
Simulating the Movement of a Double Pendulum with Euler's Method

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1 IMPORTANT NOTE

This is a work in progress. It is not finished at this moment in time.

2 WHAT ARE WE TRYING TO DO HERE?

We want to spend some time thinking about double pendulums and numerical simulations. Our goal is, of course, to create a working simulation of a double pendulum. What has to be done to get there? What kind of math is necessary? Let's start our journey by breaking down the problem into smaller pieces.

- Defining and labeling of the mathematical double pendulum model
- Deriving the Differential Equation
- Setting up the simulation using the Differential Equation

That's better. The problem doesn't look all that daunting anymore.

3 DEFINING THE DOUBLE PENDULUM

4 CONSTRUCTING THE DIFFERENTIAL EQUATION

In order to get the simulation up and running, we need equations (14) and (19) from science-world's Double Pendulum page¹. Here they are.

¹<http://scienceworld.wolfram.com/physics/DoublePendulum.html>

$$(m_1 + m_2)l_1\ddot{\theta}_1 + m_2l_2\ddot{\theta}_2\cos(\theta_1 - \theta_2) + m_2l_2\dot{\theta}_2^2\sin(\theta_1 - \theta_2) + g(m_1 + m_2)\sin\theta_1 = 0 \quad (4.1)$$

$$m_2l_2\ddot{\theta}_2 + m_2l_1\ddot{\theta}_1\cos(\theta_1 - \theta_2) - m_2l_1\dot{\theta}_1^2\sin(\theta_1 - \theta_2) + m_2g\sin\theta_2 = 0 \quad (4.2)$$