

Abstract No: PS-34

Mathematical model for kinematics of basketball free-throw shooting

J. Munasinghe* and G. H. B. C. Gunawardhana

Department of Mathematics, Faculty of Science, University of Kelaniya, Sri Lanka
munasing@kln.ac.lk*

Basketball shooting is a basic and essential practice for a basketball player. Points are scored in a game of basketball, by throwing the ball over a hoop. This can be done by Free throws and field goals. A free throw is a special shot granted when a player is fouled while shooting a basket. Any player of the opposition team who is on the court at that time can be awarded a free throw. Hence, all the members of a team should be competent in scoring baskets. The angle and the velocity of the ball are important mathematical parameters in scoring goals. If the players are aware of the correct angle and velocity for a successful free throw then players can practice accordingly and aim perfect shots. Hence a model for the players to know their perfect successful angles would be helpful. Therefore, the main purpose of this research is to obtain a model to calculate the best releasing angle and the releasing velocity for the free throw shots. The air resistance is considered as zero, magnus effect is negligible and having zero spin of the ball were the assumptions in developing the model. Equations of motions for horizontal and vertical directions of the velocity was used and simplified them. An expression was developed for minimum angles by examining the descends of the ball to the hoop. Tables were constructed for the release angles and velocity for various heights using MATLAB(R2018a) to plot the graphs to find the feasible regions for the angles and velocity. Finally, the minimum angle for the longest shot was calculated. A physical model was developed to find the releasing angles with their release velocities. Basketball players could use the free throw shot using the best angles developed in the current study. Measuring velocity is not practical in basketball games, hence the players can practice with the best angle for a free throw and manage their velocities with the angle according to the velocities given in the table. Based on the tables, an increase in height of the player including the height to the releasing point will decrease the releasing angle and releasing velocity. The derivation of the model for optimal angle a quadratic equation was solved to develop the model. Therefore, there were ranges of releasing angles for some releasing velocities. The effect of air resistance was small for the motion of the basketball shot was observed.

Keywords: Basketball free throws, Minimum angle, Releasing angle, Releasing velocity