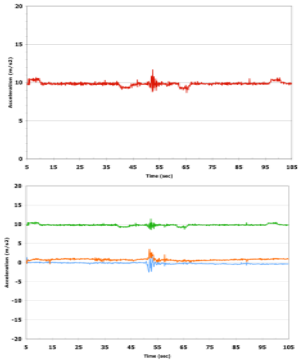
MATCH GAME

Match Acceleration Traces to Kings Island Rides

A



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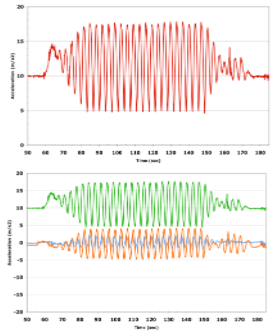

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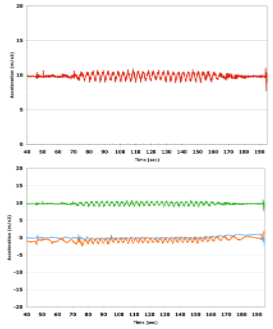

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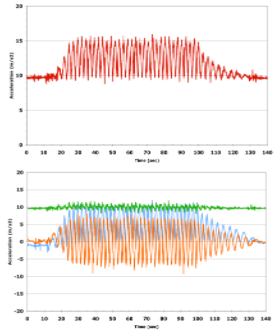


Rides at an amusement park may be differentiated by the pattern of accelerations to which a rider is subjected. This acceleration experience, coupled with height, speed, and the unknown, is unique to each ride.

Use your knowledge of accelerations and your familiarity with the rides to match the accelerations experienced on a ride with its name. The 'feel' of each ride is different, but the acceleration pattern may look similar. Think carefully and choose wisely!

Linear acceleration is a straight-line acceleration quite often experienced when a ride begins and ends. This may also be felt when a brake is applied during the course of a ride, such as on a roller coaster, to control the maximum speed.

Centripetal acceleration is due to circular motion and quite often causes a rider to experience a force from the outer side of the car. This is found on circular rides, but also can be found on roller coasters going around a curve or a turn-around.

Earth's gravitational acceleration (1-g) is 9.8 m/s2. The accelerations in these data plots were measured with an accelerometer (and thus reference frame) attached to the rider's body.

The X-axis is left to right on the rider's body.

The Y-axis is along the rider's spine.

The Z-axis is perpendicular to the rider's chest.

The resultant acceleration magnitude is the vector (root-sum-square) of the three individual axes.

The resultant acceleration magnitude is graphed as the red trace above the graph of the three individual axes (blue, green, and orange traces).

1 - SHAKE, RATTLE & ROLL

Shake, Rattle & Roll is an unusual ride with two axes of rotation, one of which becomes tilted from vertical after the rides starts. Seven individual cars are oriented around a secondary vertical axis; that axis is at the end of one of three large radial arms from a central vertical rotary axis. When the ride starts, the radial arms' ends are lifted which tilts the secondary axis.

2 - DROP TOWER

The Drop Tower is a free-fall ride where a carriage holding many riders is pulled vertically up a tower, remains suspended for a few seconds, and then drops with the acceleration of gravity. The free-fall motion is straight down and then a smooth braking system is applied.

3 - GENERIC ROLLER COASTER

The accelerations of a roller coaster (not at Kings Island) is shown here to illustrate the nature of riding a coaster. This coaster has the usual lift hill and multiple hills and valleys.

4 - GRAND CAROUSEL

The Grand Carousel is a typical merry-go-round with up-and-down horse seats, fixed horse seats, and fixed bench seats.

On which type of seat was the rider sitting when these measurements were made?

5- VIKING FURY

The Viking Fury is a pendulum ride with a large boat holding about 50 riders that is suspended below a horizontal axis. Motors push the boat back and forth until it is swinging about 90 degrees, end-to-end.

For the data shown here, where was the rider sitting in the boat (I.e. in the middle or at one end)?

6- TYPHOON

The Typhoon has three sets of cars; each set arranged in a circular fashion around a vertical axis. Each axis (along with the axes of the other sets of cars) is rotated around a central vertical axis. When the ride is at operational speed, an individual car performs a cycloid-type motion.

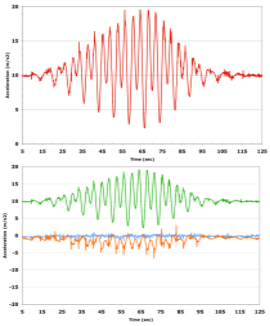
7- ZEPHYR

The Zephyr is a circular ride with swing seats suspended on chains below a disk rotating around a central vertical axis. After the ride starts, the disk and swing seats are raised and the axis of rotation is tilted slightly.

8- EIFFEL TOWER

The Eiffel Tower ride is an elevator straight up and down. The actual motion is very smooth with very little jerky motion.

E



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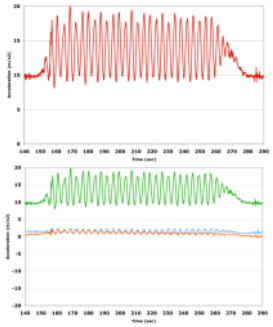

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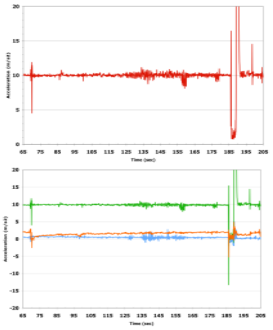

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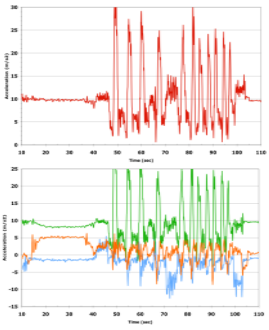

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