

1- PROBLEM

Golf is a precision sport that consists in hitting a ball into a series of holes using a club. The objective is to perform the course using as few strokes as possible.

When a golf ball is hit by a club, the impact, that lasts less than one millisecond, allows to send the ball to several hundred meters before it falls down on the ground. Thus, at his first stroke, a professional golfer can send the ball with a speed of 250 km/h to a distance of more than 400 m. To make a success of such a performance, the choice of the equipment and of the golf ball, the technique of the golfer and the chosen path are crucial.

2- ANTICIPATIONS

What are the different parameters that have an effect on the distance travelled by a golf ball?

3- EXPERIMENTAL STUDY

A golf ball (of mass $m = 56$ g and diameter $d = 4.26$ cm) is obliquely thrown in the air.

The earthly frame of reference is composed of an orthonormal set (O, \vec{i}, \vec{j}) placed in the same vertical plane as the one of the motion of the centre of inertia of the golf ball and an origin of dates.

3.1- ANTICIPATIONS

- *Anticipate the features of the acceleration vector. Justify briefly and indicate the possible approximations.*
- *Anticipate the shape of the following curves: $x(t)$; $v_x(t)$; $y(t)$; $v_y(t)$; $y(x)$. Justify briefly*

3.2- EXPERIMENTAL CHECKING

The ball has been filmed with a video camera (its axis of aim is placed perpendicularly to the plane of the ball motion).

Have a look to the picture for the calibration and use the help card.

- *Plot the following graphs: $x(t)$, $y(t)$, $v_x(t)$, $y(x)$ exploiting the video with the Latis Pro software.*
- *Compare with your own anticipations. Draw the shape of these curves in your report.*

**3.3- MATHEMATICAL MODEL**

Find a mathematical model for each curve. Write down the obtained equations.

4- CONCLUSION

Study the effect of the initial conditions on the ball motion:

- *with an empirical approach using the following simulation:*
<http://www.ac-grenoble.fr/lycee/herriot.voiron/site/Spip/spip.php?article19>
- *by using the motion equations.*

Study the effect of the other parameters (you can search them on the Internet).

You can have a look to: Science of golf: <http://www.nbclearn.com/science-of-golf/cuecard/69845>