

CAS 741: Problem Statement

Double Pendulum

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Table 1: Revision History

Date	Developer(s)	Change
18/09/2019	Zhi Zhang	Initial Draft
22/09/2019	Zhi Zhang	Changed project from polynomial interpolation to double pendulum
02/10/2019	Zhi Zhang	Fix date

1 Problem

A double pendulum consists of two pendulums attached end to end. With simply two limbs and two masses, a double pendulum can perform various motions. The moving curve of a double pendulum is highly sensitive to the initial conditions, which makes it a chaotic system, and the fundamentals of its motion gives full expression to dynamics, physics and mathematics. Studying the motions of a double pendulum can help us better understand the deterministic feature of a chaotic system.

In this project, we restrict the motion of a double pendulum in two dimensions. Considering a double pendulum with masses m_1 and m_2 , and set the wires attaching them have lengths l_1 and l_2 . Let θ_1 and θ_2 be the angles of the two wires, we will first get the potential and kinetic energy equations of the system, and use them to get the Lagrangian of the system which is the difference between the two. Then use the derived Lagrangian equation, we will determine the equations of the movements of the system, and demonstrate the double pendulum's strong sensitivity to initial conditions.

2 Context of Problem

The stakeholders of this project would be Dr.Smith and all students taking CAS 741. And the environment for this software is MacOS.