5. Limiting cases

Now we want to add a dynamic rider into our model. There are two limiting cases we can consider first.

1. A heavy rider and a light (massless) cable. In this case the path of the rider is an ellipse because at all points along the rider trajectory, the cable will be pulled into straight lines.

2. A very light (massless) rider and a very heavy cable. In this case the path of the rider is the catenary because the rider is not heavy enough to deform the shape of the hanging cable.

Of course, in designing a zipline to be used with human riders, we are not in either of these two limiting cases. In general a human rider will weigh between 25 and 100 kilograms. And a zipline cable of between 200-600 meters long will weigh between 20 and 400 kilograms, depending on the type of cable used. So the trajectories that we will see will be much more interesting.

What we do know is that the trajectory of a rider should lie somewhere inside the ellipse, and should typically be below the catenary connecting the two end points of the zipline (assuming no crazy bouncing). The mathlet visualization below shows you these two limiting case, and allows you to change the positions of the end point of the right hand side of the zipline, change the mass of the rider, and the horizontal position of the rider to see the static position of the rider in each case that a force is applied to the rider to prevent further movement. Note that in all configurations, the length of the cable is fixed.

Zipline + help

5. Limiting cases

Hide Discussion

Topic: Final project: Applications to nonlinear differential equations / 5. Limiting cases

Add a Post

Show all posts ▼ by recent activity ▼

There are no posts in this topic yet.

✖