

# 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

**Dependencies:** 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

**Dependencies:** 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

**Dependencies:** 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`.