



UCL Undergraduate Mathematics Colloquium

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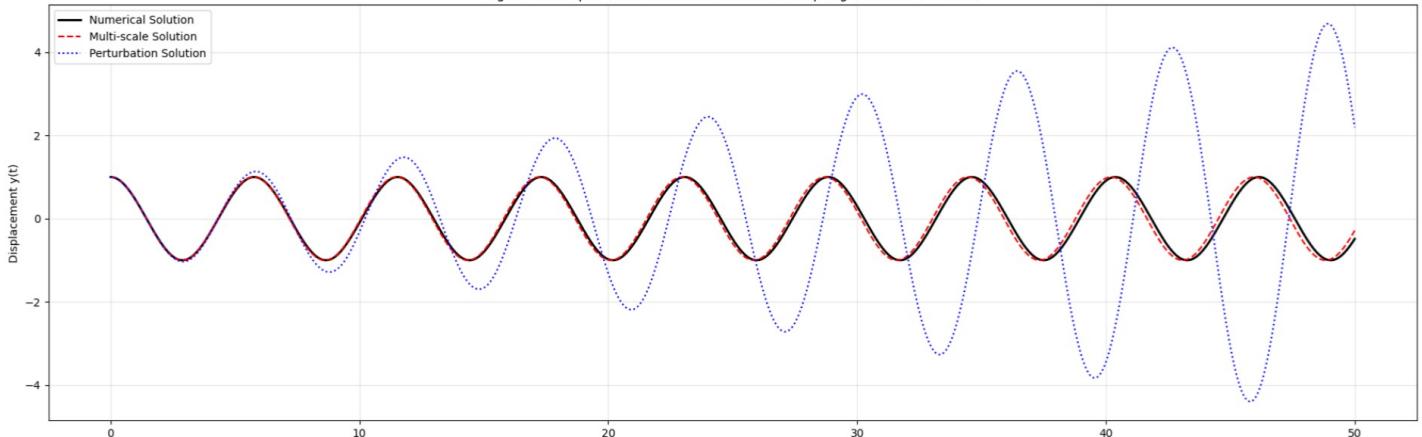
Multiple Time Scale Solutions of Models for a Pendulum

10th December 2025

Abstract: Simple harmonic oscillators are ubiquitous in the physics world, however, real-world systems exhibit essential non-linearity. For example, an oscillator with a hardened spring can be described by $y'' + y + \epsilon y^3 = 0$ where $0 < \epsilon \ll 1$. Though the y^3 term is small it does introduce a non-linearity. Also, the non-linearity term can be huge on a large scale.

This talk will show how to apply the perturbation method to give a solution to this hardened spring oscillator and refine the solution with multi-scale variable method to avoid the large-scale error. The solution produced by this method can be refined to any degree $O(\epsilon^n)$ needed.

Figure 1: Comparison of Solutions for Hardened Spring Oscillator ($\epsilon = 0.25$)



Speaker: **Mohan Huang**

Location: Room 105, 24 Gordon Square
Time: **1.30-2.30pm**

