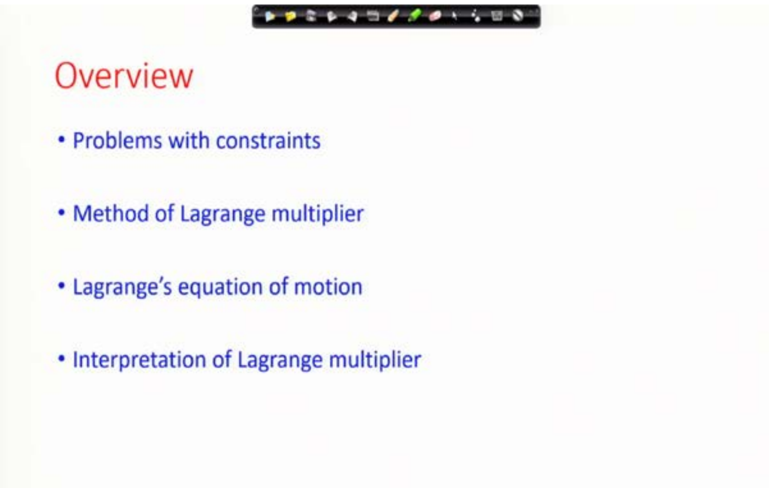
Advanced Dynamics
Prof. Anirvan Dasgupta
Department of Mechanical Engineering
Indian Institute of Technology – Kharagpur

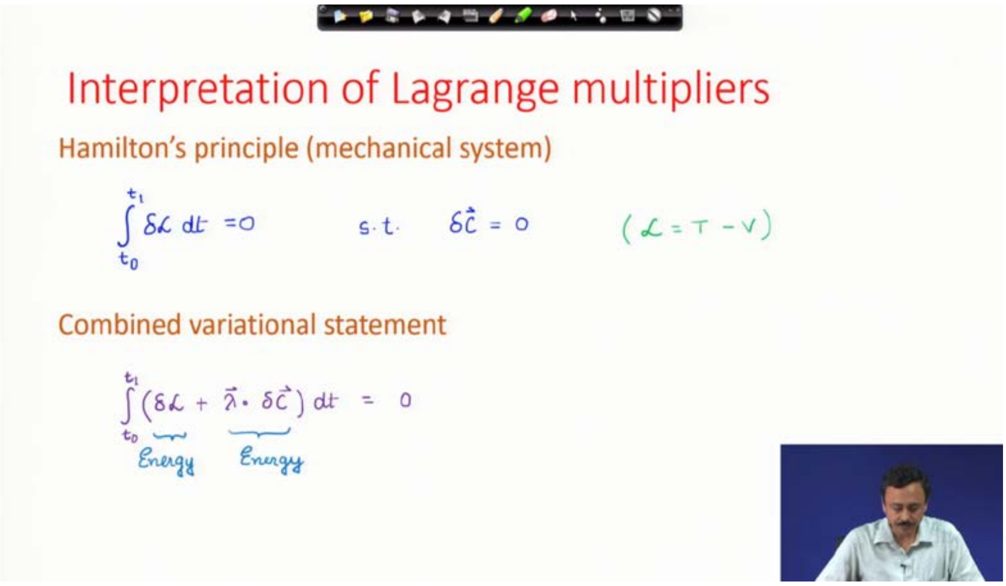
Lecture – 53
System with Constraints - II

(Refer Slide Time: 00:19)



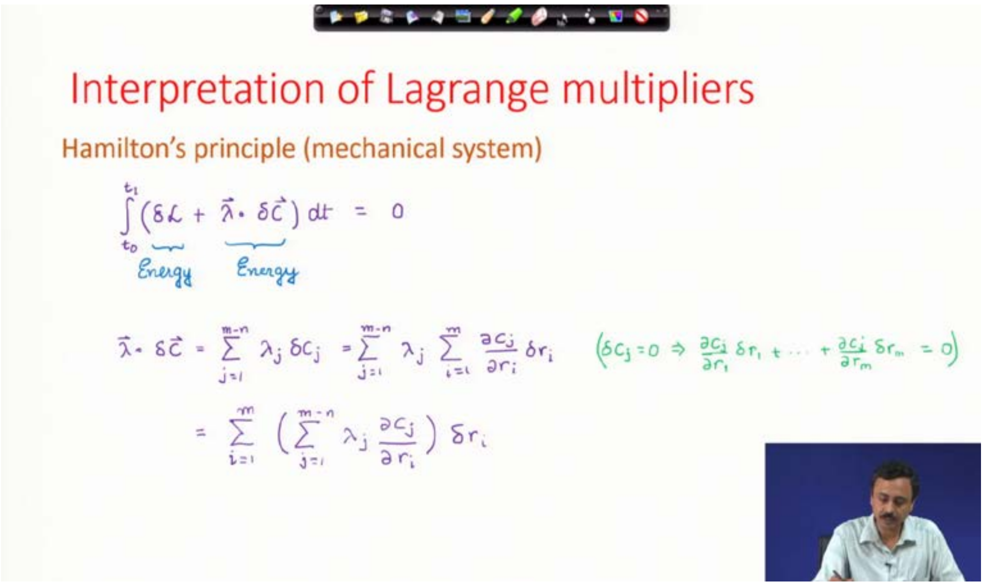
In the last lecture, we had started discussing on systems with constraints. We will continue that in this lecture as well. We had looked at the method of Lagrange multiplier to deal with constraints in our Hamilton's principle and we have seen how to derive the equations of motion for systems with constraints. In this lecture, I am going to look at the interpretation of the Lagrange multiplier.

(Refer Slide Time: 00:43)



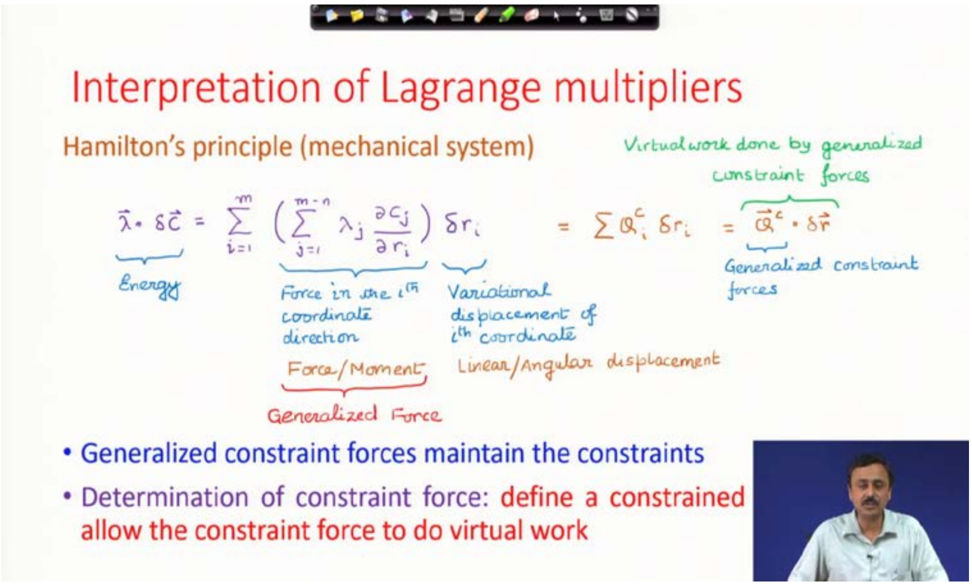
Let us go through a little bit of what we had discussed as presented in the slide above.

(Refer Slide Time: 02:05)



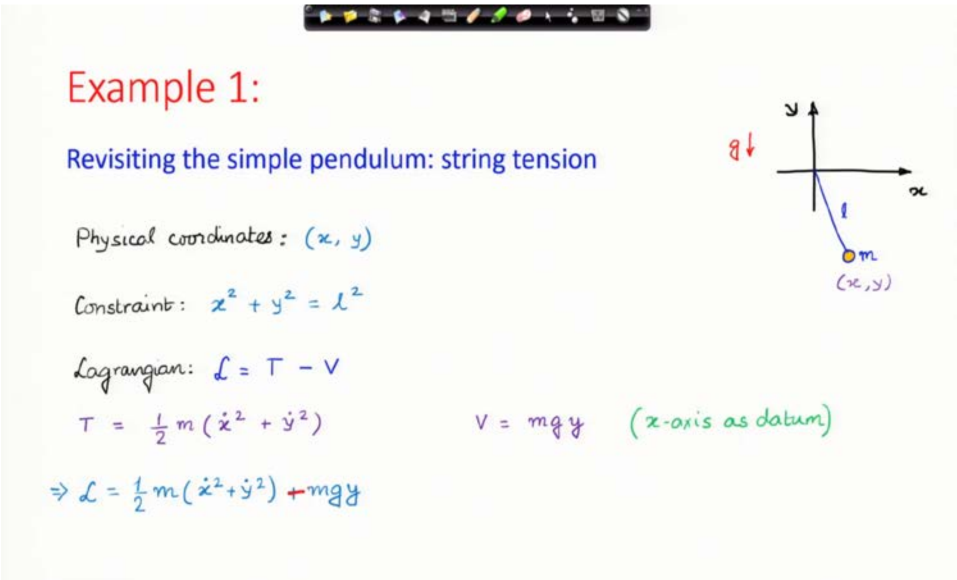
All terms in the variational statement must have dimensions of energy, and from here we were going to interpret what is lambda.

(Refer Slide Time: 04:28)



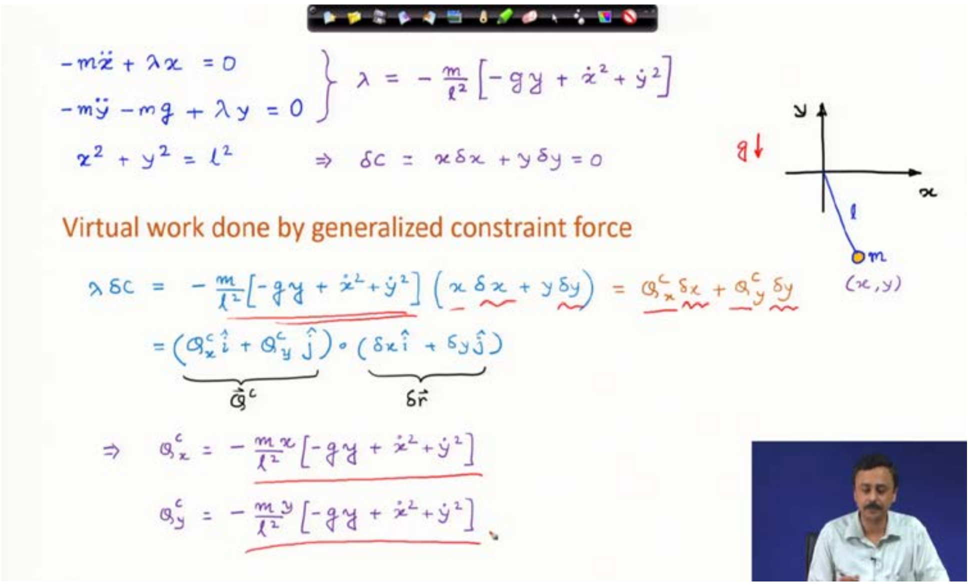
The above slide presents the interpretation of the Lagrange multipliers.

(Refer Slide Time: 08:22)



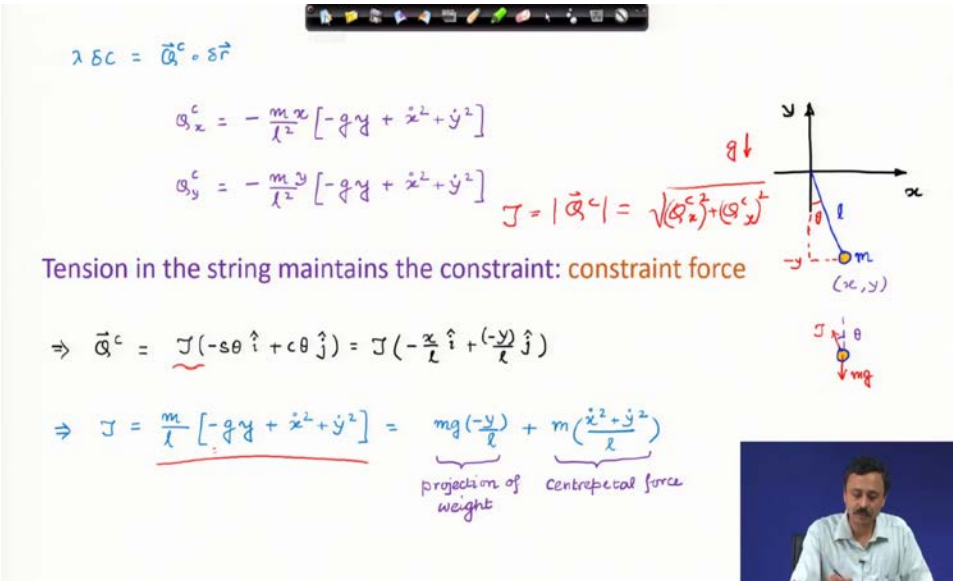
Let us revisit the pendulum problem that we had looked at in the last class.

(Refer Slide Time: 09:21)



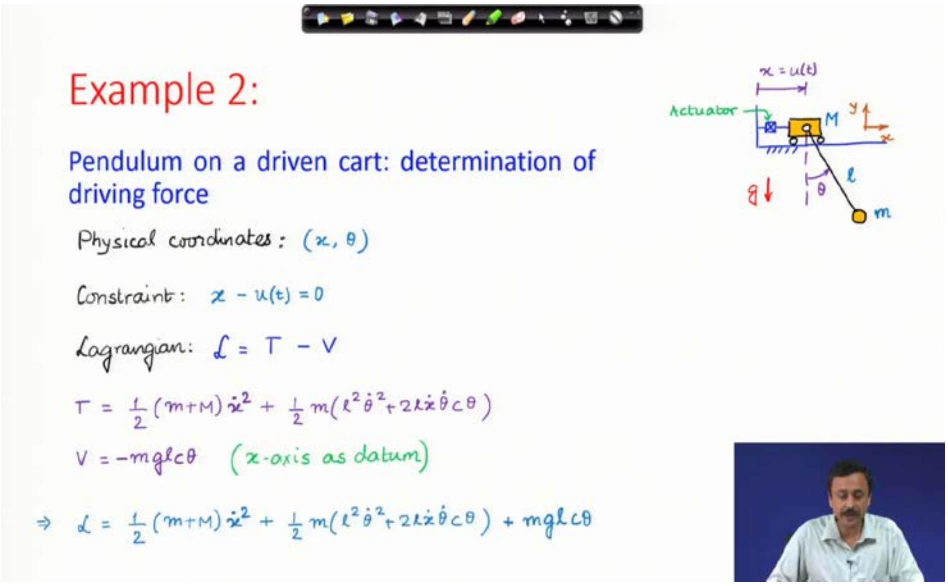
In the above slide, we determine the generalized constraint forces for the pendulum.

(Refer Slide Time: 12:04)



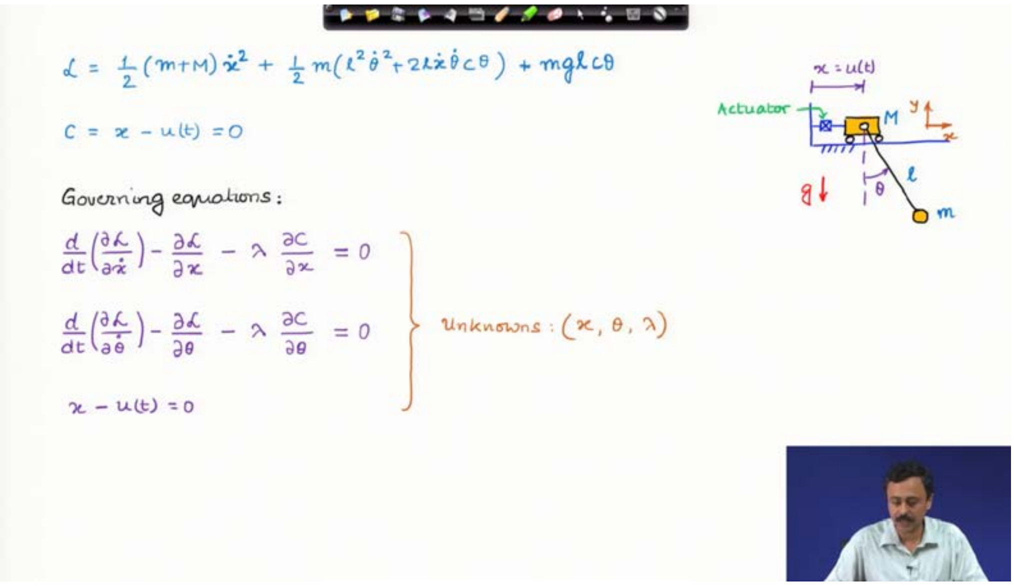
Using the generalized constraint forces, we determine the string tension.

(Refer Slide Time: 14:57)



Let us then proceed to our second example, pendulum on a driven cart. We would like to find out the force required to drive the cart for a desired motion u(t) of the cart.

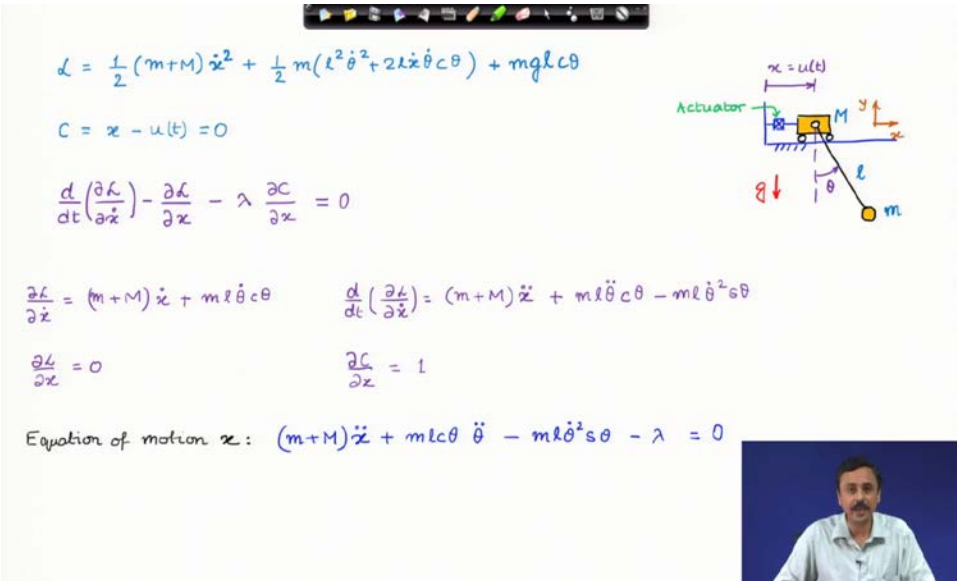
(Refer Slide Time: 16:58)



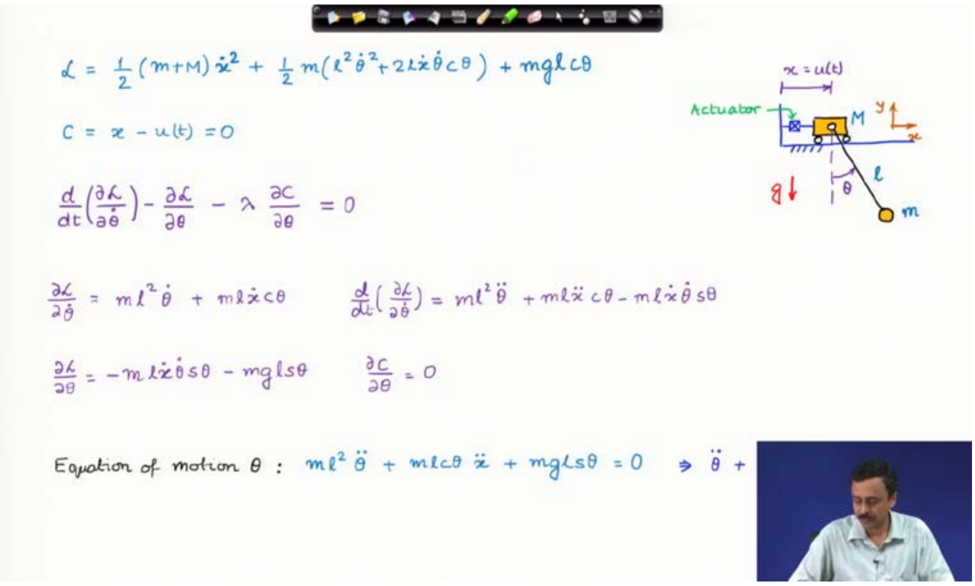
We pose it as a constrained problem as presented above.

The equations of motion are derived in the following 2 slides.

(Refer Slide Time: 17:29)

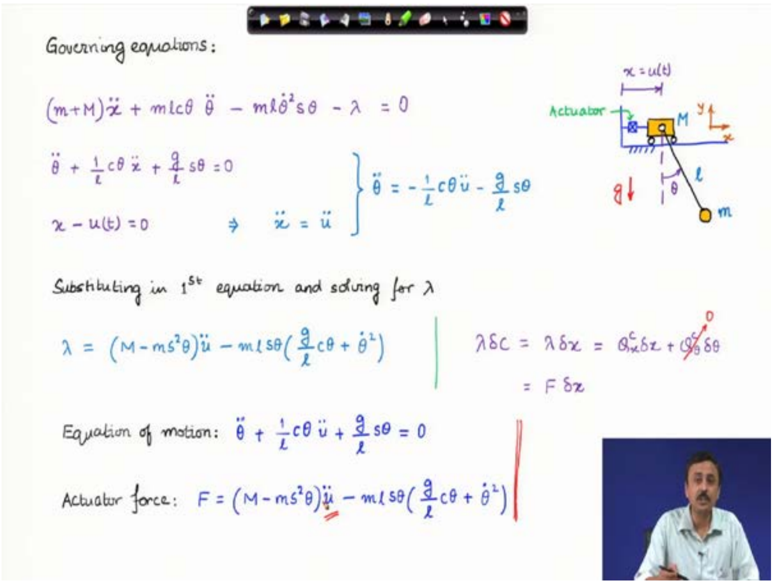


(Refer Slide Time: 18:10)



Next, we determine and interpret the Lagrange multiplier.

(Refer Slide Time: 18:51)



Finally, we obtain the actuator force as calculated above.

(Refer Slide Time: 22:57)