Nonlinear Driven Oscillator

Fluxion Example Description

1 Background

This project calculates the movement of a periodically driven bistable pendulum. A good experimental example of this is the Pohl wheel, which is provided with an additional weight which causes the bistability.

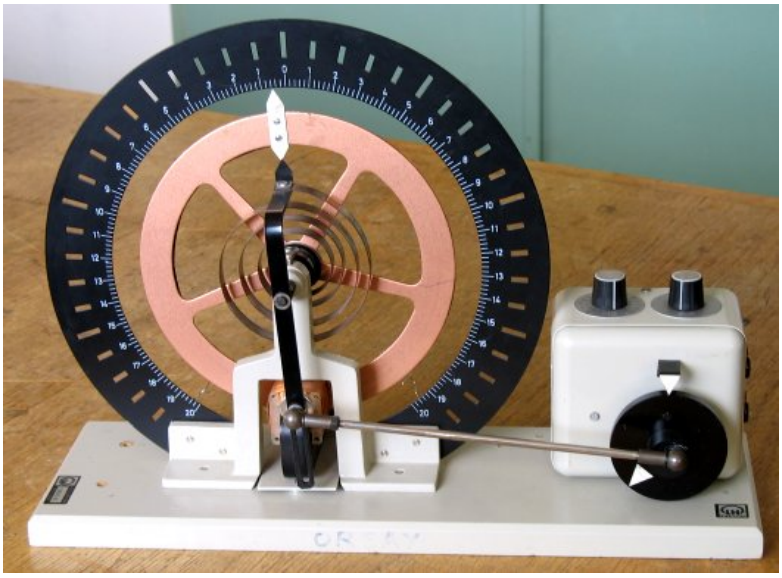

Abb. 1: Pohl's Wheel.
Source: Dbfls at fr.wikipedia - Transferred from fr.wikipedia; transferred to Commons by User:Bloody-libu using CommonsHelper., CC BY-SA 3.0, https://commons.wikimedia.org/w/index.php?curid=16040416

The acceleration a of an external mass point of the oscillator is composed of the following terms.

- $-d \cdot \phi$ is the linear part of the restoring force.
- $-c \cdot \omega$ is the effect of the inner damping (see also the example on damped oscillation)
- $f \cdot sin(\omega_E \cdot t)$ represents the periodic external drive with amplitude f
- $p \cdot sin(\phi)$ is the non-linear component due to the bistability

This results in the following net acceleration:

$$a = -d \cdot \phi - c \cdot \omega + f \cdot sin(\omega_E \cdot t) + p \cdot sin(\phi) \tag{1}$$

In the deffault setting of the example, the ω vs. ϕ phase space is shown, so that the different vibration states are particularly visible.
The control parameters that determine the behavior for a fixed system are the excitation amplitude f and the excitation frequency ω_E. These are defined as variable parameters, so that it is easy to set the different oscillation states over a doubling of the period up to chaotic oscillations.
Note: In the simulation, the transient phase (the first 500 values) is omitted.