Day 36 - Lagrangian Examples II

Announcements

- Last "Class" Week
- Homework 8 due Friday, April 18
- Next Week: Project Work and Discussion
- Final Project Due April 28th (no later than 11:59 pm)
- **No Final Exam**

Seminars This Week

WEDNESDAY, April 16, 2025

- **Astronomy Seminar**, 1:30 pm, 1400 BPS, **Undergraduate Thesis Talks will be given the next two weeks**
- **PER Seminar**, 3:00 pm., BPS 1400, **Speaker: Rebeckah Fussell, Cornell University**, Title: Comparing approaches to using large language models in science education research
- **FRIB Nuclear Science Seminar**, 3:30pm., FRIB 1300 Auditorium, **Speaker: Professor Alex Brown (FRIB)**, Title: Nuclear Science Advances at the MSU Cyclotron, NSCL, FRIB, ...

Seminars This Week

THURSDAY, April 17, 2025

- **Colloquium**, 3:30 pm, 1415 BPS, **Speaker: Jessie Christiansen, Caltech/IPAC**, Title: From Kepler to the Habitable Worlds Observatory: The Emerging Picture of Planet Populations
- **Astronomical Horizons Public Lecture Series**, 7:30 pm, Skye Theater, Abrams Planetarium, **Speaker: Marcel Yanez Reyes**, Title: From Event Horizons to Particle Collisions: The Geometry of the Extreme.

Stand Up for Higher Education

- Graduate Employee Union
- Union of Nontenure Track Faculty
- Union of Tenure System Faculty

Thursday, April 17th at 3pm

Please make time to show up!

www.dayofactionforhighered.org

Reminders

We found the Lagrangian for the Atwood's machine with a rotating pulley to be:

$$\mathcal{L} = \frac{1}{2}(M+m)R^2\dot{\phi}^2 + \frac{1}{4}M_pR^2\dot{\phi}^2 - (M-m)gR\phi$$

where M is the mass of the left block, m is the mass of the right block, M_p is the mass of the pulley, R is the radius of the pulley, and ϕ is the angle of rotation of the pulley.

We used the scleronomic constraint $y_1 = R\phi$ to do this.

Clicker Question 36-1

We derived the Lagrangian for the Atwood's machine with a rotating pulley to be:

$$\mathcal{L} = \frac{1}{2}(M+m)R^2\dot{\phi}^2 + \frac{1}{4}M_pR^2\dot{\phi}^2 - (M-m)gR\phi$$

What is generalized force, $F_\phi = \partial\mathcal{L}/\partial\dot{\phi}$?

1. $+(M-m)gR$
2. $-(M-m)gR$
3. $+(M+m)R^2\dot{\phi}$
4. $-(M+m)R^2\dot{\phi}$
5. Something else

Clicker Question 36-2

We derived the Lagrangian for the Atwood's machine with a rotating pulley to be:

$$\mathcal{L} = \frac{1}{2}(M+m)R^2\dot{\phi}^2 + \frac{1}{4}M_pR^2\dot{\phi}^2 - (M-m)gR\phi$$

What is the generalized momentum, $p_\phi = \partial\mathcal{L}/\partial\dot{\phi}$?

1. $+(M-m)gR$
2. $-(M-m)gR$
3. $+(M+m)R^2\dot{\phi}$
4. $-(M+m)R^2\dot{\phi}$
5. Something else

Clicker Question 36-3

For the constraint for the bead in a parabolic bowl ($z = c\rho^2$), what are the units of c?

1. $[L^2]$
2. $[L^{-2}]$
3. $[L]$
4. $[L^{-1}]$
5. Something else

Clicker Question 36-4

For the bead in a parabolic bowl, there is a generic Lagrangian:

$$\mathcal{L}(\rho, \dot{\rho}, \phi, \dot{\phi}, z, \dot{z}, t)$$

How many coordinates are there, truly? **here, each variable is a coordinate**

A. 2

B. 3

C. 4

D. 5

E. None of these

Which coordinates are independent?

Clicker Question 36-5

The Lagrangian for the bead in a parabola does not depend on which of the following?

1. ρ
2. ϕ
3. z
4. More than one of these
5. None of these