Air Track Collisions Lab
Curriculum Module

Created with R2020b. Compatible with R2020b and later releases.

Description

This curriculum module contains *Simscape Multibody* models and a *live script* that explore one-dimensional collisions using a virtual air track. The first two models investigate the law of conservation of momentum by simulating elastic and inelastic collisions. A third model studies the law of conservation of energy by attaching a hanging mass to one of the carts. The live script contains a manual for conducting an experiment using the virtual air track. This lab includes background, pre-lab, virtual experiment, and data analysis sections.

Learning Goals:

- Compare inelastic and elastic collisions
- Use conservation laws to predict motion after collision
- Measure the velocities of carts using photogate readings
- Compute momentum and energy from experimental observations
- Assess conservation of momentum
- Assess conservation of energy

Details

airTrackLab.mlx

Products: MATLAB
Contents: A lab manual for the virtual experiment. This live script includes a background description, pre-lab questions, a guide to the virtual experiment, and data analysis.

airTrackElastic.slx

Products: Simulink, Simscape, Simscape Multibody
Dependences: files included in `stls/` and `images/`
Contents: A Simscape Multibody model that simulates elastic collisions on an air track. A description of how to use the model can be found in `airTrackLab.mlx`.

airTrackInelastic.slx

Products: Simulink, Simscape, Simscape Multibody
Dependences: files included in `stls/` and `images/`
Contents: A Simscape Multibody model that simulates inelastic collisions on an air track. This model is identical to `airTrackElastic.slx`, except that the carts will stick together after collision.

airTrackHangingMass.slx

Products: Simulink, Simscape, Simscape Multibody
Dependences: files included in `stls/` and `images/`
Contents: A Simscape Multibody model that simulates energy transfer using a cart and a hanging mass. Besides the additional hanging mass, this model is identical to `airTrackElastic.slx`.

airTrackLabSoln.slx

Products: MATLAB
Contents: Completed solution for the virtual lab, `airTrackLab.mlx`.