Good example of report on real-life dynamical system

Technology, Internet

There are several ways to improve the volley ball serve and increase the likelihood that it will result in an ace or a serve that cannot be returned and results in a point for the offensive team. The main goal when seeking to increase the likelihood that a serve results in an ace is to minimize the time the ball spends in the air and increase the speed of the ball. This will reduce the amount of time the opposing team has to react, forcing them to react faster than their normal reaction time would dictate. In this analysis of the kinematics of the volley ball serve, the main variable examined will be the time the ball spends in the air and ball velocity. Equations that model the ideal direction and angle of the serve for reducing air-ball time will be used. It is hypothesized that when the time the ball spends in the air is reduced, that it is more likely that the serve will result in an ace. It is also hypothesized that increased speed of the ball will more likely result in an ace.

- Using Equations to Determine the Ideal Volley Ball Height and Speed for a Serve

In order to setup the analysis of the kinematics related to height of the serve and distance from the net, several variable will need to be analyzed. The schematic diagram that follows will show the top view of volley ball court followed by the values that will need to be used when constructing equation to predict the amount of time the ball spends in the air.

Where:

La is considered as the distance from net and the serve location, in the direction of served volley ball.

Lb is considered as the arbitrary distance from where the volley ball lands on

the land and the net.

d is the distance from the net beyond the ball lands.

α is the angle of the volley ball makes its side line.

The volley ball trajectory is showed on the schematic diagram, this shows the point where the volley ball lands and serves position.

Where:

g = acceleration due to gravity

H = net height

Hmax = ball maximum height

Ho = initial height of ball from the serve position.

V = velocity of volley ball

θ = initial angle of the volley ball

In order to simplify the equation for the purpose of this analysis, we can ignore the aerodynamics and air resistance on the volley ball. The projectile motion is used and its equation will be:

Where x and y denotes the ball position and t will be time. When equations 1 and 2 are combined we get:

Equation of parabola in terms of x and y will be given as

Where:

The coordinates of point B is (La , H—ho) relative to xyThe coordinates of point C is (La+Lb , -ho) relative xy

Where:

The probable equation will be given by:

The parameter La, Lb, Lo will used to solve x and y co-ordinates. The initial velocity and initial angle can be given by:

The time we have to reduce will be given by:

This suggests that we can minimize the time of volley ball in air through the following methods:

- The volleyball should be served just over the net
- Lb should be as large as possible (served as close to the opposing teams endline)
- Ho should be as large as possible (using a jump serve to increase height)

Let us consider the problem based on the kinematic equation for decreasing the time a volley ball spends in the air for a serve. We will use the following values:

d = 9 m

h0 = 3 m

H = 2. 4 m

Applying these variables in the above equation we will have the time of the ball to spend in air, which solve for t. Based on the equation, t = 0. 86 s. This analysis helps us to predict the kinematic behavior of the volleyball during a serve.

Based on the equation we can determine that serving at a cross court angle does not change the time the ball spends in the air but the angle of the serve does change the balls horizontal speed. So, in order to obtain greater speed, decreasing the time the opposing team has to react to the serve, a

greater angle must be used. The greater the speed the more likely it will result

- The Magnus Effect and Ball Velocity

Another skill that can reduce the time the ball spends in the air on a serve is top spin. Applying top spin to the ball results in the Magnus Effect. This means that topspin causes an aerodynamic force to push down on the ball making it land faster. The Magnus Effect is illustrated in the following diagram:

Using topspin causes the velocity of air around the top of the volley ball will be less than the air velocity around the bottom of the ball. in the environment. This causes the top half of the ball to turn in the opposite direction of the spin and the bottom half to turn in the same direction as the spin. This leads to pressure forcing the ball downward. As a result, volley ball air borne time will be reduced by applying top spin on the volley ball, so that the opponent team will have greater difficulty returning the serve. in an ace and a point for the serving team.

- Conclusions and Implications

Using the findings here, volley ball players can optimize their served by focusing on the following:

- Serve the ball just over the net

- Serve the ball so it will be fall as close to the opposing teams end line as possible

- Use a jump serve to maximize the height of the ball from the ground while minimizing the time between launching the ball and hitting it to serve

- Use top spin when serving to increase velocity and decrease the amount of

reaction time for the opposing team

Kinematics are very useful for sports and it has a broad application on athletes’ performance. Using kinematics in sports to improve athletes’ skills will increase their chance of winning. Coordination of movements and proper self-control are key areas needed to implement advanced skills aimed at improving athletic performance. Understanding the kinematics of sports will help every athlete to improve performance.