A collaborative LaTeX document

Class of ID2090, Third Trimester of 2021 batch

June 14, 2022

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1 Introduction

This file includes tex files from the folders of each student. The students are expected to update the file named after their roll number and place any images in the same folder. Students do not have to edit this master document. Once the student has sent a pull request which is accepted and processed successfully, his/her assignment submission is deemed to be complete.

You are also welcome to add references and cite them. Examples on how to do that are on the course repository [1].

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31 MM21B024

31.1 Lagrangian Operator

$$\mathcal{L} = \sum_{i=1}^{n} \frac{1}{2} m\dot{q_i}^2 - U(q_1, q_2, q_3, q_4....q_n)$$

31.2 Euler Lagrangian Equation

$$\frac{d}{dt}\frac{\partial \mathcal{L}}{\partial \dot{q_i}} = \frac{\partial \mathcal{L}}{\partial q_i}$$

31.3 Symbols Involved

SYMBOL	DEFINITION
q_i	generalised coordinate
$\dot{q_i}$	generalised coordinate's velocity $\frac{dq_i}{dt}$
$\mathcal{L}$	Lagrangian
$\frac{d}{dt}$	derivative with respect to time
$\frac{\partial \mathcal{L}}{\partial q_i}$	partial derivative of Lagrangian with respect to q_i
$\frac{\partial \mathcal{L}}{\partial \dot{q_i}}$	partial derivative of Lagrangian with respect to $\dot{q_i}$
m	mass of object
$U(q_1, q_2, q_3....q_n)$	Potential energy of the object

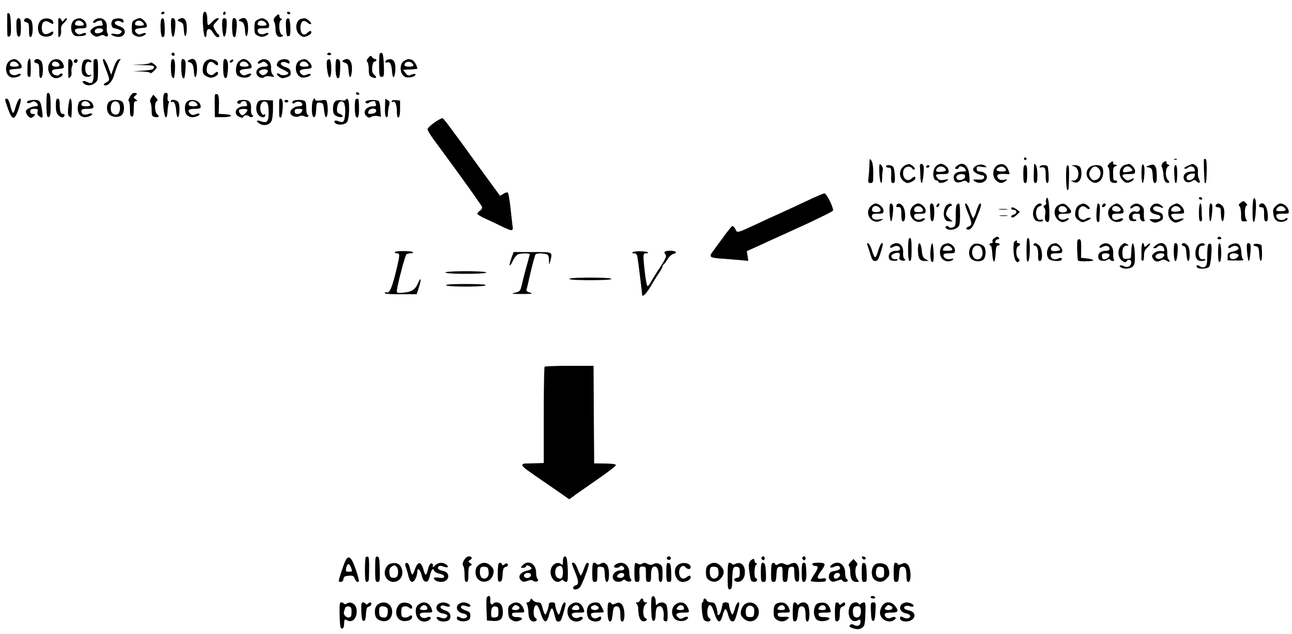

Figure 1: The Lagrangian Operator

32 Explanation of equation

This is a mechanical model developed by Lagrange to analyse complex systems which are very difficult to analyse by Newtonian Mechanics. The process follows the calculus of variations and defines a procedure to analyse a system by the Euler Lagrangian equation which is a result of Hamilton's principle of least action.The mechanical state of the object i.e its potential and kinetic energies are determined in terms of generalised coordinates. The number of generalised coordinates of a body is same as the number of degrees of freedom it has.The generalised coordinates have their own velocities defined as their derivatives with respect to time. The Lagrangian is now expressed in terms of the generalised coordinates and their velocities. By principle of least action and calculus we arrive at the Euler Lagrangian equation. On proceeding to do the math we get a second order partial differential equation in the generalised coordinate. On solving all the partial differential equations simultaneously we can calculate the exact state of the system at a given time. This setup is generally used to analyse oscillators.

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45 Conclusions

If this master tex file could be compiled successfully, it means that the class has learnt the concepts of Git as well as LaTeX properly.

46 References

References

[1] Repository for id2090 course. `https://github.com/gphanikumar/mm2090`. Accessed: 2022-06-13.