Air Track Collisions Lab

Curriculum Module

*Created with R2020b. Compatible with R2020b and later releases.*

Description

This curriculum module contains[*Simscape Multibody*](https://www.mathworks.com/products/simmechanics.html) models and a [*live script*](https://www.mathworks.com/products/matlab/live-editor.html)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.