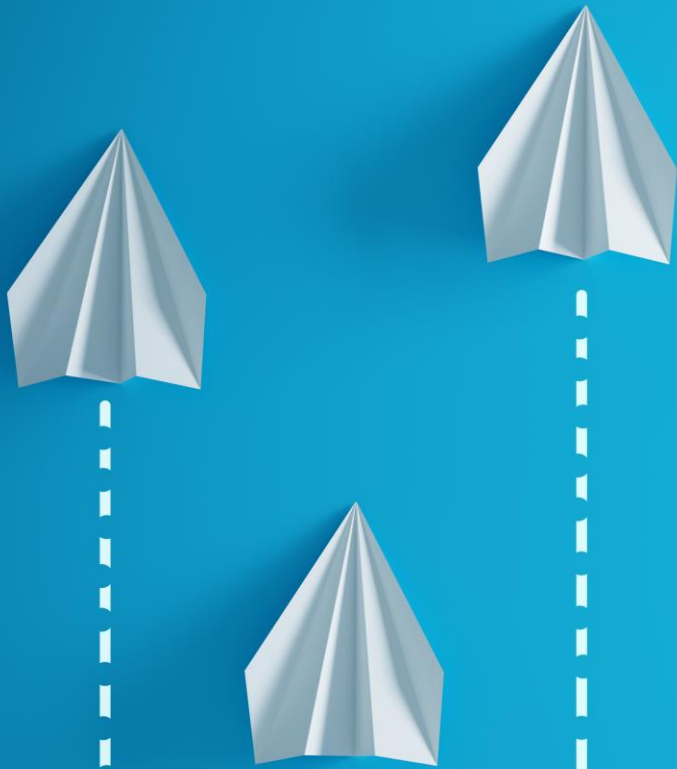



LO-FI(DELITY) SIMULATIONS OF DYNAMICS FOR HI-FI(DELITY) UNDERSTANDING

- Aidan Lee, Kevin Nolan, Vikram Pakrashi



UNDERSTANDING NONLINEARITY UNDERSTANDING CHAOS





Simulate
4 Nonlinear Systems
that appear *chaotic*:

Magnetic pendulum



Double pendulum

Spaceballs toy

Rollercoaster chaos

Routes to chaos
in the
magnetic pendulum

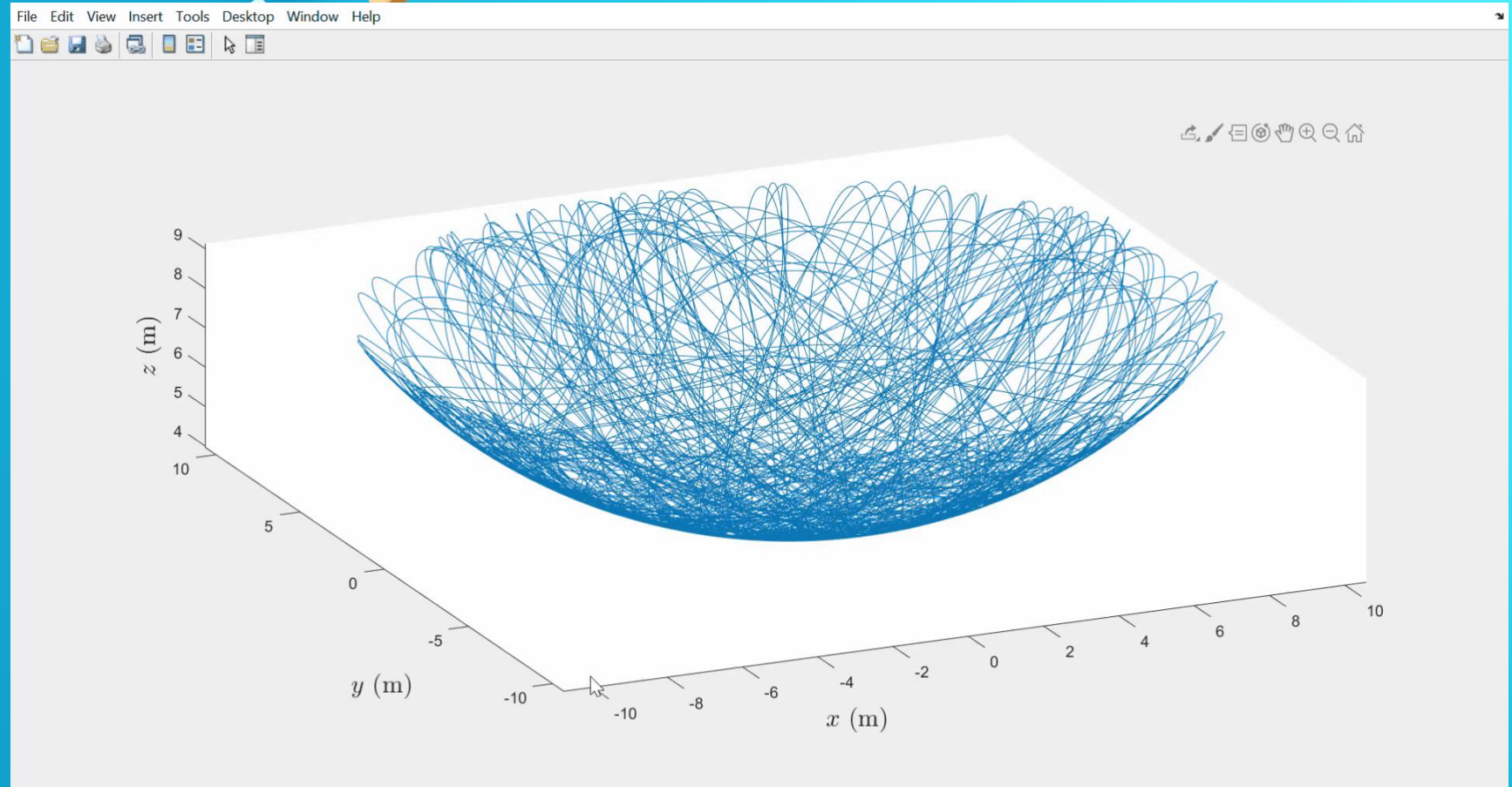
Intermittency
Fourier spectrum
Poincaré maps
Lyapunov exponent
Fractal dimensions
Time histories

Oscillating Galton Board
Simulations

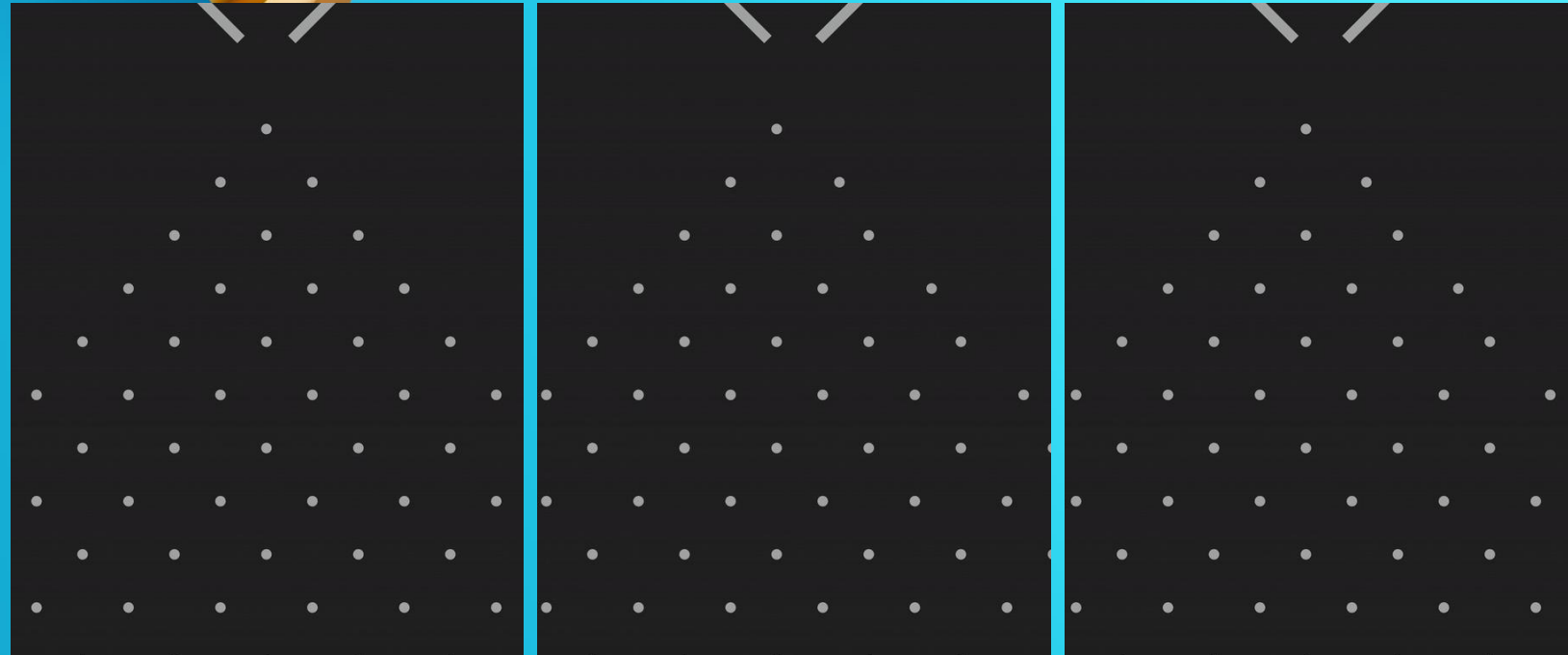
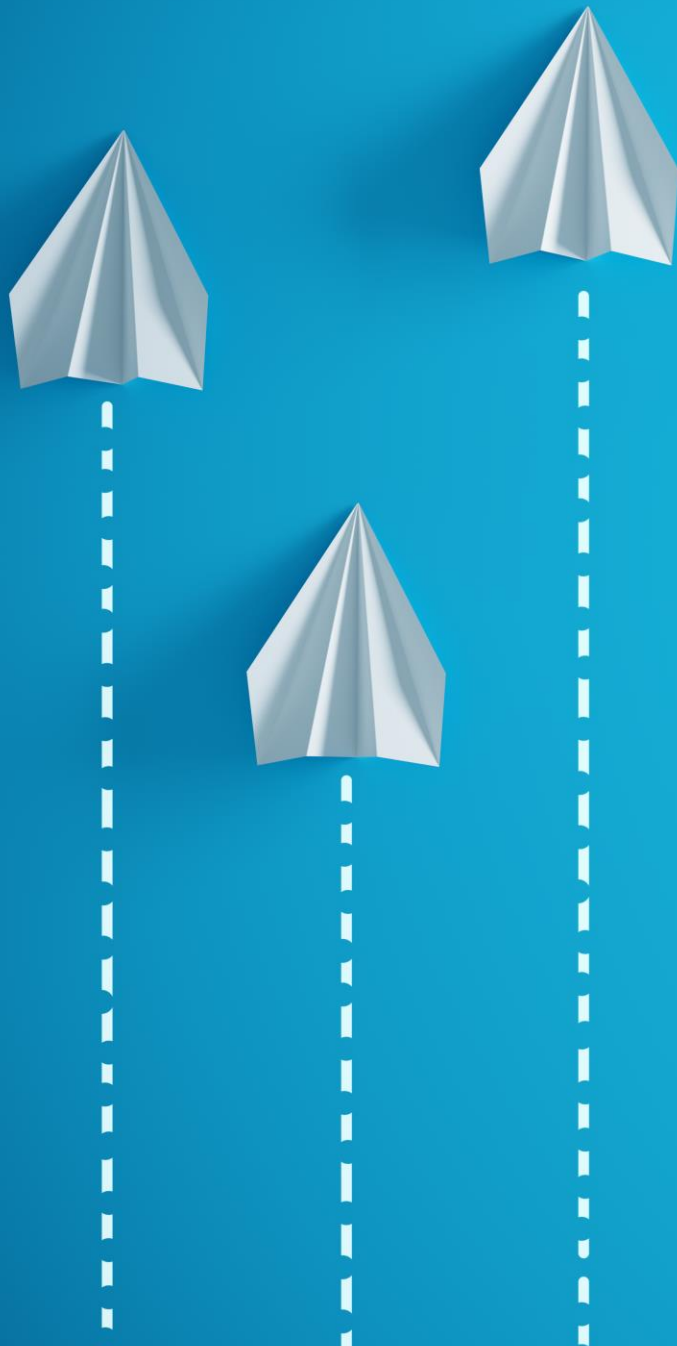
Effects of:
Frequency
Phase Difference
Amplitude

Narrowing?

Magnetic Pendulum Example

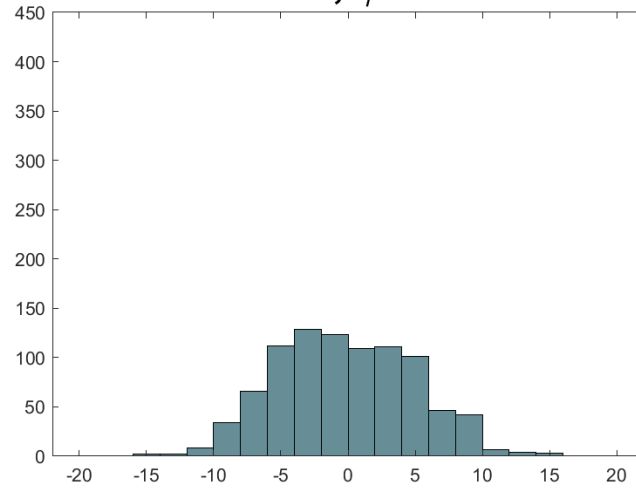


Oscillating Galton Board Example

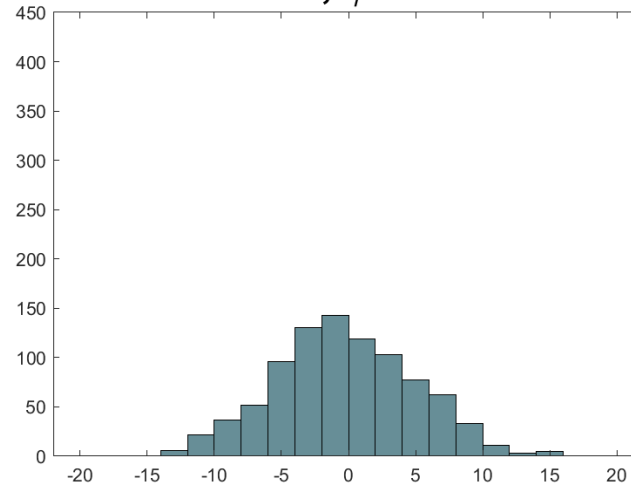


Oscillating Galton Board Example

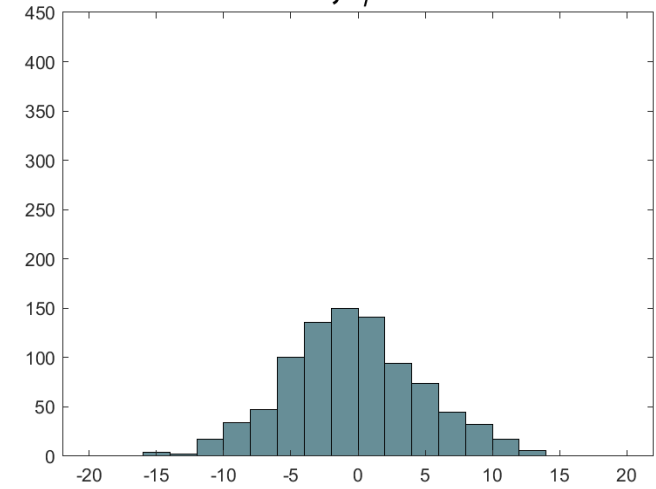
2 Hz, $\phi=0^\circ$



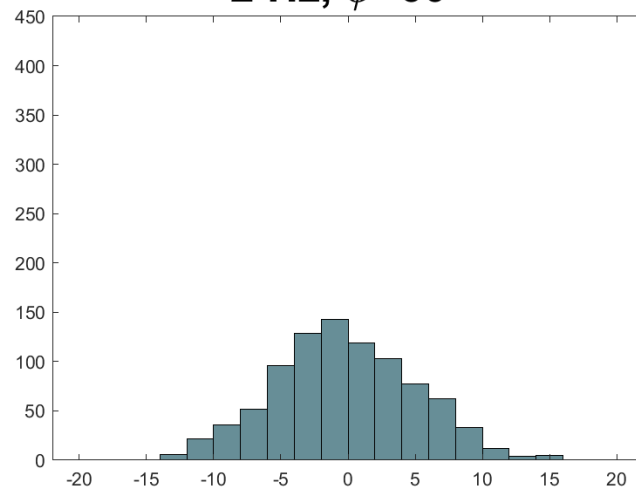
2 Hz, $\phi=30^\circ$



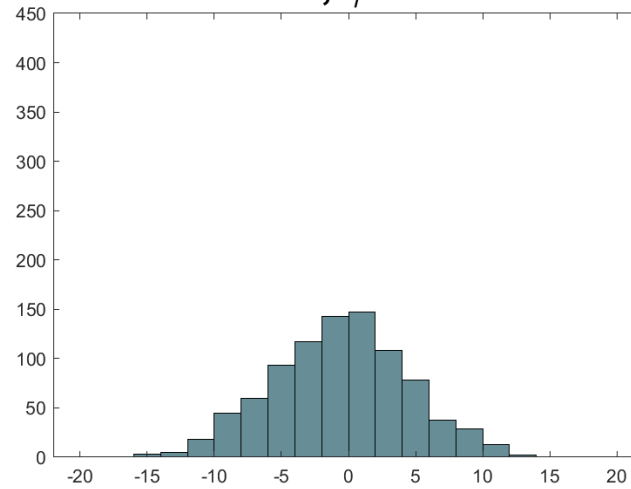
2 Hz, $\phi=45^\circ$



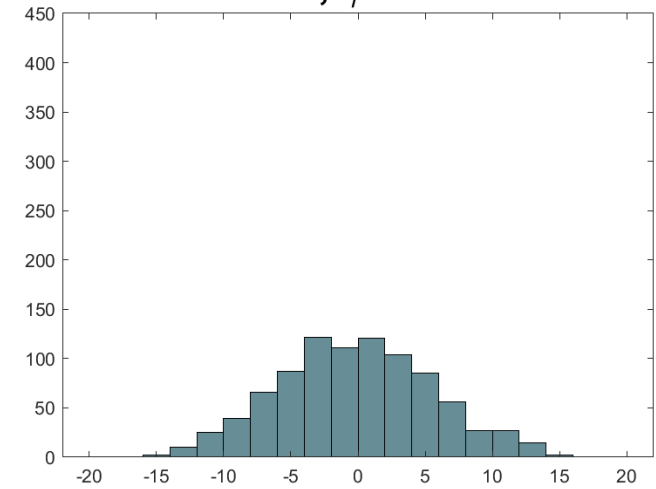
2 Hz, $\phi=60^\circ$



2 Hz, $\phi=90^\circ$



2 Hz, $\phi=180^\circ$



Conclusions



Reacting to Covid19

New set of simulations and physical test for nonlinear mechanics teaching with UDL aspects and involving UCD Agile Community (via poster)

Repository : <https://github.com/a-zy-lee/Blender-NonlinearChaosDynamics>

Oscillating Galton board were presented at the Internal Conference on Engineering Vibration 2020, hosted by University of Aberdeen, 2020.

Second prize (Aidan Lee) in Engineers Ireland 'This is Engineering' Video Competition

All Ireland Conference on Undergraduate Research 2021, University of Limerick 2021.