

Video Analysis – Inertial and non-inertial reference frames

Apparatus

Tracker software (free; download from <http://www.cabrillo.edu/~dbrown/tracker/>)
video: `two-carts.mov`

Goal

In this experiment, you will measure the motion of two carts in the reference frame of the stationary video camera. You will then describe the motion of the second cart as measured in the reference frame of the fancart and vice versa.

Lab frame

1. Analyze a graph of $x(t)$ for each cart in the lab's frame of reference (i.e. the stationary video camera).
2. Describe the motion of the fancart. Measure its acceleration. Sketch a free-body diagram for the fancart and discuss whether its motion is in agreement with Newton's laws.
3. Describe the motion of the second cart. Measure its acceleration and velocity. Sketch a free-body diagram for the cart and discuss whether its motion is in agreement with Newton's laws.
4. Is the camera's video frame inertial or not? Provide evidence for your answer.

Fancart frame

1. Change the coordinate system to the fancart.
2. Analyze $x(t)$ for the second cart.
3. Describe the motion of the second cart. Measure its acceleration. Sketch a free-body diagram for the cart and discuss whether its motion is in agreement with Newton's laws.
4. Is the fancart's frame inertial or not? Provide evidence for your answer.

Second-cart frame

1. Change the coordinate system to the second cart.
2. Analyze $x(t)$ for the fancart.
3. Describe the motion of the fancart. Measure its acceleration. Sketch a free-body diagram for the fancart and discuss whether its motion is in agreement with Newton's laws.
4. Is the second cart's frame inertial or not? Provide evidence for your answer.