Physical Math Seminar

Exploiting periodicity in the dynamic stability of systems with time-varying properties

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ABSTRACT:

Dynamic stability is the ability of a system's configurational state to overcome a disturbance over time. A common way to passively control this dynamical feature is to periodically modulate the properties of the system in time. This is what is done to trigger the swings of the Butafumeiro at the Santiago de Compostela Cathedral, to dynamically stabilize charged particles in mass spectrometers or to sustain exotic quantum states in Floquet engineering.

In this presentation, we show that new dynamical phenomena emerge when the periodic variations of the system's properties are large and occur on similar time scales than the natural ones. In this regime, it becomes straightforward to break the record of super-harmonic orders observed in the parametric pumping of an oscillator or to dynamically trap a magnetic dipole on its unstable equilibrium thanks to an overlooked quantum analogy.

All the shown examples are rationalized through a fundamental 1 degree-of-freedom model and some desktop-scale experiments but the dynamical concepts being universal, it should offer new functionalities across scales and engineering domains.

TUESDAY, MARCH 12, 2024
2:30 PM – 3:30 PM
Building 2, Room 131
NOTE Location

https://math.mit.edu/pms/

Massachusetts Institute of Technology