

CLASSICAL MECHANICS TFY4345 - Exercise 5

(1a) A plane, double pendulum consists of two masses m_1 and m_2 in the end of two massless rods of lengths l_1 and l_2 . Explain why there are only two degrees of freedom instead of six degrees of freedom for the two masses, and write down the total Lagrangian of the system. Using the angles θ_i , $i = 1, 2$ as generalized coordinates, identify Lagrange's equations for θ_1 and θ_2 .

(1b) Put $m_1 = m_2$ and $l_1 = l_2$. Moreover, assume that the deviations from equilibrium are small, i.e. $\theta_i \ll 1$. Assume that the solution has the form

$$\theta_i = A_i \cos \omega t \quad (1)$$

where A_i are constants, and find the two possible solutions for ω .

(1c) Discuss what kind of term you could have added that would account for friction, such as air resistance, in the equations of motion. How would the solution in b) change when

taking into account friction?

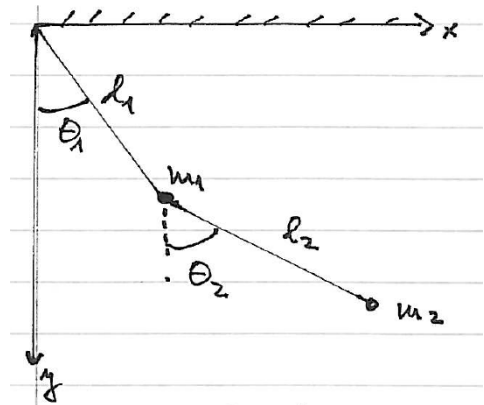


FIG. 1: (Color online). The system under consideration.