A Brief Overview of the Simple Harmonic Oscillator

Peter Maffay

November 24, 2025

Abstract

This paper provides a brief overview of the simple harmonic oscillator, focusing on its mathematical description and physical significance. We discuss the fundamental equation of motion and its solution, demonstrating why this system serves as a cornerstone model in physics.

1 Introduction

The simple harmonic oscillator is one of the most fundamental models in physics. Its applications range from the motion of pendulums to the behavior of atoms in crystal lattices [Feynman et al., 1963].

2 Mathematical Description

The equation of motion for a simple harmonic oscillator is given by:

$$\frac{d^2x}{dt^2} + \omega^2 x = 0 \tag{1}$$

where ω is the angular frequency of oscillation. The general solution to this equation is:

$$x(t) = A\cos(\omega t + \phi) \tag{2}$$

where A is the amplitude and ϕ is the phase constant [Goldstein et al., 2002].

```python
# Python code to calculate sum of squares of first 10 numbers
def sum_of_squares(n):
    return sum(i**2 for i in range(1, n+1))

result = sum_of_squares(10)
print(f"The sum of squares of first 10 numbers is: {result}")
```

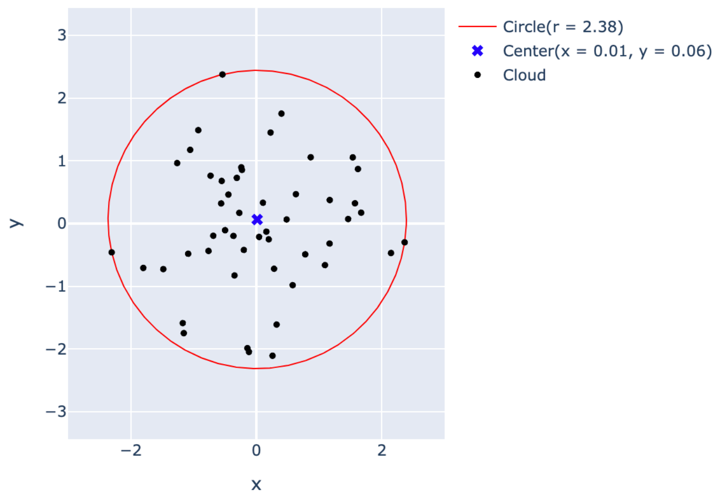

Figure 1: This is an example image

References

Richard P. Feynman, Robert B. Leighton, and Matthew Sands. *The Feynman Lectures on Physics*. Addison-Wesley, Reading, MA, 1963.

Herbert Goldstein, Charles Poole, and John Safko. *Classical Mechanics*. Addison Wesley, San Francisco, 3rd edition, 2002.